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Shall we dance? — The effect of information presentations on negotiation processes and outcomes

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ABSTRACT

The way information is presented influences human decision making and is consequently highly relevant to electronically supported negotiations. The present study analyzes in a controlled laboratory experiment how information presentation in three alternative formats (table, history graph and dance graph) influences the negotiators' behavior and negotiation outcomes. The results show that graphical information presentation supports integrative behavior and the use of non-compensatory strategies. Furthermore, information about the opponents' preferences increases the quality of outcomes but decreases post-negotiation satisfaction of negotiators. The implications for system designers are discussed.

1. Introduction

Managers spend up to one fifth of their working time with conflict resolution and negotiation [15,63]. They increasingly negotiate via electronic media such as e-mail, e-meeting and e-negotiation systems [73]. Electronic negotiations are not mere translations of traditional negotiations onto electronic media, but rather they provide additional value by supporting the decision making and/or communication process [62,74]. Electronic negotiation support (eNS) is realized through information and communication technology and can range from a simple message exchange to a complex support system. A negotiation support system (NSS) comprises one or more of the following functionalities: facilitation of communication, decision/negotiation analysis support, process organization and structuring, and access to information, negotiation knowledge, experts, mediators or facilitators [26]. In this context, the representation of information (textual, graphical, and auditory) is important for human–computer interactions. Due to technical advances in the last decades, users can often rapidly and effectively choose from various formats of computer generated reports. We know from empirical evidence that the way information is presented strongly influences human perceptions, preferences and decision making (e.g. [5,76]). Thus, the presentation of information is of essential importance for decision makers [70,77].

Current technological advances allow decision makers to access information more easily by using wireless networks, data warehouses and similar tools [42,52]. The vast amount of information is not necessarily linked to more accurate and efficient decisions, but rather sometimes to "information overload" for a decision maker (e.g. [41,72]). Scientific interest also focuses on handling large amounts of information and on overcoming mental resource limitations and cognitive biases (e.g. [23,46]). These developments have led to the advancement of stylized decision aids that "represent the problem in a stylized way that capitalizes on some special human cognitive processing ability" [86, p. 46]. Traditional stylized decision aids are tables and graphs in the form of lines, scatter plots, bar charts, and animations [45]. These display formats have been used successfully to extend human processing abilities in decision making [34,78,79]. Nevertheless, the potential of stylized decision aids has not yet fully been explored in eNS research. Thus far, scholars have focused on the improvement of tool-functionalities which aid bargainers in the negotiation process (e.g. [11,37,53]). In that sense, graphical support implemented in a system would be used to improve process and outcome (e.g. [7,12,82]). In electronic negotiation systems, information to be represented in a graphical manner would include message threads, preferences and utility values [62].

Although information representation is relevant, it has received little attention in negotiation research. Typically, information in e-negotiation systems is presented in text or tabular format. Except for the suggested utilization of the "negotiation dance graph" [56], to date only a "history graph" has been proposed and implemented [27,63]. A history graph exhibits the history of offers and counteroffers over

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time of both negotiators based on preferences of the supported user only. In contrast, the negotiation dance graph represents all offers and counteroffers in the utility of both negotiators, while time is only implicitly considered, and it provides users with information about the actual preferences of their counterparts.

The present study aims to analyze how information presentation in these alternative formats (table, history graph and dance graph) influences the negotiators' behavior and negotiation outcomes. The paper reports on a 2006 controlled laboratory experiment. Students from three universities in Europe and the Middle East negotiated a contract in a scenario with multiple issues in the tourism industry. Using the NSS Negoisst [62,63], subjects were divided into three treatment groups using the three different representation aids on the negotiation process: a table, a negotiation history graph or a negotiation dance graph.

The paper is structured as follows: a discussion of the cognitive fit and related theories serving as the theoretical background of this study; an introduction of different types of information representation in a NSS; a discussion of the hypotheses comparing the effect of the three different information representation aids on negotiation processes and outcomes, based on previous empirical findings; a presentation of the Negoisst system and description of the experimental setting; and a presentation and discussion of the results and limitations of our study and future research threads.

2. Theoretical background

The paradigm of cognitive fit suggests that effective and efficient problem solving is obtained when all tools or aids used in the problem solving process correspond to the requirements of the task [78–80]. Problem solving is seen as an outcome of the relationship between problem presentation and the problem solving task. Cognitive processes act on the information presentation and the problem-solving task to provide a mental representation of the situation. The latter is the way the problem is represented in human working memory. When the types of information in the problem presentation match those in the task, the problem solver formulates a mental representation that is based on the same type of information. In contrast, a mismatch between the problem presentation and the task leads to a mental representation based only on the problem representation. The decision maker must then mentally transform the task into a suitable form, exerting additional cognitive efforts in order to solve a particular type of problem. Similarly, if a mental representation is formulated according to the task alone, the decision maker has to transform the data of the problem presentation into an appropriate form for the task solution. In both cases, additional cognitive capacities are required for auxiliary mental steps, which typically lead to poor results for the decision maker. The cognitive fit theory encourages the use of problem representations consistent with task requirements in order to improve the decision making process for those using decision aids.

Complementing the cognitive fit theory, Paivio [48–50] proposes the dual coding theory. This suggests that human working memory encodes, organizes, stores and retrieves imagery and verbal information in two different ways. When retrieving, processing and reproducing information, cognitive activities are mediated by two independent yet interconnected cognitive subsystems in the human mind: An imagery system (specialized in the representation and processing of nonverbal objects in a sequential manner) and a verbal system (specialized in handling linguistic propositions using a parallel processing system). Both methods are functionally interconnected at the referential levels, so that an activity in one system can cause an activity in the other system. The visual argument approach asserts that graphical displays make less demands on human cognitive resources [34,59]. According to this theory, graphs enable users to extract information without engaging in deep processing by providing guidance, constraints and facilitations in cognitive processes.

The cognitive fit theory and its complementary models (dual coding theory, visual argument approach and conjoint retention hypothesis) have received significant attention in empirical research. Several studies confirm the basic assumptions of the cognitive fit theory and propose further extensions. Speier and Morris [71] provide a study associating literature on graphical support and cognitive fit theory. They investigate the characteristics of query interfaces and show that visual interfaces provide a holistic perspective of the presented data. Along with Smelcer and Carmel [68], they extend the view of comparative advantages of graphical display formats by showing that the performance difference in terms of time and accuracy increases even with task complexity. The relationship between the level of information processing and environmental complexity has the shape of an inverted “U” [65], demonstrating that graphical aids allow users to gather more information prior to reaching the critical point of information overload. Free cognitive resources can be used elsewhere. A more recent Speier study [70] illustrates that subjects supported with graphs perform as well as subjects supported with tables, when facing complex symbolic tasks involving decision accuracy. Furthermore, they outperform the latter when facing spatial tasks. Graphs help subjects find solutions faster regardless of task complexity in spatial tasks, while subjects supported with tables are only equally efficient in complex symbolic tasks. Concerning the characteristics of spatial language, Hubona et al. [21] provide support for the cognitive fit theory in terms of decision accuracy but not in terms of time. Recently, Khatri et al. [28] extended the perspective of cognitive fit for external problem presentations and internal task representations. They find subjects to perform more accurately but not faster when both presentation formats match. The fit of both presentations facilitates an understanding of the presented information.

Other studies suggest a trade-off between the benefits of minimizing errors and the cognitive effort or time needed in a particular task environment [14]. When facing complex situations, decision makers use cognitive simplification strategies [15,61] and pursue a strategy of swapping effort in terms of time invested in the problem solution for accuracy [24]. The graphical organization of information influences the equation of this cost–benefit tradeoff by allowing the user to pursue an adequate strategy more easily than others. Jarvenpaa [22] introduces the term “incongruence” to describe a situation in which the processing required for a decision strategy and the process encouraged by the graphical tool are in conflict. Thus, the cost–benefit principle assumes that this incongruence results in additional costs for the user, increased effort or time or higher likelihood of mistakes. Dilla and Steibart [13] confirm that additional mental calculations increase the potential of making mistakes.

3. Types of information representation in eNS

In general, NSS have incorporated the following types of information representation for quantitative data: (1) solely text-based systems, (2) numerical systems offering analytical decision support with utility functions and preference values, (3) systems offering stylized decision aids in the form of tables, and (4) systems offering graphical display of the negotiation history.

While text-based systems constitute a minimum requirement, all other representation forms are more sophisticated. One idea to support decision makers is to quantify all available data and to implement it into numerical systems, which have already been shown to provide better support than simple textual messages. Numerical systems require well-structured inputs in a predefined format [19], show impacts of variables on results [7] and provide assessment scores [36]. However, numerical systems do not support decision makers in handling dynamic processes [7]. In negotiations, the history of exchanged offers, the concessions of the negotiation parties over time, their possible change of preferences and similar dynamic processes contain essential