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Overconfidence in What-if Analysis: Active Involvement vs. Imaginability of Outcomes

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Introduction

Recent published studies suggest that the use of what-if analysis often leads decision makers to become overly confident in their resulting decisions. The purpose of the present research is to investigate the theoretical mechanisms underlying this inflated sense of confidence. The two candidate mechanisms examined relate to two prominent features of what-if analysis. First, the additional effort put forth physically entering decision scenarios into a what-if model compared to unaided decision making may be a form of "active involvement" which could lead to inflated expectations of success according to the illusion of control principle. Second, witnessing a broader range of simulated future outcomes via the what-if model might inflate the "imaginability" of successful outcomes, which theoretically could exaggerate decision makers' perceptions of the likelihood of those outcomes. The present research proposes an experiment to assess the relative roles of "active involvement" and "imaginability of outcomes" as underlying determinants of overconfidence during what-if analysis. The experimental design involves independently manipulating entry of model input and receipt of model results, and assessing their relative impact on decision confidence. Such research would have important implications for designing interventions aimed at reducing overconfidence using what-if analysis as well as for identifying possible sources of biased confidence in other types of decision support tools.

What-if analysis has long been among the most widely used capabilities of computer-based decision support systems. What-if analysis is a method for manipulating a quantitative model of a business situation in which decision makers specify alternative values of decision variables and environmental assumptions, and the computer solves the model and displays predicted results. Numerous computer programs, including IFPS and Excel, are available for creating business models and interrogating them via what-if analysis.

Despite this popularity, research to date on the effectiveness of what-if analysis, and decision support systems in general, has produced mixed results (for reviews, see Benbasat & Nault, 1990; and Sharda, Barr, & McDonnell, 1988). Researchers have often been unable to find any performance differences between assisted and unassisted decision making (e.g., Aldag & Power, 1986; Goslar, Green, & Hughes, 1986). Significant effects, when found, have sometimes been positive (e.g., Benbasat & Dexter, 1982; Benbasat & Schroeder, 1977; Sharda, et al., 1988), and sometimes negative (e.g., Chakravarti, Mitchell, & Staelin, 1979; Kottemann & Remus, 1987).

Why is what-if analysis so popular when research has been unable to demonstrate consistent advantages? Do decision makers overestimate the effectiveness of what-if analysis? Several research studies have documented that people do often overestimate the effectiveness of what-if analysis. In a simulated production scheduling task, the use of what-if analysis had no significant effect on decision quality compared to unaided decision making, and yet subjects perceived what-if to be significantly more effective (Davis & Kottemann, 1994; Kottemann, et al., 1994). When offered the advice of a simple but powerful decision rule, subjects perceived no significant difference in effectiveness between using the rule versus what-if analysis (Davis & Kottemann, 1994; 1995). When users overestimate their decision performance using what-if analysis, they are apt to unintentionally degrade their own performance by using it to the exclusion of alternative tools that may well be more effective than what-if analysis (such as quantitative decision rules).

Hypotheses

As evidence begins to accumulate that decision makers at least sometimes overestimate the effectiveness of what-if analysis relative to alternatives such as unaided decision making and decision rules, more research is needed on the issue of why these misperceptions occur and, therefore, what can be done to correct them. The present research investigates two theoretical mechanisms underlying the formation of inflated performance beliefs using what-if analysis. First, the additional effort put forth physically typing decision scenarios into a what-if model compared to unaided decision making may be a form of "active involvement" which could lead to inflated expectations of success according to the illusion of control principle. Second, witnessing a broader range of simulated future outcomes via the what-if model might inflate the "imaginability" of successful outcomes, which theoretically could exaggerate their perceived likelihood of occurring.

Theory

Langer (1975) theorized and provided evidence that when factors ordinarily associated with increased performance in skill situations are introduced into situations at least partially determined by chance, a person's expectation of success on the task is inflated to levels that are inappropriately higher than objective circumstances warrant. As Langer points out (1975, p. 318): "In skill situations, the more one actively participates in the event, the more control one has over the outcome. Hence it is predicted that the greater one's active involvement in a chance event, the greater the illusion of control." Langer and Roth (1975) also found that active involvement in a chance task inflated subjects' sense of control over outcomes.

By requiring decision makers to enter the desired values of decision variables and assumptions into a model, what-if analysis increases the degree of active involvement in the decision task relative to unaided decision making. In the studies cited above in which what-if analysis led to inflated performance beliefs, subjects did in fact take significantly longer using what-if analysis versus unaided (Kottemann, et al., 1994; Davis & Kottemann, 1994), though it is not clear whether the increased confidence was due to additional time spent entering scenarios or examining predicted outcomes. The design proposed below attempts to clarify this by independently manipulating entry of scenarios and examination of outcomes.

Imaginability of Outcomes.

An alternative mechanism by which what-if analysis may lead to inflated decision confidence is by increasing the "imaginability of outcomes." By examining the results of many hypothetical scenarios, decision makers may find it easier to imagine more successful outcomes than in cases where the number of explicit scenarios examined is low (e.g., zero in the case of unaided decision making or one in the case of a quantitative decision rule). Much research has shown that judgments of the likelihood of an event are influenced by the ease with which the event can be imagined (Anderson, 1983; Kahneman & Tversky, 1982; Tversky & Kahneman, 1973). In the present context, we suggest that using what-if analysis to examine the simulated outcomes associated with a range decision scenarios, some of which represent fairly successful outcomes, decision makers would find it easier to imagine a successful outcome than would be possible unaided.

Method

There are thus two potential theoretical mechanisms, active involvement and imaginability of outcomes, either of which could plausibly lead decision makers to have inflated decision confidence using what-if analysis.

The experiment will employ a 2x2 factorial between-subjects design. Subjects will be introduced to a decision model calibrated to a base case scenario; the outcome associated with the base scenario will be displayed to all subjects. Subjects will be given the decision inputs associated with ten additional decision scenarios (counterbalanced in their presentation order). Active involvement will be manipulated by

controlling whether or not subjects are asked to manually enter into the computer model the inputs associated with the scenarios. Imaginability of outcomes will be manipulated by showing or not showing subjects the model-predicted results of the scenarios. Thus, group 1 sees but does not enter the inputs, and does not see the outcomes. Group 2 sees both the inputs and the outcomes, but does no data entry. Group 3 manually enters the inputs but does not see the outcomes. Group 4 manually enters the inputs and sees the outcomes. All subjects will then be asked to answer questionnaire items regarding their perceived decisional confidence, degree of active involvement, and ease of imagining successful outcomes.

The experiment will be conducted during Summer 1996. Participants will be recruited from among MBA and undergraduate business students at large Mid-Atlantic University. A minimum sample size of 60 is intended.

The results obtained from this research effort should serve to inform the efforts to design interventions aimed at reducing overconfidence using what-if analysis as well as identify possible sources of biased confidence in other forms of decision support tools.

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