CAN MANAGERS BE REALLY OBJECTIVE? BIAS IN MULTICRITERIA DECISION ANALYSIS

Silvio Borrero, Universidad Icesi
Felipe Henao, Universidad Icesi

ABSTRACT

Strategic management frequently requires making decisions in complex situations. Strategic decision-making is widely assumed to be an objective process supported by rational analytical tools. A strategic decision, however, involves both a structured part, which can be dealt with using different analytical tools, and an unstructured part, which must be dealt with by means of the decision maker's judgment, intuition and experience. Therefore, individual leanings are inherent to complex strategic decisions. To make such decisions, the human brain appeals to diverse heuristics or shortcuts to analyze and simplify contextual information. These mental strategies are not infallible; on the contrary, there is abundant evidence that humans' minds are prone to cognitive biases or traps that cloud objectivity when making decisions. In a managerial context, such biases or traps can result in suboptimal or inefficient decisions that undermine organizational value. It is not surprising, therefore, that there are so many tools and techniques devised to make (arguably) objective management decisions, based on evidence. Among other disciplines that facilitate decision making and thus reduce cognitive biases, operations research (OR) offers multiple analytical methodologies and procedures, such as Multi-Criteria Decision Analysis (MCDA). However, the relationship between cognitive biases and these decision-making tools has not been amply investigated. Empirical evidence on how individual differences and cognitive factors influence the effectiveness of these tools in practice is still lacking, and it is uncertain whether they contribute effectively to reducing cognitive biases, or if, on the contrary, cognitive biases interfere with the tools' effectiveness. This paper presents an experimental study involving undergraduate and graduate students where their individual differences, as measured by their hedonic or utilitarian leanings, are linked to two motivational biases, respectively known as confirmation and desirability of choice, and how these biases influence a decision made through MCDA techniques. Results suggest that experimental subjects employ MCDA to confirm previously conceived decisions, rather than using the tool to explore the problem situation, make sense of their preferences and choose the most appropriate course of action accordingly. This is, it appears that subjects make use of the OR tool to support a decision they have already made in their own minds. Consequently, the effectiveness of MCDA and other strategic or decision-making tools might be affected by individual differences and corresponding motivational biases. These results also suggest that there is a very fine division between valid, preference-based decisions and biased preconceptions. In particular, these experimental results question the effectiveness of multicriteria analysis tools; more generally, this research suggests that a totally rational decision making process—and therefore a completely objective, analytical, tool-supported, evidence-based management—might be a utopic endeavor.

Keywords: Strategic management, decision-making, individual differences, motivational biases, Multi-Criteria Decision Analysis.

INTRODUCTION

Strategic decision-making is often deemed as an objective exercise, especially when it is supported by—arguably—rational analytical tools. Classic rationality and bounded rationality paradigms assume that top managers approach strategic decision-making by means of a purposive, systematic and comprehensive process (Simon, 1955, 1979). Per this process, managers state concrete objectives, collect relevant information, develop viable alternatives, and identify the optimal course of action, thus maximizing utility. Throughout the past few decades, numerous techniques have been developed to facilitate decision making, including classic tools such as the strengths-weaknesses-opportunities-threats (SWOT), the political-economic-social-technological-environmental-legal (PESTEL), the external factor evaluation (EFE) or the internal factor evaluation (IFE) matrices, or more recent extensions, such as the internal competitive profile (ICPM), the external competitive profile (ECPM) or the financial competitive profile (FCPM) matrices (Capps III & Cassidy, 2016). The introduction and development of decision support systems (DSS) and other computer-based decision tools further enhanced the strategic decision making processes, and their capability to address increasingly complex situations (Shim et al., 2002). In general terms, most of these decision support tools are intended to deal with the structured parts of complex managerial problems to make decision making more efficient. Strategic decisions, though, involve both structured and unstructured elements, which must be dealt with by means of the decision maker's judgment, intuition and experience, in addition to any analytical approach chosen.

It follows that individual leanings or preferences are inherent to complex strategic decisions. Therefore, inevitably, cognitive and motivational biases pervasively affect managerial decisions and influence strategic outcomes (Das & Teng, 1999). As the exercise of strategic management frequently requires making decisions in complex situations, managers appeal to diverse heuristics or shortcuts to analyze and simplify contextual information. Since the publication of Tversky and Kahneman's seminal paper (1974), there has been an increasing interest in understanding the underlying mechanisms that explain such heuristics or shortcuts, and the consequent biases that may affect human behavior in organizational decision making and strategic planning contexts (Busenitz & Barney, 1997; Busenitz et al., 2003). Numerous experimental studies have been performed within the premises of different academic fields, such as psychology, economy, finance, marketing, and—marginally and more recently—operations research (Franco & Hämäläinen, 2016; Hämäläinen, Luoma, & Saarinen, 2013). As a result, researchers have identified an ample range of human biases that can be classified as cognitive or motivational, and which are capable of distorting judgment and decision-making (Montibeller & von Winterfeldt, 2015). This is known as decision theory. Overall, it could be argued that its most remarkable contribution to knowledge is that is has proven that humans are all vulnerable to fall into these biases, leading us to make suboptimal or inefficient decisions that violate rationality and commonly accepted normative principles (Kahneman, 2011).

In a managerial context, these biases can be especially costly because they could cloud objectivity when making decisions and therefore undermine organizational value (Frederick, 2005; Montibeller & von Winterfeld, 2015; Montibeller & von Winterfeldt, 2015). Although media and popular literature tend to praise gutsy business decisions—and the gutsy leaders who implement them—that yield successful market or business moves (Freiberg, 2004; Keyt, 2003), it is difficult to argue against the idea that firm strategies should be the result of sound analyses that consider as

much contextual evidence as possible before making a decision (Kiron, Ferguson, & Prentice, 2013). Not surprisingly, business literature abounds with tools and techniques devised to make management a scientific exercise that eliminates or reduces biases, and hence aim at achieving objective business decisions (Rigby & Bilodeau, 2007, 2015).

Operations Research (OR) is one of several disciplines that offer analytical methodologies and procedures to facilitate decision making and strategic planning (Stewart, French, & Rios, 2013). Although OR tools—such as Multi-Criteria Decision Analysis (MCDA), decision tress or influence diagrams, among others—focus on helping people solve problems and make better decisions under conditions of uncertainty, it appears to have ignored the behavioral aspects of the humans involved in its process (Hämäläinen et al., 2013). The relationship between people's individual differences, their biases and decision tools has not been amply investigated (Franco & Hämäläinen, 2016). This is, it is unknown whether decision making tools contribute effectively to deal with these cognitive factors, or if, on the contrary, cognitive factors interfere with the effectiveness of such tools (Montibeller & von Winterfeldt, 2015). It is therefore necessary to further develop the behavioral OR agenda (Franco & Hämäläinen, 2016; Hämäläinen et al., 2013) and to more effectively connect decision making tools with the managerial reality. This paper contributes to this need by reporting the design of an experimental study that links individual differences, as measured by personal leanings towards hedonic or utilitarian preferences, with two motivational biases, known as confirmation and desirability of choice. More specifically, this study explores how such personal preferences and biases influence decisions made supported by MCDA.

In what follows, we first briefly discuss from a theoretical point of view the known effects that individual differences and motivational biases have on decision-making, with particular detail on confirmation and desirability of choice biases. Then, the hypotheses for this study and our experimental approach to evaluating the effects of these two motivational biases on a MCDA problem are discussed in detail. We present some results that suggest that experimental subjects (undergraduate and graduate students) utilize MCDA to confirm previously conceived decisions, rather than to identify the best possible solution for them. Finally, we finish the paper by summarizing our main arguments, drawing some conclusions and presenting opportunities for extending our research.

ANTECEDENTS

For decades, the strategic and organizational literature has attempted to model the managers' decision-making processes and to propose analytical approaches to make better strategic decisions. In an attempt to rationalize and objectivize decision making, and to optimize managerial decisions, OR and other disciplines have developed analytical methodologies and decision support systems (Shim et al., 2002; Stewart et al., 2013). Most mid-size and large companies utilize such methods and systems, in varied settings, and there is abundant research on practical applications of decision support tools. The evidence is relatively scarce, however, on the potentially undermining effect of the human factor on the effectiveness of these tools. Extant literature tends to investigate and describe the firm's or its leader's strategic orientation, as evidenced by the observed actions (Pleshko & Nickerson, 2008), or to explore external factors that affect decision making in particular contexts (Akyürek, Sawalha, & Ide, 2015), rather than to understand the strategic decisions as a function of the manager's motivational or cognitive preferences. A manager's approach to a complex decision will strongly depend on specific individual differences, which inevitably affects the decision process' outcome. Strategic

management could certainly benefit from a more thorough understanding of the personal factors that affect strategic decisions, and, more specifically, from context-depending, prescriptive recommendations aimed at improving the effectiveness of strategic analytical tools. Such understanding requires a cross-disciplinary approach that combines a strategic perspective with contributions from other fields (Ronda-Pupo, 2015), such as social psychology, organizational behavior (OB) or operations research.

Social psychology and OB, for instance, have investigated the underlying mechanisms that explain human decisions. Appealing to strategies that facilitate decision-making processes is inherent to the human nature. Rather than approaching a novel problem by means of sequential, systematic or structured mental processes, the human brain tends to use heuristics or shortcuts to analyze contextual information and make decisions (Kahneman, 2011; Kahneman & Tversky, 1979; Tversky & Kahneman, 1974, 1981, 1986). These facilitating strategies result in more "efficient" decision processes, especially in complex situations (Frederick, 2005; Witteman, van den Bercken, Claes, & Godoy, 2009). However, such facilitating strategies are not infallible, and there is abundant evidence that indicates that humans' minds are prone to biases or traps that cloud objectivity when making decisions (Frederick, 2005; Kahneman, 2011).

Within the context of decision and risk analysis, for instance, Montibeller and von Winterfeldt discuss the effects of cognitive and motivational biases and suggest possible ways to counteract them (2015). A cognitive bias is defined as the systematic discrepancy between the actual answer given by a person to a particular judgmental task and what would be considered the correct answer after applying a formal normative rule. Motivational biases, on the other hand, are more about the influence of people's desirability or undesirability towards an event, consequence, outcome, or choice, in a particular judgmental task. Although both types of biases, cognitive or motivational, are likely to cloud objectivity when making decisions, this study focuses on the latter, given its prevalence and therefore likelihood to occur in business or strategic contexts.

Confirmation bias is one of such motivational biases. It is conceptualized as a mental shortcut that simplifies complex analyses and arduous inferential tasks by appealing to strongly grounded beliefs (Friedrich, 1993; MacCoun, 1998; Wason, 1960). Such beliefs thus serve as a heuristic that makes evaluation of new information more expedite and efficient. With a caveat; because people assume that their existing beliefs are true, the confirmation bias often results in poor decisions, given that extant evidence is not considered thoroughly or in a balanced manner (Hernandez & Preston, 2013). On the other hand, desirability of choice, another motivational bias, occurs when a person desires a particular decision option, and, consequently, overestimates or underestimates relevant parameters in order to favor the desired option.

In a business or strategic context, a person's bias might result in decisions which reflect conscious or subconscious individual preferences (Kahneman, Lovallo, & Sibony, 2011), rather than seeking value maximization for the firm. Previous research, for instance, has explored the influence of CEOs' and upper echelons' preferences—especially as related to demographic characteristics—in shaping corporate strategy (Jensen & Zajac, 2004). The marketing literature provides an interesting framework to better grasp the potential influence of personal preferences on business decisions. Indeed, in consumer behavior settings, there is ample research on the dichotomy between hedonic and utilitarian goals, which affect consumers' perceived value and hence their purchase decisions (Bridges & Florsheim, 2008; Jones, Reynolds, & Arnold, 2006; Overby & Lee, 2006; Sweeney & Soutar, 2001; Ulaga & Chacour, 2001). There is abundant evidence that the type of personal goal, hedonic or utilitarian, has a significant impact on a person's purchase decisions. In addition, it is believed that a person's motivational orientation for either

hedonic or utilitarian goals tends to be quite stable through time. Therefore, it is reasonable to expect people to favor decision options that match their hedonic or utilitarian preferences, and therefore will privilege evidence supporting such motivational orientation. Moreover, extrapolating organizational behavior findings on the influence of personal orientations on organizational decisions (Polman, 2012), it can be argued that personal preferences—and hence biases—will influence not only consumption decisions, but also decisions in other business or strategic contexts.

The influence of individual preferences and personal biases on people's decisions has recently captured the attention of OR literature. For instance, it has been argued that cognitive and motivational biases (Franco, Rouwette, & Korzilius, 2016), as well as people's individual differences (Franco & Hämäläinen, 2016; Hämäläinen et al., 2013; Montibeller & von Winterfeldt, 2015), can influence the effectiveness and practical value of arguably rational decision making tools. Consequently, individual differences and biases might be affecting the quality of the decision modelling process, the transparency of the resulting analyses, and therefore the effectiveness of the final decisions made.

There is not much evidence, though, on the undermining effects of personal biases on strategic decisions supported by analytical tools, especially in actual organizational settings. To assess the potential influence of personal leanings on the quality of a decision, and, more generally, on the effectiveness of strategic decisions, in this paper we study the relationship between individual differences regarding hedonic or utilitarian preferences and confirmation and desirability of choice biases, and the resulting effect on decisions made with a multicriteria decision analysis tool.

HYPOTHESES

Building on the aforementioned antecedents and our revision of previous research on decision making, multicriteria analysis, and cognitive biases, we contend that MCDA is sensitive to both, confirmation and desirability biases. This is, when considering diverse options; people will tend to choose the option that matches their personal preferences, regardless of the decision technique or tool used. Moreover, we argue that such personal desire is greatly determined by the person's motivational orientation, whether hedonic or utilitarian. Therefore,

H1 *(Motivational bias) There is a positive relationship between a person's motivational orientation and this person's decision.*

Furthermore, people who have a strong personal desire for a particular option will consider only those pieces of information that corroborate why the option should be chosen (confirmation bias) and will assign more priority to criteria that further favor that option (desirability of choice). Therefore,

H2 *(Confirmation bias) to make a decision, a person with a hedonic orientation will consider experiential criteria rather than performance criteria, whereas a person with a utilitarian orientation will consider performance criteria rather than experiential criteria.*

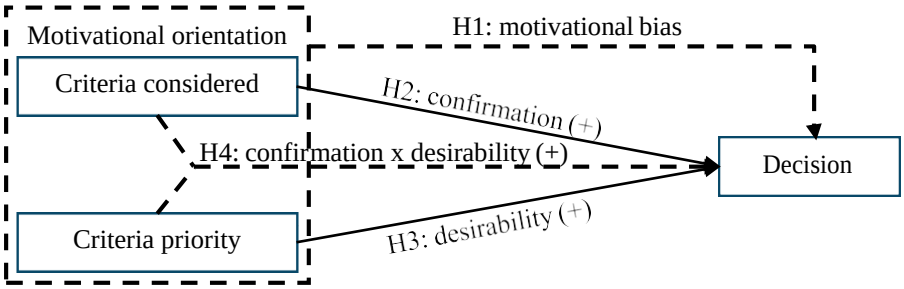
H3 *(Desirability of choice bias) To make a decision, a person with a hedonic orientation will assign higher priority to experiential criteria, relative to performance criteria, whereas a person with a utilitarian orientation will consider performance criteria rather than experiential criteria.*

Finally, given previous findings on the positive relationship between desirability of an outcome and selection of relevant information, we anticipate that both biases, confirmation and desirability of choice reinforce each other and jointly influence people's decisions. Therefore,

H4 *(Motivational interaction) the interaction between criteria considered and relative priority assigned to criteria, upon making a decision, will strengthen the positive relationship between a person's motivational orientation and this person's decision*

Figure 1 illustrates these hypotheses as components of a single, integrated model.

Figure-1
HYPOTHESES OF THE EXPERIMENTAL STUDY



METHODOLOGY

To study the effects of the confirmation and desirability of choice biases on an MCDA-supported decision, we designed an experimental intervention where undergraduate and graduate students, acting as the decision-makers of a simple decision problem, employ MCDA to support their decision. The experiment looks at the effects that both biases have on the decision making process and the actual decision made. We designed our experiment as a vehicle purchase decision, under the assumption that undergraduate and graduate students would easily relate to such a familiar decision context. We infer that confirmation and desirability of choice biases will positively relate to a person's orientation towards hedonism or utilitarianism and to their final purchase decision.

Participants

Participants included undergraduate (N=43) and graduate students (N=72) at a private university in Colombia. We specifically chose a class on OR techniques because of its relevance to the theses tested. The experiment was conducted during the multicriteria analysis module, embedded in one of the author's regular classes. Participants were recruited at the beginning of the class using a verbal and written information sheet that told them about their right not to participate in the experiment. To fine-tune our experimental design, which is described below, we conducted three early pilot versions of the experiment using undergraduate (N=35) master students (N=45) during the previous semester. The questionnaires and tools and manipulation were thus assessed to come up with the final version for the experiment with graduate students. All questionnaires to measure the variables were administered using on-line Qualtrics software before and during the class time.

Experimental design

We contrasted individual motivational orientation, confirmation bias and desirability of choice bias with hypothetical purchase decisions. The complete experiment consisted on three subsequent stages that asked them to make simulated purchase decisions, following a class lecture on multicriteria analysis. To analyze our results, descriptive statistics, pairwise correlations and analysis of variance (ANOVA) were conducted using SAS statistical software.

Note that common claims on the variability and effectiveness of MCDA results are related to its use either for individual or for group decision making (Schafer & Gallemore, 2016). This is, the use of MCDA and similar iterative methods in groups allow participants to mutually compare decisions, engage in dialogue, and discuss choices or weights, on a one-on-one or public manner. As a result, there is great potential for cross-contamination and distortion, and people might end up deciding on behalf of others' preferences or biases, which makes it difficult to make generalizable or standardized inferences. To control for this issue, respondents read instructions, analyzed data, and made their decisions in individual computers. Also, to minimize interaction between participants during the actual experiment, they were instructed to not talk with their classmates and the instructor lead them through successive stages in an orderly sequence, and with a reasonably limited time for each stage.

Stage 1

Following a lecture and corresponding material on MCDA and decision making, participants were asked to complete a questionnaire that assessed their motivational orientation. Then, they were given broad and limited descriptive specifications of the four purchase decision options and were asked to choose the one that they found more appealing (Decision 1).

Motivational orientation *(Predictor)*

Individual motivational orientation towards either *hedonism* or *utilitarianism* was assessed using the PERVAL 19-item scale developed to measure consumer perceived value (Sweeney & Soutar, 2001). Thus, participants' were categorized according to their individual leanings on four distinct value dimensions: emotional, social, quality/performance and price/value for money. For our study, we termed quality/performance and price/value for money as utilitarian motives and emotional and social motives as hedonic motives. The participants completed the PERVAL questionnaire before the experiment started.

Decision (Criterion)

Participants' decisions 1-3 were measured using custom questionnaires that asked them to choose between a limited set of purchase options, in a hypothetical car purchase decision. For their first decision (Decision1), four distinct car descriptions similar in price range and type of vehicle (respectively labeled A, B, C and D), were presented to the participants along with made-up specifications relevant to the purchase decision (see Table 1). Each vehicle option's specifications were designed to emphasize either *performance* (Car A) or *user-experience* (Car B) or to present a balance between performance and user- experience attributes (Cars C and D).

Table-1 EXPERIMENT STAGE 1: BROAD SPECIFICATIONS GIVEN FOR DECISION 1	
Car A: Sophisticated style, elegant exterior design, luxury interior finishes, very good audio system and highly pleasurable driving.	**Car B:** Maximum factory warranty, very powerful engine, optimal price-power, and maximum safety for passengers.
Car C: Powerful engine, luxury interior finishes, extended factory warranty, driving pleasure and high security for passengers.	**Car D:** Minimum fuel consumption, modern exterior design, good price-power, upgraded audio system and extended factory warranty.

Stage 2

Participants were given more detailed, qualitative and quantitative, specifications of the four purchase decision options and were asked to choose the one that sounded more appealing to them (Decision 2). The information was presented in the form of a pay-off matrix where performance-related criteria was listed as factory-catalogue specs and experience-related criteria was presented as consumers' self-reported assessment of their consumption/driving experience (Table 2).

Criteria Used (Predictor)

The specific evidence used by each participant to make a decision was used as a proxy for an individual's confirmation bias towards *performance* or *experience*. To measure this variable, participants were asked during stage 2 to highlight what specific data cells they had inspected and used to make their second decision. This was done by means of a custom tool based on the made-up specs sheet shown in Table 2. With this tool, respondents indicated which criteria they used by clicking on the appropriate cells on the table.This helps us to identify if participants systematically overlooked or neglected parts of the information given in the matrix.

Stage 3

Participants were asked to assign weight factors to the problem's criteria by following the *Swing weight* method protocol (Goodwin & Wright, 2004) and then to introduce them into the HiView3 software (www.catalyze.co.uk) so they would be able to play with the problem's data, which was already preset in the software. Thus, participants were asked to enter the weight factors into the software, look at the graphs generated and make a third and final choice (Decision 3).

Criteria priority (predictor)

The relative weights assigned by each participant were used as a proxy for an individual's desirability of choice bias towards *performance* or *experience*. This was done by means of a custom tool based on the same made-up specs sheet shown in Table 2. This allows us not only to identify if participants learned something from their interplay with the OR tool that made them change their minds, but also see if participants systematically allocated larger weight factors to the criteria that favored the decision option they had in mind from the start.

Table-2
EXPERIMENT STAGE 2: DETAILED SPECIFICATIONS GIVEN FOR DECISION 2

		Performance criteria (source: factory-catalogue)					Experience criteria (source: consumers' self-reported assessment of driving experience)				
Decision options	Price ($ COP)	Power (HP)	Price / torque ($ mill)	Warranty (Years)	Airbags (#)	Fuel consumption (km/gal)	External design	Luxury interior finish	Audio system	Highly pleasurable driving	Apparent social status
Car A	63	200	$3.800	3	2	32	Elegant	Luxury	Full	90	sofisticated upper class
Car B	61	300	$3.500	5	6	26	Basic	Standard	Basic	50	upper middle class
Car C	65	300	$4.000	5	5	30	Standard	Luxury	Full	70	upper middle class
Car D	59	160	$3.700	4	3	36	Modern	Standard	Hi-Tech	60	lower middle class

RESULTS

A total of 43 undergraduate students and 72 graduate students completed both the individual difference questionnaire that assessed their motivational orientation and the subsequent surveys that asked them to make a decision based on either experience or performance criteria. The motivational orientation 19-item questionnaire, as well as the custom instruments applied to test the desirability of choice hypothesis (weights assigned to prioritize criteria), showed good internal reliability, with Cronbach's alpha standardized values of .872 and .723, respectively. Table 3 presents the descriptive statistics and pair-wise, Pearson-product correlations between the measured variables.

Table-3
DESCRIPTIVE STATISTICS AND PAIR-WISE CORRELATIONS

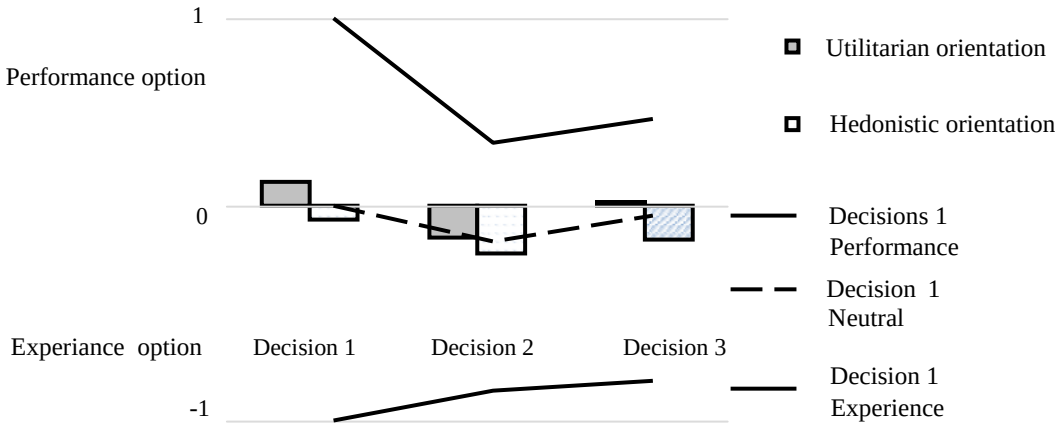
	Mean	SD	1	2	3	4	5	6	7
1. Motivational	1.273	0.844	1						
2. Decision 1	-	0.508	.259**	1					
3. Decision 2	-	0.549	.106	.441***	1				
4. Decision 3	-	0.542	.174	.464***	.697***	1			
5. Criteria considered	-	0.429	.398***	.445***	.520***	.528***	1		
6. Criteria priority	0.024	0.256	.328***	.465***	.604***	.684***	.590***	1	
7. Criteria favored	0.029	2.526	.175	.281**	.395***	.502***	.438***	.425***	1

Valid N (list) = 103; * p-value < 0.05 (2-tailed); ** p-value < 0.01 (2-tailed); *** p-value < 0.001 (2-tailed)

To illustrate how successive decisions maintained (or not) the first decision made by the

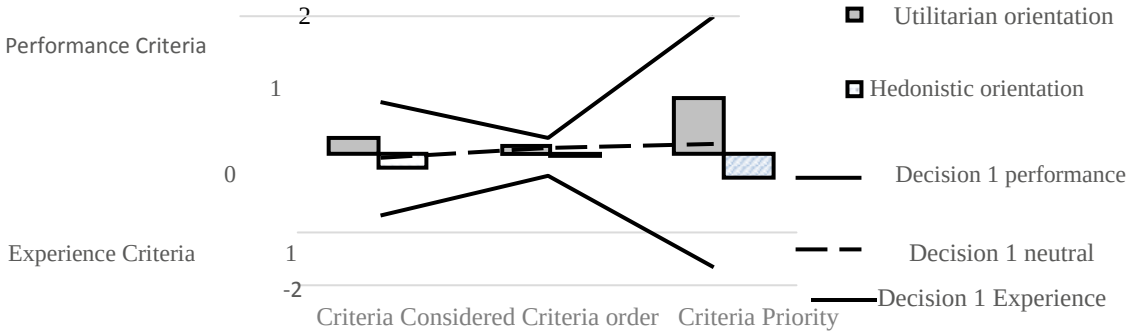
respondents, and how such decisions compared to the respondent's motivational orientation, we plotted the graph shown in Figure 2. In total, 60% of the participants adhered to their first decision on subsequent decisions 2 and 3; 29% changed their decision once, and 14% changed twice. Also, as illustrated by the columns in Figure 2, respondents with a hedonic orientation leaned more towards an experience-based decision than respondents with a utilitarian orientation, across all three decisions.

Figure-2
SEQUENCE OF DECISIONS 1-3, CATEGORIZED BY INDIVIDUAL MOTIVATIONAL ORIENTATION (HEDONIC VS. UTILITARIAN) AND FIRST DECISION MADE (PERFORMANCE, NEUTRAL OR EXPERIENCE).



To further assess the hypothesized biases, in Figure 3 we analyzed the criteria used by respondents, categorized by their motivational orientation, when making their decision using the made-up specifications data. *Criteria considered* refers to the criteria selected to make their decisions from the made-up specs table; *criteria order* refers to the order assigned to the selected criteria by the respondents; and *criteria priority* refers to the relative weights assigned by the respondents to all available criteria in the specs table.

Figure-3
EVIDENCE OF COGNITIVE BIAS, CATEGORIZED BY INDIVIDUAL MOTIVATIONAL ORIENTATION (HEDONIC VS. UTILITARIAN) AND FIRST DECISION MADE (PERFORMANCE, NEUTRAL OR EXPERIENCE).



To further test our hypotheses, including our interaction hypothesis (H4), we conducted an analysis of variance (ANOVA) regressing motivational orientation, criteria used and criteria priority, as independent variables, on the mean of decisions made, as the dependent variable. That is, we propose that the relationship between individual differences, biases and final decision can be expressed by the equation in (1):

$$DECISION = \beta\beta_0 + \beta\beta_1 MMMM + \beta\beta_3 CCCC + \beta\beta_4 CCCC + \beta\beta_5 (CCCC * CCCC) + \varepsilon\varepsilon \quad (1)$$

Where *MO* is *motivational orientation* (H1), *CC* is the *criteria considered* (H2), *CP* is the *criteria priority* (H3) and CC*CP is the *interaction* between both biases (H4).

Table-4
ANOVA - GLM PROCEDURE

Class-level information

Class	Levels	Values
Criterion priority	2	-1.00, 1.00
Observations read	117	
Onbservations used	107	
Dependent variable:	Decision	

Source	DF	Sum of squares	Mean square	F-value	Pr > F
Model	4	10.7224	2.6806	25.8400	<.0001
Error	102	10.5798	0.1037		
Corrected Total	106	21.3022			

R-squared	Var coeff	MSE root	Decision mean
0.5033	-240.4226	0.3221	-0.1340

Source	DF	Type I SS	Mean square	F-value	Pr > F
Motivational orientation	1	0.8945	0.8945	8.6200	0.0041
Criteria priority	1	6.3341	6.3341	61.0700	<.0001
z-criteria considered	1	2.9184	2.9184	28.1400	<.0001
Crit priority*z-crit cons	1	0.5753	0.5753	5.5500	0.0204

Source	DF	Type III SS	Mean square	F-value	Pr > F
Motivational orientation	1	0.0518	0.0518	0.5000	0.4814
Criteria priority	1	2.6876	2.6876	25.9100	<.0001
z-criteria considered	1	1.9147	1.9147	18.4600	<.0001
Crit priority*z-crit cons	1	0.5753	0.5753	5.5500	0.0204

Minimum mean suqares at z-criteria considered = -1 SD

Criteria priority	Decision LS mean	H0: LSmean1=LSmean2 t value	Pr > |t|
-1	-0.5334	-4.8300	<.0001
1	0.0071		

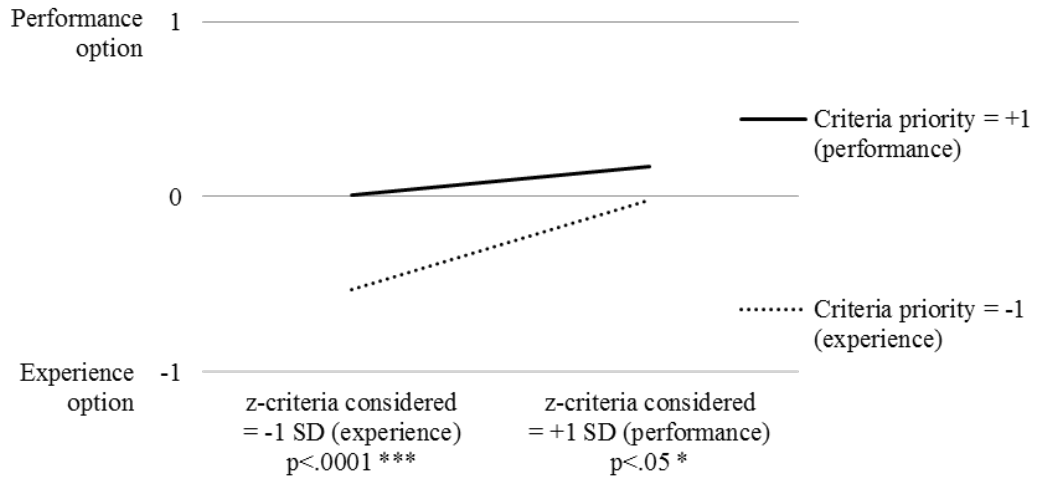
Minimum mean suqares at z-criteria considered = +1 SD

Criteria priority	Decision LS mean	H0: LSmean1=LSmean2 t value	Pr > |t|
-1	-0.01667	-2.02	0.0459
1	0.17353		

A dichotomous dummy variable was computed for each individual decision depending on the type of choice made (performance choice = 1, experience choice = -1), and the resulting values were then averaged to obtain an estimate of the respondents' mean decisions (i.e., their individual

leanings towards a performance or an experience option). MO, as measured by the PERVAL 19-item scale, is a continuous measure. CC was estimated by adding the total number of performance-type criteria selected and subtracting the total experience-type criteria selected. Similarly, CP was estimated by adding total weight assigned to performance-type criteria and subtracting total weight assigned to experience-type criteria. To compare results at high (performance) and low (experience) values of criteria priority, CP was dichotomized about its median. To plot results at high (performance) and low (experience) values of criteria used, a standardized score for CC was computed as a function of standard deviations about 0 (zCC). Table 4 presents the ANOVA results. From the ANOVA output, Figure 4 plots the dependent variable at zCC = -1 SD for experience criteria and zCC = +1 SD for performance criteria (i.e., standardized criteria considered measure at -/+ 1 standard deviations).

Figure-4
EFFECT OF CRITERIA CONSIDERED AND CRITERIA PRIORITY (EXPERIENCE VS. PERFORMANCE) ON DECISION, STANDARDIZED (N=109, P<.001 FOR CC*CP).



DISCUSSION

Overall, the results provide support for our hypotheses. As shown in Table 3, the positive correlations between the motivational orientation and the first, essentially intuitive decision, suggests that individuals tend to make decisions based on their personal leanings, thus supporting hypothesis 1. Likewise, the positive correlations between subsequent decisions 1-3 provide additional support to this notion as it suggests that people tend to adhere to the first decision they make, across different conditions or evidence. On the other hand, the positive correlations between the decisions made and both the criteria selected to make the decision and the weights assigned to decision criteria, support the confirmation (H2) and desirability of choice (H3) hypotheses. This is, participants' decisions towards either performance or experience options were consistent with the criteria they used to support their decisions and the relative importance they assigned to such criteria. Finally, the positive correlation between criteria used and criteria priority suggests that these two personal biases might reinforce each other and together determine a person's decision. Altogether, the pairwise correlations support the notion that people tend to adhere to their first decision, which relates with subjective personal preferences, even after being confronted with additional evidence or analytical tools.

The correlations are supplemented by the graphs shown in Figure 2 and Figure 3, which show how participants, categorized by their first decision (performance, neutral or experience option), tend to maintain their initial choice. This figure also highlight how respondents with a hedonic orientation lean more towards an experience-based decision than respondents with a utilitarian orientation, across all three decisions. These results further support hypothesis 1.

Also, as shown in Figure 3, results suggest a correspondence between individual decisions and both, the criteria used to make the decision and the order assigned to each criterion used (hypothesis 2). Also, that both the decision and the criteria selected are directionally consistent with the relative weight assigned to all available criteria (hypothesis 3). This is, as illustrated by the line graphs, respondents who initially choose a performance-type option tend to use only performance-based evidence and to assign a higher weight to performance data, relative to user-experience data. Conversely, respondents who opt for an experience-type option at the beginning tend to use only experience-based evidence and to assign a higher weight to user-experience data, relative to performance data. Results are consistent across motivational orientation, as utilitarian participants preferred and assigned more weight to performance criteria, whereas hedonic participants preferred and assigned more weight to user-experience criteria. Although the contrast is especially clear for criteria priority, as measured by relative weights assigned, the results are overall directionally consistent with our hypotheses. Taken together, these results support hypotheses 2 and 3.

The ANOVA yields additional support to our hypotheses, with a significant model ($F=25.84$, $p<.0001$), and significant effects both for the independent variables zCC and CP ($p<.001$ in each case) and for their interaction ($p<.05$). As shown in Table 4, the results are directionally consistent with our basic and interaction hypotheses, as people who choose the performance option tend to consider and to prioritize performance criteria, rather than user-experience criteria, and conversely for those who choose the experience option. Also, the different slopes and intersecting curves suggest an interaction effect, which supports our hypothesis 4. The difference between people who prioritize performance criteria (CP = +1) and those who prioritize experience criteria (CP = -1), however, is clearly stronger for those who consider experience-related criteria (zCC = -1 SD) than for those who consider performance-related criteria (zCC = +1SD), which suggests intriguing implications. The stronger effect might suggest that people who are prone to experiences tend to make more intuitive decisions, compared to people leaning towards performance. Conversely, individuals who tend to consider or prioritize objective, performance-based evidence, might rely more on analytical procedures and objective evidence in general and therefore be less prone to cognitive biases, relative to experience-prone people (Frederick, 2005; Witteman et al., 2009).

CONCLUSIONS

Results suggest that decision makers tend to make intuitive decisions consistent with their motivational orientation, and that they are inclined to adhere to such first intuitive decisions despite getting access to new supporting evidence or additional analytical tools. In fact, participants apparently utilized MCDA to confirm previously conceived decisions, rather than to identify the best possible solution for them. In other words, participants appear to have actually sought support for a decision they have already made in their own minds, rather than striving to attain a more thoughtful, better quality decision.

It should be noted that MCDA is not supposed to be a normative tool that provides a

"correct" answer, but rather an insightful approach that helps decision makers learn and make a more informed choice. Notwithstanding, our results shed doubts on the participants' actual learning from MCDA and whether the tool really added value to the decision process, since little learning seems to have happened throughout their interplay with the tool. One would expect that if any learning takes place as a result of the participants' interaction with the MCDA tool, a significant number of them would have changed their minds throughout the three stages of the experiment. However, the evidence suggests that, regardless of the first option chosen, the number of participants adhering to their initial impressions was larger than those who changed their perception along the experiment. Alternatively, even if we accept the proposition that MCDA is devised to reflect its users' preferences (and help them learn about them), it seems reasonable to ask what distinguishes a valid preference-based decision from a not-so-valid, biased decision.

In sum, it appears that people's individual differences regarding hedonic and utilitarian motivational orientation can lead them to motivational biases, which in turn may affect the effectiveness of their use of the MCDA tool. More generally, the effectiveness of strategic decision support tools is likely affected by the managers' leanings and biases. Strategic decision making should be understood as a human-machine system, composed both by structured and unstructured components (Shim et al., 2002). Although decision-making tools can enhance the efficiency of structured information processing and analysis, the unstructured part of a strategic decision is still subject to the managers' leanings and preferences. Therefore, the objectivity of many strategic decision that rely on analytical models or tools is doubtful, at most. This said, we do not intend to imply that decision support tools are not useful, or even essential, in modern strategic decision making. We rather advocate for a grounded, cross-disciplinary approach that better understands and addresses such tools' limitations. It follows that future research should further explore the mechanisms underlying strategic decisions supported by analytical tools, in actual organizational contexts, in order to propose prescriptive recommendations for management practitioners.

Our results also suggest that motivational biases might differ across decision makers depending on other individual differences, beyond personal prevailing preferences, such as their level of rationality or intuition (Frederick, 2005; Witteman et al., 2009). Future research is indeed needed in this area (Franco et al., 2016), so in our future studies we would like to explore such nuances and try to better grasp the underlying mechanisms that explain individual differences, and attempt to predict which types of people are more or less prone to motivational biases and perhaps advance custom analytical approaches for each category. Also, future research should involve the exploration of strategies to counteract or de-bias these effects.

Finally, future research should also strive to increase the generalizability of these results. Our findings might not hold for other contexts, given the particular context of the experiment, with students as respondents and a simulated purchase decision as experimental scenario. Previous research suggests that such an artificial setting, involving a personal consumption choice, might favor intuitive decisions, whereas a more professional situation, with real-world consequences, would motivate more analytical approaches (Sjöberg, 2003). Future research should therefore try to replicate and extend these findings in an organizational or managerial setting, and involving more strategic or business-specific decisions. Moreover, future investigations should likely be of a cross-disciplinary nature, such as the present paper, thus benefiting the strategy literature with contributions from other fields (Ronda-Pupo, 2015).

Should our results hold in more varied and generalizable settings, it would appear that a totally rational decision making is not feasible. Which, in turn, would suggest that it is utopic to expect that management and strategic planning can be completely objective, analytical, tool-

supported, evidence-based processes. A more thorough understanding of their limitations, however, would certainly enhance the utility and applicability of analytical approaches, in real-world, real-people contexts.

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