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BREAKING THE FRAME: AN ANALYSIS OF STRATEGIC COGNITION AND DECISION MAKING UNDER UNCERTAINTY

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This paper reports the findings of two experimental investigations into the efficacy of a causal cognitive mapping procedure as a means for overcoming cognitive biases arising from the framing of strategic decision problems. In Study 1, final year management studies undergraduate students were presented with an elaborated strategic decision scenario, under one of four experimental conditions: positively vs. negatively framed decision scenarios, with prechoice vs. postchoice mapping task orders (i.e., participants were required to engage in cognitive mapping before or after making a decision). As predicted, participants in the postchoice mapping conditions succumbed to the framing bias whereas those in the prechoice mapping conditions did not. Study 2 replicated and extended these findings in a field setting, on a sample of senior managers, using a decision scenario that closely mirrored a strategic dilemma currently facing their organization. Taken together, the findings of these studies indicate that the framing bias is likely to be an important factor in strategic decision making, and suggest that cognitive mapping provides an effective means of limiting the damage accruing from this bias.

INTRODUCTION

In recent years there has been a growing recognition of the importance of cognition in the strategy process in general (e.g., Huff, 1990; Schwenk, 1984) accompanied by a proliferation of studies seeking to elucidate theoretically and empirically the precise ways in which strategic thinking influences strategy development and implementation (for recent reviews see Schwenk, 1995; Walsh, 1995). From the perspective of the practitioner, however, the ultimate aim of this research is to enhance the practice of strategic management, through the development of intervention techniques for facilitating strategic conversations (see, for example, van der Heijden, 1996; Eden and Ackermann, 1998). Although significant progress has been achieved in the development of techniques for exploring actors' representations of strategic phenomena, there have been few published attempts to rigorously evaluate the efficacy of these procedures for practical use in applied settings.

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In the present paper, we report the findings of two studies designed to evaluate the efficacy of one of these procedures: causal cognitive mapping (Axelrod, 1976). The purpose of the studies was to determine whether or not this particular approach to cognitive mapping decreases or eliminates the framing bias (Kahneman and Tversky, 1984), a factor known to reduce the quality of decision making in a broad range of situations. In this introductory section we briefly review theory and research on strategic cognition as a basis for developing our hypotheses.

Two complementary streams of research are evident in the recent literature on strategic cognition. In the first, concepts from the heuristics and biases literature (e.g. Kahneman, Slovic, and Tversky, 1982) have been applied to strategic decision-making processes in field settings (see, for example, Golden, 1992; Lant, Milliken, and Batra, 1992). This stream of research treats strategic decision making as a special case of decision making under uncertainty, in which actors are viewed as limited-capacity information processors faced with complex informational cues at each stage of the decision-making process. It is argued that in order to render the world manageable, strategic decision-makers employ a variety of heuristics (or 'rules of thumb') which enable them to cope with a complex and uncertain business world by making a number of simplifying assumptions which reduce the burden of information processing. However, these heuristics can have a deleterious effect on decision making (cf. Simon, 1957). On the basis of a detailed review of the experimental laboratory evidence, several researchers (Barnes, 1984; Bazerman, 1998; Schwenk, 1984) have identified a number of potential cognitive biases, which are likely to affect strategic decision-makers.

To date, applications of the heuristics and biases perspective to the field of strategic management have involved drawing inferences from extant theory and research within the experimental cognitive psychology and behavioral decision-making literatures. Despite calls for research which directly examines the ecological validity of this previous work in the context of strategic decision making (e.g., Schwenk, 1982), there have been few published experimental studies which have sought to meet this challenge—for notable exceptions, however, see Bateman and Zeithaml (1989) and Bukszar and Connolly (1988).

The central focus of this paper is the framing bias. This bias arises when trivial changes to the way in which a decision problem is presented, emphasizing either the potential gains or the potential losses, lead to reversals of preference, with decision-makers being risk averse when gains are highlighted and risk seeking when losses are highlighted (Kahneman and Tversky, 1984). To overcome this bias decision-makers are encouraged to adopt procedures 'that will transform equivalent versions of any problem into the same canonical representation' (Kahneman and Tversky, 1984: 344) in order to bring about the normatively desirable state of affairs in which individuals' preferences conform to the basic axioms of rational choice. In other words, decision-makers need to develop more elaborate models of problems, taking into account both the potential gains and losses involved, to ensure that trivial features of the decision context do not unduly influence choice behavior. However, beyond the confines of typical laboratory-based decision studies, in practice it may not be so easy to follow this prescriptive advice.

The second stream of research (reviewed in Huff (1990), Fiol and Huff (1992), Schneider and Angelmar, (1993), Walsh, (1995); and Hodgkinson (1997a)) has involved the development of mapping techniques that seek to capture the structure and content of actors' strategic thought processes in a relatively direct fashion. Drawing on the field of cognitive science, this stream of work is predicated on the assumption that actors construct a simplified working model of reality (a 'mental model') which in turn acts as a basis for strategic decision making.

While this literature has demonstrated that a cognitive perspective can enrich our understanding of processes of strategic management, much of the recent work on the role and influence of actors' mental models in strategic decision making has been characterized by relatively limited research designs, in which poor controls prohibit causal inference. Several commentators (e.g., Hodgkinson, 1997a; Schneider and Angelmar, 1993; Walsh, 1995) have observed that most of the studies which have directly explored strategic cognition, in field settings, have failed to control for the impact on cognition of a number of individual and organizational factors, thus rendering the substantive significance of the findings equivocal. On the basis of currently available

evidence, it is difficult to ascertain what role, if any, actors' mental models play in determining the outcomes of strategic decisions.

One way in which the judgmental biases identified in the first stream of research might be minimized in complex field settings is through the use of the various cognitive mapping techniques developed within this second stream of research. These techniques require individuals to engage in effortful thought in a relatively detailed, structured and systematic fashion, prior to selecting a course of action (cf. Smith and Levin, 1996). To the extent that judgmental biases can be eliminated in this way, practitioners would have at their disposal a readily available intervention technique for enhancing the quality of the strategy process.

One approach to cognitive mapping in particular which, *a priori*, appears to be suitable for the purposes of debiasing actors' judgments of risky problems under uncertainty, is the technique of causal mapping (Axelrod, 1976). Causal maps depict the perceived pattern of (causal) interrelationships between a set of variables. During the past decade this approach to cognitive mapping has had a significant impact within the strategy field (see, for example, Eden and Spender, 1998; Huff, 1990). In the words of Huff:

> "Causal maps allow the map maker to focus on action—for example, how the respondent explains the current situation in terms of previous events, and what changes he or she expects in the future. This kind of cognitive map is currently the most popular mapping method in organization theory and strategic management. (Huff, 1990: 16).

In addition to providing a useful means for gaining insights into the nature and significance of cognitive processes underpinning strategic decision making, this dynamic emphasis on antecedents, behaviors and consequences, renders causal cognitive mapping techniques particularly attractive as a potential means for overcoming the effects of framing (and possibly other cognitive biases) in situations involving relatively complex decision scenarios. In the following studies we investigate the extent to which judgmental biases arising from the framing of risky decision problems can indeed be eliminated through the use of this particular cognitive mapping technique.

Two hypotheses are tested. First, if it is correct to assume that the framing bias is not restricted to simple laboratory problems and is a potentially influential factor in more complex strategic decisions, then we should find evidence of significant differences in risk preferences when participants are presented with alternative versions of elaborated problem scenarios, identical in all respects except for the fact that the choice alternatives have been systematically manipulated so as to emphasize the potential gains (positive problem version) or the potential losses (negative problem version). Second, if cognitive mapping does lead to improvements in the strategy process (by eliminating the framing bias) then we should find that the observed significant differences in risk preference attributable to the framing manipulation are no longer evident when participants are required to engage in a cognitive mapping task prior to decision making.

STUDY 1

Method

Participants

Eighty-eight final year undergraduate management studies students (N = 46 male; N = 42 female) completing a compulsory two-semester course in strategic management acted as participants. Their ages ranged between 20 and 28 years (mean = 21.2 years; SD = 1.1). The study was undertaken in class time, in part fulfillment of the course requirements.

Previous investigations into the effects of framing in the strategy field (e.g., Bateman and Zeithaml, 1989), have failed to reveal substantive differences between participants who are advanced undergraduates and participants who are experienced practitioners completing MBA degrees. Nevertheless, in order to ensure that the current participants were sufficiently familiar with a range of advanced theoretical concepts, frameworks and techniques in the strategic management literature, data collection took place towards the end of the program.

Materials

The stimulus materials comprised a case vignette which described a real strategic investment

decision facing a manufacturer and distributor of fast paint-drying systems, used in the repair of automotive vehicles. The case involved 'E. S. Paint Systems Ltd' (a pseudonym), a company facing increasing competitive pressures in its domestic market in the form of growing numbers of rival firms seeking to offer similar products, to the point of market saturation, with a longer-term threat of product substitutability arising from rapidly advancing technological developments. The case was presented in the form of a background report (circa 500 words) outlining briefly the (10-year) history of the company to date, culminating in the fundamental strategic decision facing the board, set against a background of a specific profit target of £3 million. The participants were required to adopt the role of a board member and indicate which of two options they would chose.

Positively and negatively framed versions of the decision problem were developed. In each case participants had to choose between a 'safe' alternative (continue in the domestic market) with a highly predictable outcome and an equivalent 'risky' alternative (invest overseas) with two possible outcomes each associated with a different likelihood of occurrence. In the positively framed version participants had to choose between:

> A. Developing a new marketing effort within the domestic market and not attempting to export overseas. Market research indicates that this option would certainly lead to profits of £1 million;
>
> B. Halting new developments within the domestic market but a commitment to the export market overseas. Market research indicates that this initiative would lead to profits of £3 million with probability one-third, and no profits with probability two-thirds.

In the negatively framed version, by contrast, they had to choose between:

> C. Developing a new marketing effort within the domestic market and not attempting to export overseas. Market research indicates that this option would certainly lead to profits £2 million below target;
>
> D. Halting new developments within the domestic market but a commitment to the export market overseas. Market research indicates that this initiative would lead to profits at target level with probability one-third, and profits £3 million below target level with probability two-thirds.

Apart from these particular variations, the stimulus materials presented to participants were identical in all respects.

Cognitive mapping task

In addition to completing the decision task outlined above, participants were asked to represent the ways in which they thought about the problem in the form of a cause map. This involved the participants identifying the variables that they thought about while making their decision, and drawing a network diagram with each variable represented as a node. Within the system employed in this study, causal relations between nodes are represented in terms of linkages between nodes, drawn as lines with an arrowhead depicting the direction of causality and a number (ranging from +3 to −3) depicting the nature and strength of the relationship. Perceived positive causal relations are indicated by positive strength ratings (+3 representing the strongest possible positive effect) and perceived negative causal relations with negative strength ratings (−3 denoting the strongest possible negative effect).

The participants were instructed to identify those mapping variables they considered to be central to the way in which they thought about the problem, with the proviso that both of the choice alternatives had to be incorporated in their 'shortlists', as a given. In order to complete this task, the participants were provided with a comprehensive list of variables (18 in all) identified on the basis of a conceptual analysis of the stimulus materials. However, in order to ensure that the participants were not constrained unduly, they were allowed to add additional variables of their own choosing if considered appropriate. They were advised that their lists may contain as few as two to three variables or as many as nine to ten, with the proviso that only those variables they actually considered (including both choice alternatives) when thinking about the problem should be included.

The mapping variables were used for deriving the participants' personalized cognitive maps, i.e., a visual representation of the way in which they thought about the problem, in causal terms. Following Green and McManus (1995) the parti-

Table 1. Choice responses of participants, as a function of the framing and pre- versus post-choice mapping manipulations

	Framing Condition			
	Positive		Negative	
	Risk Averse	Risk Seeking	Risk Averse	Risk Seeking
Post-choice mapping	10 (22.7%)	12 (27.3%)	2 (4.5%)	20 (45.5%)
Pre-choice mapping	8 (18.2%)	14 (31.8%)	8 (18.2%)	14 (31.8%)

cipants drew their cause maps directly. It was emphasized throughout that there were no 'right' or 'wrong' answers and that the participants were free to alter their diagrams in any way they considered appropriate as the task progressed.

Design

A two (positive vs. negative problem frame) by two (pre- vs. postchoice mapping) between-participants experimental design was employed; i.e., the participants received one version only of the research task. Twenty-two subjects were allocated to each condition on a random basis.[1]

Results and discussion

The raw frequencies and associated percentages of participants selecting each alternative are presented in Table 1. Inspection of this table reveals that the data are consistent with both of our hypotheses. In the postchoice mapping conditions the results indicate that the number of participants favoring the risk-averse alternative is higher following exposure to the positively framed version of the problem. Conversely, the number of participants favoring the risk-seeking alternative is higher following exposure to the negatively framed version of the problem. The results of a chi-square test confirm that this pattern of findings is statistically significant ($\chi^2(1) = 7.333$, $p < 0.01$), providing strong evidence of judgmental bias attributable to the framing manipulation.

For the prechoice mapping conditions, by contrast, there is no evidence of a framing bias. There are equal proportions of participants who prefer the risk-seeking and risk-averse alternatives, irrespective of whether they have been exposed to the positively or negatively framed version of the problem ($\chi^2(1) = 1.00$, NS).

While the results of this study demonstrate the potential power of causal mapping to militate against the framing bias, there is a weakness that might limit the external validity of the findings: participants were drawn from an undergraduate population. This means that the findings might not generalize to practicing managers making decisions directly relevant to the long-term well-being of their organizations. Undergraduates may be more susceptible to 'frame breaking' in comparison to experienced managers because their cognitive maps, or schemata, have not been substantially reinforced over many years (cf. Barr and Huff, 1997; Hodgkinson, 1997b). To explore this possibility further, we undertook a follow-up investigation, designed to examine the effects of causal mapping on the framing bias in a field setting, involving a group of experienced managers, using a case scenario developed around a strategic issue currently confronting their organization.

STUDY 2

Method

Participants

Two hundred and four sets of materials were mailed to a sample of senior managers in a banking organization. A total of 52 usable sets of data were returned, representing a response rate of approximately 25 percent. The participants' ages ranged between 25 and 50 years (mean = 37.12 years; SD = 6.43), while length of

[1] For present purposes exposure to the cognitive mapping exercise was only strictly necessary under the prechoice mapping conditions (i.e., map → decision). Nevertheless, participants in the postchoice mapping conditions (i.e., decision → map) also completed the mapping task as part of a wider investigation, beyond the scope of this paper.

service ranged between 2 and 29 years (mean = 16.53 years; SD = 7.71). The study was undertaken on an unpaid, voluntary basis.

Materials and procedure

The stimulus materials comprised a case vignette that was designed to mirror a strategic investment decision currently facing the participants' organization. The case was developed and piloted through a series of briefing meetings with members of the senior management team, supplemented by various documentary sources both internal and external to the organization concerned.

The case focused on a strategic issue facing many financial services organizations, concerning possible investment in ongoing technological developments in new delivery channels (e.g., PC banking over the Internet). While there is some agreement that traditional forms of banking have a limited future, there is still great uncertainty regarding which of the various technologies currently under review will ultimately come to dominate the industry. Each of the potentially viable alternative technologies is highly capital intensive, making investment in the 'wrong' technology disastrous for the organizations concerned. The customer profile of the sponsoring organization indicated a relatively high proportion of skilled and manual groups seen to be more reluctant to embrace the new technologies. The further development of more traditional forms of delivery was thus a realistic strategic option for this organization at the time of the study.

Building directly on this situation, the case entailed a fictitious bank (with a similar customer profile to the participants' actual organization) that had set specific targets to be achieved over the next 10 years. To meet these targets the board had to decide whether to further support a more traditional branch-based strategy or a new remote PC banking system. Whereas outcomes from choosing the branch-based strategy (the 'safe' alternative) were relatively predictable, outcomes associated with PC banking (the 'risky' alternative) were unpredictable. In a similar fashion to Study 1: (a) participants were told that a panel of experts predicted that one of the outcomes associated with the risky alternative would occur with a probability of one-third and the other with a probability of two thirds; (b) the values of the probabilities and outcomes were determined so that the safe and risky alternatives were the same in terms of expected value; (c) two versions of the choice problem were constructed—a positively framed version describing actual outcomes, and a negatively framed version describing outcomes in terms of how far short they were of the target set by the board.

As in Study 1, the case materials included arguments concerning the pros and cons of each alternative and the participants were required to make an investment decision. However, following an initial briefing meeting with several members of the organization concerned, it was apparent that a decision involving strictly dichotomous choices would lack realism for the participants. In order to further enhance the ecological validity of the study, therefore, the participants were required to allocate a fixed sum of money (£15 million) between each of the alternatives directly in proportion to their strength of preference.

As in Study 1, the participants completed a cognitive mapping task in addition to making their decisions. The cognitive mapping task was designed to follow as closely as possible the mapping task employed in Study 1.

Design

As in Study 1, a two (positive vs. negative problem frame) by two (pre- vs. postchoice mapping) between-participants experimental design was employed; i.e., the participants received one version only of the research task. Participants were allocated to each condition on a random basis. Of the 52 completed questionnaires, 25 of the participants had been allocated to one of the prechoice mapping conditions (positive frame, N = 15; negative frame, N = 10), while 27 had been allocated to a postchoice mapping condition (positive frame, N = 14; negative frame, N = 13).

Results and discussion

The means and standard deviations for the amount of money allocated to the safe and risky options, cross-tabulated by problem version under the pre- and postchoice mapping conditions, are presented in Table 2. As in Study 1, the data are entirely consistent with our two hypotheses. In the postchoice mapping condition, the average level of

Table 2. Means and standard deviations for the relative amounts (£ million) allocated to the safe and risky choice alternatives, as a function of the framing and pre- versus post-choice mapping manipulations

	Framing Condition			
	Positive		Negative	
	Risk Averse	Risk Seeking	Risk Averse	Risk Seeking
Post-choice mapping				
Mean	6.07	8.93	4.31	10.69
Standard Deviation	2.81	2.81	2.18	2.18
Pre-choice mapping				
Mean	5.67	9.33	6.30	8.70
Standard Deviation	3.58	3.58	2.36	2.36

money allocated to the safe alternative is higher following exposure to the positively framed version of the problem (mean rank = 16.50) as compared with the negatively framed version of the problem (mean rank = 11.31). The results of a Mann–Whitney *U* test confirm that this pattern of findings is significant ($Z = -1.81$, $p < 0.05$, one-tailed), providing evidence of a framing bias.[2]

In the prechoice mapping conditions, by contrast, we find that there is no evidence of judgmental bias attributable to the framing manipulation, with no significant differences in the amounts allocated to the risk-seeking and risk-avoiding alternatives across the positively (mean rank = 12.40) and negatively (mean rank = 13.90) framed versions of the problem ($Z = -0.51$, NS).

GENERAL DISCUSSION

The aim of the studies reported in this paper was to test two hypotheses concerning problem framing in strategic decision making. The first was based on suggestions that the framing bias, previously identified in relatively simple decision problems given to relatively inexperienced individuals, is also likely to be a feature of the complex strategic decisions taken by experienced individuals. In both experiments our findings provided strong support for this hypothesis.

The second hypothesis evaluated in these experiments was that cognitive mapping prior to choice would lead to a reduction in the framing bias. The findings were consistent across both experiments, showing that, as predicted, cognitive mapping prior to choice does in fact reduce this bias. Our findings indicate that cognitive mapping is as effective for experienced as it is for inexperienced decision-makers, thereby providing strong support for the prescriptive validity of this technique. Since the framing bias represents a violation of one of the fundamental principles of rational choice—the invariance axiom—we may conclude that cognitive mapping prior to choice improves the quality of the decision taken. These results are consistent with a growing body of opinion that effortful thought can attenuate or eliminate the framing bias (Maule, 1995; Sieck and Yates, 1997; Smith and Levin, 1996; Takemura, 1994). The implications for practice are that strategists, in an attempt to confront explicitly their mental models of the decision problem, should engage in a process of reflection prior to selecting a particular alternative, with a view to debiasing their judgments arising from framing.

Further work is required in two areas: (1) to examine the structure and content of the participants' cognitive maps, in an effort to uncover the precise mechanism(s) by which this debiasing occurs; (2) to determine whether causal cognitive mapping techniques will enable strategic decision-makers to overcome other cognitive biases identified by behavioral decision researchers (e.g., Kahneman *et al.*, 1982) and strategy scholars (e.g., Barnes, 1984; Bukszar and Connolly, 1988; Golden, 1992; Lant *et al.*, 1992; Schwenk, 1984). One area in particular which would seem worthy of immediate attention in this respect is the well-

[2] Conversely, the average level of money allocated to the risk-seeking alternative is equally significantly higher following exposure to the negatively framed version of the problem in comparison to the positively framed version of the problem, in mirror image to the results obtained for the risk averse alternative.

documented escalation of commitment phenomenon, i.e., the propensity to commit further resources to a failing course of action (Staw, 1997). Escalation of commitment has, *inter alia*, been linked to a variety of cognitive biases, in addition to framing, including 'illusion of control' and 'overconfidence in judgment' (see, for example, Huff and Schwenk, 1990; Schwenk, 1986). Extrapolating from the present findings, to the extent that causal cognitive mapping reveals alternative ways of thinking about strategic problems, it might prove possible to overcome the various biases associated with the escalation phenomenon, thereby reducing the tendency to escalate. On the other hand, it may transpire that some of these biases actually increase, following recourse to mapping. The suggestion here is that under certain circumstances mapping may simply act as a vehicle for elaborating existing ways of thinking. Further research is urgently needed to clarify this issue.

Experiments are a powerful means of elucidating, under controlled conditions, the nature and significance of cognitive processes underpinning strategic decision making. However, as observed by Schwenk (1982), the experimental method has been underutilized within the field of strategic management, due to the misperception that rigor must necessarily be achieved at the expense of relevance. Much of the recent literature reporting the application of cognitive mapping techniques, on the other hand, has been perilously close to the opposite extreme (for details see Hodgkinson, 1997a; Schneider and Angelmar, 1993; Walsh, 1995). The present findings, by contrast, demonstrate the virtues of combining both methods in order to enhance the scientific basis *and* practical relevance of this field.

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