The Effectiveness Of Graphic And Tabular Presentation Under Time Pressure And Task Complexity

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Time pressure affects decision making and, therefore, should be considered in the design of decision support systems. Although long recognized as an important variable, time pressure has received little attention from information systems researchers. This research empirically tested the effects of presentation format, time pressure, and task complexity on decision performance. The objective was to determine the effective presentation format (graphics or tables) for the performance of tasks of varying complexities by decision makers under time pressure. Results showed that when time pressure was low, the effectiveness of the two presentation formats depended on the type and complexity of the task. With increasing time pressure graphics generally were found more advantageous. The findings add to the literature by showing the superiority of graphics over tables in supporting decision making under time pressure.
may be applied to the study of other types of design choices. Task complexity was the third variable included in this research. The effectiveness of presentation format has been shown as a function of task complexity (Hwang and Wu, 1990; Montazemi and Wang, 1989). It will be interesting to see if task complexity has the same impact on the effectiveness of presentation format when the decision maker is under time pressure. In sum, the purpose of this study was to determine the effective presentation format (graphics or tables) for the performance of tasks of varying complexities by decision makers under time pressure. The results could benefit systems design in practice and inspire research in the future.

Literature Review

Time Pressure Studies

Time pressure has been studied by psychologists and behavioral scientists in an effort to evaluate its impact on decision strategies and decision effectiveness. Wright (1974) found that decision makers adopted simplifying strategies when time pressure was high. In addition, he found that subjects under high time pressure placed greater weight on negative information about alternatives. If individuals are more sensitive to the negative outcome of their decisions, they should become more conservative. Hansson, Keating, and Terry (1974) found that time pressure led subjects to vote more conservatively in a simulated election. Ben Zur and Breznitz (1981), who used students in a gambling choice study, found that subjects preferred less-risky alternatives and gave greater attention to negative information when time pressure was high. Zakay and Wooler (1984) replicated Wright’s findings and, additionally, found that decision quality decreased as time pressure increased.

The impact of time pressure on performance has been studied more intensively. Researchers in various fields have consistently found that time pressure increases the pace of work and thus the rate of production. For example, Kelly and McGrath (1983) found that students solved more anagrams in five minutes than in ten or twenty minutes. Latham and Locke (1975) found that logging crews worked faster when deadlines were short. Bassett (1979) reported that individuals performed a simple clerical task faster when given short time limits. Conversely, several researchers have found a drop in productivity with decreasing time pressure. For example, Bryan and Locke (1967) found that students took more time to complete arithmetic tasks when given longer deadlines. Similarly, Arvedson (1974) found that fewer subjects completed a task when no deadline was imposed.

When performance is measured in quality, however, more time pressure may not always lead to better performance. Kelly and McGrath (1985) found that students produced better quality essays in twenty-minute time periods than in ten-minute time periods. Andrews and Farris (1972) studied performance ratings of NASA scientists and engineers. They found that performance ratings were related to the subjects’ perceived time pressure at work. Also, performance tended to increase with increased time pressure only to fall off when the time pressure became too severe. Peters et al. (1984) replicated similar results in studying employees of a commercial bank. As a result, Peters et al. proposed a theory suggesting the overall relationship between time pressure and performance (as measured in quality) as an inverted U-shaped one. Increasing time pressure leads to better performance up to a certain point; after that point more time pressure reduces rather than increases performance.

McDaniel (1990) studied the effects of time pressure and audit program structure on audit performance. She found that with increasing time pressure audit efficiency increased but audit effectiveness decreased. Only one published presentation format study examined the effect of time pressure. Benbasat and Dexter (1986) compared performance between subjects using tables and graphics under various time constraints. They found that graphics led to shorter decision times than tables in the low time constraint group. When time pressure was high, the use of graphics or tables did not result in significant differences in decision time or decision quality. This insensitivity may result from the low-complexity task employed in their experiment. Also, they did not report the interaction effect of time pressure and presentation format, thus leaving the research question of the efficacy of graphics in supporting decision making under time pressure unanswered.

Presentation Format Studies

Research on the effectiveness of graphics as decision aids has been criticized as sparse and highly controversial (Dickson, DeSanctis, and McBride, 1986). Many conflicting results reported in the literature may be attributed to methodological problems such as task and measurement (Jarvenpaa, Dickson, and DeSanctis, 1985). Recent reviews by Hwang and Wu (1990), Jarvenpaa and Dickson (1988), Montazemi and Wang (1989), and Vessey (1991) confirm that task is the primary confounding variable.

In a meta-analysis, Hwang and Wu (1990) concluded that graphics are more effective than tables with medium-complexity tasks; graphics and tables do not affect decision effectiveness with simple or complex tasks. Jarvenpaa and Dickson (1988) developed guidelines on the use of graphics with different types of tasks. In another meta-analysis, Montazemi and Wang (1989) found that task complexity has a moderating effect on subject performance in timesaving and precision. Based on the theory of cognitive fit, Vessey (1991) argued that tables are more effective for symbolic tasks while graphics are more effective for spatial tasks. It should be noted that cognitive fit applies to tasks of low complexity only. As Vessey (1991) put it: “These are elementary tasks and some of the simpler decision-making tasks.” (p. 225) For tasks of medium or high complexity, the available evidence suggests that task complexity, not task type, impacts the effectiveness of presentation format studies.