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Understanding the role of computer-mediated counter-argument in countering confirmation bias

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ABSTRACT

Confirmation bias has long been discussed in the behavioral decision-making research stream. Although decision support systems were designed to counter cognitive biases and speed up information processing, confirmation bias still can be observed during the decision-making process and causes some unwanted behaviors, such as selective reading. An experimental design was conducted to examine the impact of confirmation bias in a computer-supported decision-making context. In addition, we attempted to explore whether the providing of computer-mediated counter-argument can effectively eliminate the impact caused by selective reading. The experiment results show that confirmation bias can be observed when decision makers possess strong preconceptions and selective reading behaviors, caused by confirmation bias, resulting in skewed adjustment and high confidence. This means that computer-mediated counter-arguments can effectively reduce the effects caused by confirmation bias as well as lead to higher satisfaction with the decision outcome. Lastly, the research results were discussed and implications of this finding for academics and practitioners were provided.

1. Introduction

Psychologists have pointed out that people rely on various heuristic methods in their daily lives to simplify the information processing necessary in decision making. However, subjective judgments present in the course of the heuristic cognitive processes, of which people are unaware, have a negative impact on the decision-making process. One type of subjective judgmental behavior is confirmation bias, which impedes individuals' capacity to make correct decisions when rationally accessing and utilizing information. With confirmation bias, individuals are interested in only the part of the available information that fits into their current beliefs. Information is recognized as the core of effective decision making. The quality of decisions largely depends on the quantity and variety of information considered during the decision-making process [38]. However, confirmation bias inhibits people from fairly reviewing all the information available, which results in the frequent making of inappropriate decisions. Empirical studies have shown that confirmation bias is one of the critical factors leading to overtrading and low profitability [4,9,27].

Computer-supported decision-making tools are designed to assist individuals in enhancing their information processing capabilities and avoiding the potential effects of cognitive biases. However, researchers have indicated that the rationalization of a decision-making process by formalizing it within a computer-based information system does not seem to make the process itself more rational [21]. Instead, bias that operates without the information system continues to operate within it. For example, confidence level is increased in the computer-supported context when accuracy of information is the same [12] or even when accuracy is worse [37]. Jiang et al. [32] also indicate that the use of DSS increases the decision maker's confidence to an irrational level when model performance information is provided. Moreover, the use of computer-aided decision-making tools might create the illusion of control and, therefore, increase irrational confidence [12], which is the driver of low performance decision. For example, Barber and Odean [4] found that self-attribution bias, the tendency for people to attribute high value to their abilities, and the illusions of knowledge and control increase the confidence level after investors switch from a traditional phone-based to on-line trading channel. This leads to more frequent transactions, increasing transaction costs and harming the performance of on-line investors. Therefore, understanding what can be done to avoid cognitive biases accompanying computer-supported decision-making tools is critical.

Researchers highlighting the impact of cognitive bias and the importance of de-biasing propose counter-argument and warning as two approaches to the reduction of such bias. However, to the best of our knowledge, functions embedded in computer-aided decision support

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tools to facilitate decision makers to counter cognitive biases are rare. In fact, many proposed de-bias approaches have not even been formally evaluated in environments without computer-support, or have failed to generate statistically significant results (e.g. Lau et al. [39]). In light of the above-discussed issues, this study attempts to: (1) revisit the effect of cognitive bias (e.g. confirmation bias) on the decision-making process (e.g. decision confidence and adjustment) in the computer-supported decision-making context; and (2) examine whether the effect of confirmation bias can be reduced by means of a DSS incorporated with a de-bias function, by providing computer-mediated counter-argument.

Decision making is a complicated process that is affected by various contextual factors. To simplify the process and to avoid possible interferences, an experiment was conducted to test those ideas. In the following sections, we first review related theories and empirical studies. Hypotheses are then proposed based on the literature review. In the third section, detailed information about decision design, including task, procedure and subjects, are introduced. Study results and discussion are followed by conclusions.

2. Literature review and hypotheses development

2.1. Mental models and heuristic decision making

A mental model is a psychological representation of the environment. It represents cognitive constructs and their relationships in one's mind, which provides a conceptual framework for describing and explaining current states, and predicting future system states [8,30,45]. On the basis of mental models, individuals interpret and respond to their environment. Mental models may be viewed as the basis for information processing and are critical in decision making. For example, one responds to problems by generating a situated cognition; the interaction between mental model and external context [14]. Actions are based on the situated cognition formed by one's understanding of the environment and pre-existing mental models (how to deal with this problem). Mental models also serve as guidance for information search, enabling individuals to determine the usefulness of the information, to digest it, and even to abandon useless information [15]. With a pre-existing mental model, information processing is speeded up by the information being organized in a robust and easy-to-understand way. This approach can also help avoid information overload by retaining only useful information according to the existing mental models. At the same time, mental models may also limit the information acquisition, searching, filtering, coding, storing, and retrieving processes. Truly useful information may be blocked out and not taken into consideration in the further decision-making process.

The consequences of a mental model are two-fold. Not only does it facilitate information processing, but it also creates cognitive bias which drives individuals to ignore information perceived as unimportant that might actually be critical. In addition, it has an effect not only on the information search, but also on concept forming or assumption verification. With restricted perception, individuals tend to limit their attention to a favored hypothesis; to prefer to attend to evidence in support of existing beliefs; to look exclusively or primarily for positive cases; to over-value positive confirmatory instances; and to see what they are looking for [42]. Researchers observed that decision makers, in general, seek confirmatory evidence and ignore disconfirming information [2,26,46]. Wason [52] defined this as confirmation bias. He indicated that the decision-making process is harmed by such bias because rational decision processing including the evaluating of information from both sides is then impossible.

In sum, confirmation bias may hamper decision making in several ways [42]. First, people tend to restrict themselves to preferred hypotheses only, ignoring, either intentionally or unintentionally, other possible hypotheses. Second, people tend to look for information that fits their existing beliefs. Belief refers to what an individual holds to be the truth and is represented in the mental model as the variable and the way in which two or more different variables relate to each other. If a person believes one of multiple hypotheses to be true, he or she tends to seek information which shows that the preferred hypothesis is true. For example, based on their beliefs and preferences, auditors react differently to audit evidence [40]. Hatfield [25] also found that manager-level accountants judge the staff accountants' research reports according to whether the reports confirm their initial opinions. As a result of ignoring the contradictory evidence, decision makers maintain or strengthen their current beliefs [1,28,29]. Third, with information at hand, people tend to over-value the information according to their current beliefs and under-value that which does not fit their hypothesis. Even in ambiguous situations, where both positive and negative support is provided, people only need a little positive evidence to support their hypothesis [44]. For example, medical doctors may overemphasize some test results and underplay, or even ignore, other possible explanations in the course of diagnosis [10], which often results in the drawing of wrong conclusions.

Based on the above discussion, the decision-making process is clearly problematic when it is affected by confirmation bias. As a result, low quality decisions may be made based on wrong assumptions, even if there is much evidence to suggest that the decision is wrong [11]. Therefore, exploring approaches to eliminate the occurrence of confirmation or to reduce its impact on the decision-making process is critical.

2.2. Impacts of confirmation bias on decision making

Cognitive biases many generate impacts on two broadly discussed characteristics of decision making: decisional adjustment and confidence. Decision adjustment refers to the difference between one's final decision and one's initial preference. According to DSS literature, decision makers suffer from error anchoring and inadequate adjustment [51]. Anchoring refers to one's initial judgment with respect to a decision and is determined by individual preference. On the other hand, adjustment refers to the tendency for the decision maker to be influenced by additional information. Behavioral decision-making studies indicate that the receiving of new information and evidence leads to the revision of belief [13]. During the decision-making process, possible information for reference is sought. This additional evidence may be positively or negatively related to the decision maker's belief, which is adjusted in either direction accordingly in light of the additional evidence [3]. The presentation of additional evidence changes one's belief, which then becomes the anchor for the next stage. Tversky and Kahneman [51] indicated that in general: (1) it is difficult for decision makers to anchor in the correct value initially; and (2) insufficient or inappropriate adjustment is made in light of other positive or negative information related to the initial decision.

A preconception is formed by the decision maker's pre-existing preference or on the basis of their first impression of the option. In a multi-option context, the distance between the initial anchoring point and specific option represents the extent to which that option is preferred. An option is preferred when a short distance between the anchoring point and that option, compared with others, is observed. The emergence of new evidence may drive the decision maker to move their decision either closer to or further away from the initial preferred option. Applying this concept to our study, in a two-option context, distance from the anchoring point to each realm represents the preferred level of each option. Subjects may adjust their decisions either closer to or further away from their preconception in light of new evidence. If the subject's initial anchoring settles in either realm, there is a tendency for the subject's decision to be adjusted away from their preference when receiving information that