CAN MANAGEMENT BE REALLY OBJECTIVE?

COGNITIVE BIASES IN MULTICRITERIA DECISION ANALYSIS

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ABSTRACT

The human brain appeals to diverse strategies (heuristics or shortcuts) to analyze contextual information and make decisions in complex situations. These 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 management 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 objective management decisions, based on evidence. Among other disciplines that facilitate decision making and thus reduce cognitive biases, Operations Research (OR) offers analytical methodologies and procedures. However, the relationship between cognitive biases and OR tools has not been amply investigated. This is, it is uncertain whether OR tools contribute effectively to reduce cognitive biases, or if, on the contrary, cognitive biases interfere with such tools' effectiveness. This paper presents an experimental design involving undergraduate and graduate students that analyzes the effect that two cognitive biases, known as confirmation and anchoring, have

on a decision made through multicriteria analysis. Preliminary results suggest that decision makers (experimental subjects) utilize multicriteria analysis to confirm previously conceived decisions, rather than to identify the best possible solution. This is, they actually seek support for a decision they have already made in their own minds. In particular, this paper questions the effectiveness of multicriteria analysis tools; in a more general context, this research suggests that a totally objective management might be utopic.

KEYWORDS

Cognitive biases, confirmation and anchoring, multicriteria analysis, experiment, Operations Research (OR).

1. INTRODUCTION

Since the publication of Tversky and Kahneman's seminal paper on heuristics and biases (Tversky & Kahneman, 1974), there has been an increasing interest in understanding the underlying mechanisms that explain human behavior in decision-making contexts. Numerous experimental studies have been performed within the premises of different academic fields, such as psychology, economy, finance, marketing, and only recently operations research, among others. 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 Winterfeld, 2015; 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 commonly accepted normative principles (Kahneman, 2011).

In a managerial context, these biases can be especially costly or counterproductive. Less-than-optimal or inefficient business solutions can undermine organizational value, or even threaten a firm's sustainability. Although popular literature tends to praise gutsy business decisions that yield successful market moves, it is difficult to argue that firm strategies should be the result of sound analyses that consider as much contextual evidence as possible before making a decision. Not surprisingly, business literature abounds with tools and techniques devised to make management a scientific exercise that eliminates or reduces cognitive biases, and hence aim (often vainly) at achieving objective business decisions.

Operations Research (OR) is one of several disciplines that facilitate decision making and thus help reduce cognitive biases. OR emerged during World War II, and has grown since then motivated to help organizations make better and more objective decisions by offering a wide range of analytical methodologies and procedures (Bowen, 2004). Nevertheless, although OR's main focus is to help people solve problems, it appears to have ignored the behavioral aspects of the humans involved in its process (Hämäläinen, Luoma, & Saarinen, 2013). The relationship between the human biases and OR has largely being overlooked, which sheds some doubt on the universality of OR methods, across situations or contexts. Given that OR tools use quantitative, hopefully rigorous evidence to support its decisions, such tools are assumed to contribute effectively to reduce cognitive biases. We argue, however, that, under certain conditions, cognitive biases can actually

interfere with the appropriate use of such tools or even override them, and thus yield them completely useless.

For example, risk analysis and multicriteria decision analysis tools can be affected by human biases when analysts or decision-makers elicit the components and parameters that are needed for model construction (Montibeller & von Winterfeld, 2015). This can reduce the quality of the models and the resulting analyses, which calls for a closer look at the behavioral human factors related to the use of OR tools for decision-making and problem solving (Hämäläinen et al., 2013). There is therefore a need to have more controlled comparative experimental studies to glimpse the interactions and effects of human bias on OR tools. This would allow us to improve both OR and managerial decision practices.

To address this gap, we designed an experimental intervention where undergraduate and graduate students, acting as the decision-makers of a simple decision problem, employ multicriteria analysis to support their decision. The experiment looks at the effect that two cognitive biases, kwon as self-confirmation and anchoring, 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. Although our research is still incipient at this stage, preliminary results suggest that decision makers do utilize multicriteria analysis to confirm previously conceived decisions, rather than to identify the best possible solution. In other words, participants appear to actually seek support for a decision they have already made in their own minds, rather than striving to attain a quality, “objective” decision.

In what follows, we first briefly discuss, from a theoretical point of view, the known effects that human biases both, cognitive and motivational, have on decision-making, with

particular detail on confirmation and anchoring biases. Details of our experimental hypotheses are provided, and our experimental approach to evaluating the effects of the self-confirmation and anchoring biases on a multicriteria problem is then explained in detail. As this is an ongoing research project currently at the stage of data collection, results are not conclusive yet. However, we present some preliminary results. Finally, we finish the paper by summarizing our main arguments, presenting our immediate plan to completion and drawing some preliminary conclusions.

2. ANTECEDENTS AND CONTEXT

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 appeal heuristics or shortcuts to analyze contextual information and make decisions. These facilitating strategies result in more efficient decisions, especially in complex situations. Such facilitating strategies are not infallible, though, and there is abundant evidence that humans' minds are prone to cognitive biases or traps that cloud objectivity when making decisions (Kahneman, 2011).

2.1. Cognitive biases

Confirmation bias 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). Anchoring, on the other hand, limits or influences decisions because of the strong anchoring effect that the most recent outcomes or evidence has on a new decision. Because of anchoring, people tend to believe that their previously successful decisions will continue to yield favorable outcomes, and they tend to privilege the most salient evidence in analyzing a problem to come up with a solution.

2.2. Personal preferences

A person's preconceived ideas regarding a potential decision, which might result in confirmation bias, are likely to relate with conscious or subconscious individual preferences. Marketing research, for instance, has explored the dichotomy between hedonic and utilitarian shopping 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 shopping goal, hedonistic or utilitarian, has a significant impact on a person's purchase decisions. Moreover, given that a person's preference for either hedonistic or utilitarian goals tends to be quite stable, we infer that confirmation bias will positively relate to a person's orientation towards hedonism or utilitarianism. This is, people will favor decisions that match their hedonistic—or utilitarian—preferences, and therefore will privilege evidence supporting such preferences.

2.3. Decision context and framing

If a person's preference does reinforce confirmation bias, it follows that decisions could also be influenced by other, contextual factors. Previous research has shown that confirmation and other cognitive biases are not absolute but rather context-dependent (Hernandez & Preston, 2013). Therefore, we anticipate that a decision's specific context, or the manner in which decision criteria or supporting evidence is framed, might reinforce or neutralize confirmation bias. If a person oriented to hedonistic goals is presented with decision criteria that stress hedonism, such as attributes associated with a pleasurable consumption experience, a hedonistic-confirmation bias is facilitated and reinforced. On the contrary, making performance-oriented attributes more salient should neutralize or attenuate a hedonistic-confirmation bias. Likewise, an utilitarian-confirmation bias might be positively or negatively moderated by means of the decision criteria highlighted.

2.4. Multicriteria Decision Analysis

Multicriteria Decision Analysis (MCDA) is a concept that embodies a family of OR tools that explicitly considers multiple criteria for making decisions. The purpose is to facilitate the identification of the most preferred course of action amongst several choices or decision options, by balancing those factors that were considered for making the decision (Belton & Stewart, 2002). The Multi-Attribute Value Theory (MAVT) is one of the most popular of the MCDA techniques that help decision-makers make sense of this type of situations. First, it requires of a value-tree to hierarchically organize the objectives and

criteria for the decision problem. The nodes at the top of the tree represent the most general objectives of a problem situation, whereas the nodes at the bottom represent the criteria or attributes to measure the performance of each decision option. Decision options must be assessed within the light of such criteria and the decision-maker should then express his/her preferences using weight factors and value functions (Goodwin & Wright, 2004; Wright & Goodwin, 2009). Finally, a unique score is calculated for each option by means of aggregating individual scores through a weighted average function.

3. HYPOTHESES

Building on the aforementioned antecedents, and our revision of previous research on decision making, multicriteria analysis, and cognitive biases, we suggest that,

Hypothesis 1 (confirmation bias): *There is a positive relationship between the individual preference and a person's decision.*

Hypothesis 1A (hedonism): *A person with a hedonistic preference will favor hedonistic criteria, over utilitarian criteria, upon making a decision.*

Hypothesis 1A (utilitarianism): *A person with a utilitarian preference will favor utilitarian criteria, over hedonistic criteria, upon making a decision.*

Hypothesis 2 (anchoring): *The positive relationship between the individual preference and a person's decision is moderated by the framing of the criteria used to make such decision.*

Hypothesis 2A (experience): *A person's hedonistic preference will be strengthened if the decision context highlights pleasurable experience criteria, over rational performance criteria.*

Hypothesis 2B (performance): *A person's utilitarian preference will be strengthened if the decision context highlights rational performance criteria, over pleasurable hedonistic criteria.*

4. METHODOLOGY

To test our hypotheses, we conducted a series of experimental studies with undergraduate and graduate students at a private university in Colombia. We specifically chose classes on decision making techniques because of their relevance to the theses tested. The experiment was conducted during multicriteria analysis modules, 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 (i.e., not to respond to the questionnaires, to abstain from completing any of them, or to interrupt their participation at any time during the study). The questionnaires were not tied to the students' grades whatsoever, and students who opted out only had to

attend the class and use the analytical tools being introduced, but were waived from responding the individual questionnaires relevant to our analyses.

Variables tested included *individual preference (IP)*, the participant's *decision (D)*, and a *manipulation (M)* variable.

Individual preference (predictor). Individual preference was assessed using the PERVAL 19-item scale developed to measure consumer perceived value (Sweeney & Soutar, 2001). Per this scale, participants' were categorized according to their individual leanings towards making decisions based 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 *hedonist* motives.

Decision (criterion). Participants' decisions were measured using custom questionnaires that asked them to choose between a limited set of purchase options, in a hypothetical car purchase decision. Four distinct car descriptions, similar in price range and type of vehicle, were presented to the participants along with made-up specifications relevant to the purchase decision. Specifications were designed to emphasize either performance or experience attributes, depending on each particular case, in order to relate the decision to the participant's individual preferences.

Manipulation (moderator). To test the hypothesized moderation of the decision framing on the relationship between IP and D, participants were randomly assigned to one of two manipulation conditions, termed respectively *performance* and *experience*. To do this, we designed a made-up internet ad that presented a specific car model in an internet advertising-like fashion. The vehicle, a new Ford Focus sedan, was chosen because it fit

well with the hypothetical descriptions and specs used to present the purchase options. Two alternative versions of the ad were designed, respectively worded to prime either performance or experience attributes (see Appendix 1). At an intermediate stage of the experiment, participants were randomly assigned to one of the two manipulation conditions, and read and analyzed the corresponding ad version.

Experimental design. Using a 2x2 design, we contrasted individual preferences (labeled as hedonistic-oriented or utilitarian-oriented) with manipulation condition (either performance or experience) and with the purchase decisions made at different stages during the experiment. All questionnaires to measure the variables described, as well as the manipulation ads presented to the respondents, were administered using on-line Qualtrics software during the class time.

To fine-tune our experimental design, we conducted an early version of the experiment using undergraduate students in a specialized finance class. The questionnaires, tools and manipulation were thus assessed to come up with the final version for the experiment with graduate students. A total of 15 students and one faculty member responded the pilot questionnaires and made corresponding decisions.

4.1. Study 1

For our first experimental iteration, we invited 35 undergraduate students enrolled in two groups of a business management class on decision making to participate. A total of 27 students, 11 female and 16 male, completed all the questionnaires, provided personal information and made decisions based on multicriteria analyses.

Individual preference. In advance to the class session, students were invited to participate in the study on a voluntary basis, via e-mail. Students who accepted to participate were given a link to sign into the first questionnaire. This questionnaire, based on the PERVAL 19-item scale, asked them about their individual preferences to make a purchase decision.

Briefing. At the beginning of the class session, students were explained the class agenda and their role in it. As part of the regular syllabus, the instructor explained the concepts relevant to multicriteria analysis during the first half of the class (approximately one hour).

Decision 1. At the start of the second half of the class session, students were presented with information on four different vehicles, labeled A, B, C and D (see Appendix 2). This information included specifications for each one of the car options on 11 different criteria: price, five criteria related to performance (power, price/torque relation, warranty, safety, and fuel consumption), and five criteria related to experience (exterior design, inside aesthetics, audio system, driving pleasure, and apparent status). For each purchase option, the descriptions respectively emphasized experience (A), performance (B), and a balance between experience and performance (C and D). After analyzing this information, students were asked to choose the option they would purchase. The questionnaire also asked them to explain the reasons for their individual choice, using a 11-item custom Likert scale and open-ended questions.

Multicriteria analysis. Students where then explained a multicriteria analysis methodology, and introduced to the HiView3 software to analyze the information on the four car options. As part of the analysis, students had to assign weights to each decision

criterion, which allowed us to test our confirmation hypothesis. See Appendix 4 for an example of the HiView3 software analysis. The example shown assumes equal weights for all criteria, except for car price (since the cars' prices were intentionally similar, we assigned zero weight to the cost criterion). To conduct their own analyses, students had to assign weights to each criterion, based on their own judgment. We argue that this exercise of assigning weights is particularly subject to confirmation bias.

Manipulation. After analyzing the information, students were presented with one of the two ads pictured in Appendix 1, randomly assigned by the Qualtrics software. After analyzing the ad, participants were asked to complete a 10-item custom questionnaire asking them about the ad they had just read (manipulation check).

Decision 2. Based on the multicriteria analysis, and with the ad information fresh in their minds, participants were asked to make their purchase decision amongst the four options offered, again. They were also asked to assign weights to each one of the 11 criteria, as they did when using the HiView3 multicriteria application, to assess whether they had favored performance or experience criteria upon making their decision. Finally, respondents were asked to briefly explain the reasons for their weight assignments.

4.2. Study 2

For our second experimental iteration, we invited 45 graduate students enrolled in two groups of an MBA class on decision making to participate. A total of 34 students, 9 female and 25 male, completed all the questionnaires, provided personal information and made decisions based on multicriteria analyses. The experimental design was similar to the

first one, with the addition of two questionnaires specifically devised to better assess our hypotheses.

Individual preference. As in the first study, in advance to the class session, students were invited to participate via e-mail and given a link to sign into the PERVAL-19 questionnaire on individual preferences.

Briefing. Briefing was conducted at the beginning of the class session in a similar fashion as study 1. On this study, the multicriteria analysis technique and software were introduced during the first half of the class, previous to the actual experiment.

Decision 1. Departing from the first study's design, participants were first presented with limited information on the four car options (see Appendix 3) and instructed to choose an option. This question aimed at testing the respondents' choice in the absence of thorough analyses.

Decision 2. Similar to the first questionnaire in Study 1, students were then instructed to consider the detailed information described in Appendix 2, without using the HiView3 software. They were then asked to choose a car option and to explain the reasons for their decision using an 11-item scale and open-ended questions.

Manipulation. As in Study 1, students were presented with one of the two ads pictured in Appendix 1, randomly assigned by the Qualtrics software, and subsequently asked to complete the 10-item manipulation check.

Multicriteria analysis. Students then used the HiView3 software to define weights, compare options and make a decision, using the detailed information presented in Appendix 3.

Decision 3. Based on the multicriteria analysis, participants were asked to make their purchase decision again, assign weights to each criterion, and briefly explain the reasons for their weight assignments.

Decision 4. On a final, custom 15-item questionnaire, participants were asked questions related to the reasons for their decisions and whether such decisions obeyed to the use of analytical tools, personal preferences, or both.

5. ANALYSES

Descriptive statistics and pair-wise correlation coefficients were obtained for all relevant variables. Also, predictor, criterion and moderator values were plotted in scatter-plot graphs to visualize the hypothesized effects. To test for the hypothesized main effects and to test for the moderation hypotheses, we regressed the criterion variable (*D*) on its predictor (*IP*) by means of an Analysis of Variance (ANOVA). Also, to assess the suggested situational specificity (Baron & Kenny, 1986), the potential moderator (*M*) and the interaction between all of these variables was also included in the ANOVA. This allowed us to determine whether *M* or other variables have a moderation effect on the hypothesized relationships (Boiché & Sarrazin, 2007). For the final dataset we will also include an exploratory factor analysis to assess the relation between the observed measures and their posited constructs and a confirmatory structural analysis to assess the causal relationships hypothesized in the model (Anderson & Gerbing, 1988).

6. PRELIMINARY RESULTS

At this point in time results are non-conclusive. Additional studies will be conducted, with larger sample sizes and adjustments on the experimental design, and additional analyses. Preliminary results suggest that decision makers utilize multicriteria analysis to confirm previously conceived decisions, rather than to identify the best possible solution. This is, what they actually do when they use the multicriteria analysis tool is seek support for a decision they have already made in their own minds, consistent with our confirmation hypothesis.

We conducted internal reliability analyses for the Likert scales applied (19-item PERVAL individual preference scale, 11-item custom scale on decision motives, and the 10-item manipulation check), using Cronbach's alpha standardized values (Santos, 1999).

The individual preference 19-item scale showed good internal reliability, with a standardized alpha of .706 (.598 for emotion-related items, .586 for price items, .925 for social items, and .519 for quality items). Conducting a separate analysis for the undergraduate and graduate datasets yielded similar results. The manipulation check items showed good internal reliability, with a standardized alpha of .699 (.855 for the performance items and .908 for the experience items). Again, splitting the dataset in undergraduate and graduate respondents yielded similar consistency. Our custom 11-item scale assessing the motives behind the choice of car showed reduced internal consistency, with a standardized alpha of .561 (.496 for performance motives and .771 for experience motives). Results were similar across undergraduate and graduate respondents.

For our preliminary analyses, we computed dummy variables for each decision, where Car A (experience) = -1, Car B (performance) = 1, and either Car C or Car D (balanced) = 0. Contrasting respondents' individual preferences with their successive decisions, the reasons supporting such decisions, the made-up ad manipulation, and the manipulation check yields the correlations matrix in Table 1.

Table 1. Pairwise correlations.

Pearson-product pairwise correlations										
	Individual preference	**Decision 1**	**Decision 2**	**Decision 3**	**Decision 4**	**Decision 2 attributes**	**Decision 3 weights**	**Decision 4 motives**	**Manip**	**Manip check**
Individual preference	1									
Decision 1	.248	1								
Decision 2	.101	.572***	1							
Decision 3	.007	.628***	.670***	1						
Decision 4	.104	.570***	.675***	.844***	1					
Decision 2 attributes	.154	.581***	.542***	.329**	.518**	1				
Decision 3 weights	.127	.488**	.248*	.200	.390*	.505***	1			
Decision 4 motives	.381*	.405**	.427**	.428**	.421**	.489**	.657***	1		
Manip	.101	.067	-.068	-.067	.208	-.034	.132	.216	1	
Manip check	.100	.109	.075	.090	.186	.062	.299*	.248	.624***	1

** p-value<0.05 (2-tailed); ** p-value<0.01 (2-tailed); *** p-value<0.001 (2-tailed)*

In this table, *individual preference* refers to the IP variable, as measured by the 19-item scale, *decisions 1-4* refer to the respective choices made between performance, experience or balanced car options on each iteration (note that decisions 1 and 4 were made only by the graduate students in Study 2), *decision 2 attributes* refers to respondents' leaning towards performance or experience attributes upon making their second choice, *decision 3 weights* refers to respondents' assigning more relative weight to performance or

to experience attributes in their multicriteria analysis to make the second choice, *decision 4* motives refers to respondents' self-declared reasons (performance, experience or neither) for their fourth choice, *manipulation* is the random ad read by each participant (priming performance or experience, respectively), and *manipulation check* indicates whether the respondent considered the ad to reinforce either performance or experience.

As shown in this matrix, there is a positive significant relation between all the decisions, suggesting within-subjects consistency throughout the experiment. This is, participants who chose a specific car option to begin with tended to adhere to such decision subsequently, regardless of the multicriteria analyses or the manipulation. Decisions are also positively related to the attributes privileged to make such decisions, the weights assigned to such attributes, and the motives expressed for making the decisions. Also, even though results were not significant, the correlations between individual preference and decisions are directionally consistent with the hypothesized relationships. Taken together, these results support our confirmation hypotheses, suggesting that a person's preference for performance or experience attributes tend to be stable, and that participants adapted the decision tool's criteria to favor their choice.

Regressing the decision made (decision 3) on individual preference and manipulation (and their interaction) did not yield significant results for the hypothesized moderation of manipulation on the positive relation between individual preferences and decisions, as summarized in Table 2. Therefore, our moderation hypothesis is rejected.

Table 1. Moderation test.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.145[a]	.021	-.030	.71407

a. Predictors: (Constant), MANIPxIP, IP, MANIP

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.636	3	.212	.415	.743[b]
	Residual	29.574	58	.510		
	Total	30.210	61			

a. Dependent Variable: D3

b. Predictors: (Constant), MANIPxIP, IP, MANIP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.083	.149		.558	.579
	MANIP DUM	-.158	.149	-.224	-1.062	.293
	TD SESGO	.020	.096	.027	.207	.837
	MANIPxTDSESGO	.100	.096	.218	1.041	.302

a. Dependent Variable: D3

Having said this, it is interesting that the results do appear directionally consistent with our hypothesis, as depicted in Figure 1, which plots the regression coefficients for the actual criterion range obtained for IP. Negative values for IP indicate an hedonistic orientation, whereas positive values suggest an utilitarian orientation. Positive values for D indicate a preference for performance attributes and negative values indicate a preference for experience attributes. As suggested by this graph, the type of manipulation could actually influence respondents to switch their personal preference, which is consistent with our hypotheses. Note, however that the effect is very weak (and non-significant), which could be a result of issues in our manipulation. This is something which we must address in future experiments.

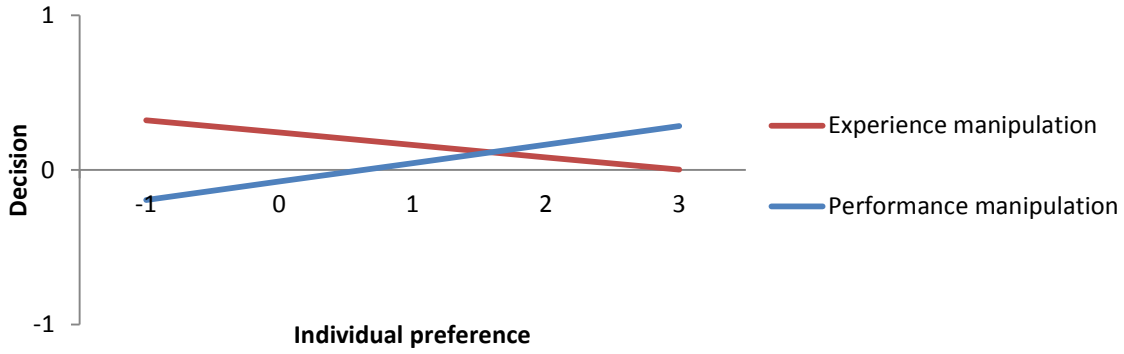

Figure 1. Relationship between individual preference, manipulation, and decision.

7. CONCLUSIONS

To test our hypotheses, we designed our experiment as a vehicle purchase decision, under the assumption that undergraduate and graduate students would relate to such a decision context. Given our hypothesis that cognitive biases affect the quality of managerial decisions, our extended research should test our theses in a managerial setting, in order to improve the generalizability of our results to a business context. Also, future research might look further into the nuances that help explain situational specificity. For instance, future studies should explore whether potential moderators such as a marketing message or an organizational directive can have a significant anchoring impact and thus override subjective individual biases or objective decision analyses.

In short, our preliminary results question the effectiveness of multicriteria analysis tools. More generally, our research suggests that a totally objective management might be utopic, and that we should come to terms with the limitations inherent to firms being ran by humans, and not by tools.

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- Tecnologías de asistencia BLIS® y MyFord Touch® para conducir relajada y cómodamente

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APPENDIX 2. PURCHASE OPTIONS – DETAILED INFORMATION

		Criterios de rendimiento y especificaciones (catalogo de fábrica)					Criterios de experiencia de manejo de otros consumidores (encuestas)				
Alternativas	Precio ($mill)	Potencia (HP)	Relación precio / torque ($mill)	Garantia (Años)	Airbags (#)	Consumo de combustible (km/gal)	Diseño exterior	Acabados interiores	Sistema de audio	Placer de conducción	Status aparente
Carro A	63	195	$3,800	3	2	36.5	Elegante	Lujoso	Full	90	Sofisticado + Gama Alta
Carro B	60	315	$3,549	5	6	26.2	Sencillo	Standard	Básico	50	Gama Alta
Carro C	57	291	$4,031	4	5	32.1	Moderno	Lujoso	Full	50	Gama Alta
Carro D	59	160	$3,724	4	4	30.2	Moderno	Standard	Hi-Tech	60	Gama Media

APPENDIX 3. PURCHASE OPTIONS – SUMMARY INFORMATION

Carro A Estilo sofisticado, diseño exterior elegante, acabados interiores lujosos, muy buen sistema de audio y conducción altamente placentera	**Carro B** Máxima garantía de fábrica, motor muy potente, óptima relación precio-potencia, máxima seguridad para los pasajeros y mínimo consumo de combustible
Carro C Motor potente, acabados interiores lujosos, garantía extendida de fábrica, conducción placentera y alta seguridad para los pasajeros	**Carro D** Mínimo consumo de combustible, diseño exterior moderno, buena relación precio-potencia, el mejor sistema de audio y garantía extendida de fábrica

APPENDIX 4. MULTICRITERIA ANALYSIS – HIVIEW3 SOFTWARE