Intuition and Data in Decision Making:
How does Uncertainty affect the Decision Making Process?

by

João Pinto Diniz

Master in Management

Advised by

Professor Teresa Proença

Professor Eva Oliveira

2016

Biographical Note

João Pinto Diniz was born in Porto on July 26th, 1993. He was admitted to School of Economics and Management of University of Porto in 2011 to study Management. He concluded his Bachelor's degree in Management in 2014, with a grade of 15/A. In the same year he enrolled in the Double Degree Master in Management, a partnership between the School of Economics and Management of University of Porto and Kedge Business School.

During the final year of his Master's degree he started working at Prio Energy, a company that operates in the oil and gas industry, working on oil market research and risk management. At the moment he works in the Supply and Trading team of Prio Energy which is responsible for the supply of oil products and financial market operations of the company.

Abstract

Decision making sciences have begun to better understand and incorporate intuition in decision making models. Recent research has been focused on the effectiveness of intuition (Dane & Pratt, 2007) and the automatic processes of intuition, called heuristics (Mousavi & Gigerenzer, 2014). The main aim of this study is to analyze the use of intuition in decision making, in situations of different levels of uncertainty and understand if intuition is used more as uncertainty increases or if there is a tendency to rely more on solid data and rational decision making. Researchers have suggested that intuition may be a useful asset in highly uncertain situations (Agor, 1986), such as strategic management. However, the empirical evidence about the relationship between intuition and uncertainty is scarce. Obtaining a solid answer to this question will allow decision makers to better understand their behavior in highly uncertain situations and adapt decision making skills towards better results.

The study is based on an experimental design involving a sample consisted of 215 subjects divided in three groups, one manipulated towards the intuitive cognitive system, one manipulated towards the rational/deliberative cognitive system and a last one that was not manipulated. Subjects evaluated packages that varied in the ratio of positive, negative and uncertain aspects. Results showed that the subjects default cognitive system changed when there was a change in the level of uncertainty, relying more on the intuitive cognitive system in more uncertain scenarios. In less uncertain scenarios, subjects showed no clear preference in used cognitive system.

Key-words: Intuition, Decision making, Uncertainty

JEL codes: D01; D03; D81

Table of Contents

Table Index

1. Introduction

There are two distinct decision making systems that are responsible for our daily decisions, the intuitive decision making system and the rational decision making system (D. Kahneman, 2003). The main aim of this study is to understand the behavior of decision makers in increasingly uncertain scenarios, regarding their use of intuitive modes of reasoning. As a future manager, the understanding of this paradigm of decision making in uncertain scenarios is fundamental for developing the right mindset and acquiring the correct methods to be prepared to deal with these very important cases. This study will also aim to understand which of the two decision making systems, the intuitive decision making system or the rational decision making system, has the most usage in very uncertain scenarios.

The work of previous authors has allowed us to understand that the two systems described above have very different characteristics (D. Kahneman, 2012), namely in terms of speed, processes and consciousness. The intuitive system is faster than the rational system, as the latter functions based on rules and sequential processes. On the other hand, the intuitive system is automatic and functions based on holistic associations (Dane & Pratt, 2007). These differences, which will be further analyzed during this study, encourage a study of decision making in different scenarios as they guide the decision maker through different thinking processes which may reach different conclusions and trigger different decisions.

In light of the recent advancements in data search and data analysis, decision makers are faced with tremendous amounts of information about potential decisions which apparently may reduce uncertainty. These enormous blocks of information are called big data and are defined by the Oxford English Dictionary as being "*data of a very large size, typically to the extent that its manipulation and management present significant logistical challenges.*"(Oxford English Dictionary as cited in Press (2014)). Big data is a tool that encourages the use of the rational decision making system, as it provides the inputs needed for better rational decision making. However, such an enormous amount of information, that reflects the complexity of a certain situation, can often be too extensive for the conscious human mind to fully understand its reach and consequences. Linking and analyzing all of this information is also an extremely difficult process, which may hinder the usage of big data. Nonetheless, big data allows

managers to analyze and forecast trends in key aspects of a corporation's environment. On the other hand, big data may be insufficient in uncertain scenarios, in which trends are not predictable.

It is also important to acknowledge aspects, besides the issues of analysis and treatment of information referred above, which present major hindrances towards real world usage of big data. We would highlight uncertainty as one of the issues that big data does not have a way to handle, and that can compromise the use of big data in these uncertain scenarios, as it may give the manager information that can be both non-relevant and point towards erroneous decisions. For instance, big data may overvalue past information and miss key changes in the market where companies operate, which assume a particularly important position in strategic planning.

When framing these decision making systems in today's evolution on data search and data analysis, one may be inclined to think that the rational decision making system has the upper hand. However, it is our belief that the intuitive decision making system is an important process in very uncertain scenarios as it provides a more flexible approach to the changes in scenarios as they present themselves unexpectedly.

In fact, there is no consensus on this topic. Some authors praise big data as the new revolution in management in uncertain scenarios (McAfee & Brynjolfsson, 2012). However, other authors mention that expert intuition is a more powerful weapon in the fast changing corporate world, where uncertainty is very present (Dane & Pratt, 2007).

Studies about intuition usually focus on what intuition is and how effective intuition is (Dane & Pratt, 2007). However, there is little data on the possibility of intuition being an asset in new scenarios of increasing uncertainty. Especially important would be to study how decisions in uncertain scenarios are made by decision makers, either leaning towards a more rational and data based approach or an intuition based approach which could be more effective when dealing with the issue of uncertainty.

To conclude which of the two decision making systems is the most used in very uncertain scenarios the following questions were defined as the key research questions: Do decision makers rely more on intuition as uncertainty increases or do they rely more on rational/deliberative decisions?

In order to answer the research questions posed above, an experimental methodology is used. Through extensive experimentation and observation of the

decision making process in situations of different levels of uncertainty, we will manage to get a more accurate perception of the usage of intuition in different scenarios.

In addition to this introduction, this report will be structured in the following way: in Section 2, the literature review. In section 2, the relevant definitions of the main topics are discussed, as well as the main theories, focusing on decision making (2.1), intuition (2.2) and uncertainty (2.3). In section 2.4, some relevant and similar studies are analyzed in several aspects, including methodological issues. Section 3 describes and explains the methodology that will be used, including the identification of the best methodology and the explanation of the principles that theoretically support the methodology (3.1). In section 3.2 you may find the presentation of the results obtained. In section 4 you may find the discussion of the results obtained in the study. In section 5 you may find the conclusion of the study as well as limitations of the study and ideas for further researches. Section 6 refers to the bibliography that supports this study. In section 7 you may find the Annex, where relevant parts of the experiment are presented, as well as the tables with the results of the statistical tests used.

2. Literature Review

In this section you will find the literature review, which is divided in four distinct parts. In section 2, the relevant definitions of the main topics are discussed, as well as the main theories, focusing on decision making (2.1), intuition (2.2) and uncertainty (2.3). These will be explored both in a holistic and historic approach, in order to both clarify and contextualize the key topics that will be covered. In section 2.4, some relevant and similar studies are analyzed in several aspects, such as theoretical advances and methodology.

2.1. Decision Making and Rational Decision Making

Decision making is defined by Business Dictionary as *"The thought process of selecting a logical choice from the available options."* (BusinessDictionary.com, 2015). While this definition seems to be very broad, recent research requires the questioning of what a logical choice is, and whether decision making only arises from logical processes. Other authors define decision making by saying that *"Decision making is the process of choosing the best alternative for reaching objective"* (Certo & Certo, 2006, p. 182). Some authors also refer to decision making by focusing on the deliberation process and studying it. Busemeyer and Townsend (1993, p. 1) define deliberation as being *"a time-consuming and effortful cognitive process that involves an extensive amount of information seeking, weighing of consequences, and conflict resolution".* This definition clearly strays towards the rational decision making system and contrasts with the intuitive decision making system, as will be explained further on.

The definition of the rational decision making system used in this study is the one found in the work of D. Kahneman (2003), where he describes rational decision making as System 2, a slow, rule-governed and controlled decision making system. He goes on to show that System 2 is not the only decision making system used by decision makers, as opposed to what decision making theorists were stating during most of the 20th century, and presents System 1, the intuitive decision making system. This duality of cognitive systems extends beyond decision making, as shown by Evans (2008).

Decision making and understanding how decision makers decide between several different alternatives is a field that has been deeply explored. Earlier studies,

such as the expected utility theory (Von Neumann & Morgenstern, 2007), set the trend on rational decision making, assuming that agents' decisions are based on maximizing utility. Edwards (1954) wrote a paper detailing the evolution of decision theory, according to a rational decision making paradigm, where the several steps of the process are described.

More recent research on decision making has focused on decision making in new scenarios of higher complexity or based on the use of intuition, such as the prospect theory (Daniel Kahneman & Tversky, 1979), and heuristics decision making theory (Gigerenzer & Gaissmaier, 2011). The prospect theory (Daniel Kahneman & Tversky, 1979) challenged the expected utility theory by showing that people, for instance through risk averse or risk seeking behaviors, would make decisions that are not rational, thus pushing towards a system which is not irrational in the sense that it follows a certain logic of behaviors and feelings, but also isn't fully rational in the sense that it doesn't respect the expected utility theory. The heuristic decision making theory (Gigerenzer & Gaissmaier, 2011) states that rational thinking may not be effective in most scenarios, where decisions need to be taken quickly. As such, these heuristics, which are mainly routine thinking processes, are not irrational in the sense that they provide a better return on the time/energy invested into them. In fact, many authors advance that decision making tends to be more heuristic/intuitive when time constraints are bigger (Tat, Hooi, Rasli, Chin, & Yusoff, 2010). Nonetheless, these heuristics are more prone to failure than logical thinking.

2.2. Intuition and Intuitive Decision Making

As stated before, research about intuition has been mostly concerned with its definition, biases and effectiveness (Dane & Pratt, 2007) in different contexts. As seen in Table 1, authors have failed to agree on a single definition. As pointed by Khatri and Ng (2000), these differences of definition are far from being trivial, and present significant changes in the way intuition is studied. However, most of the authors agree on certain points, which Dane and Pratt (2007) sum up in the following definition: "*Specifically, our review of the various literature on intuition has tended to converge on four characteristics that make up the core of the construct: intuition is a (1) non-*

conscious process (2) involving holistic associations (3) that are produced rapidly, which (4) result in affectively charged judgments." (Dane & Pratt, 2007, p. 36). This definition can be integrated into the most common theories related to intuition and decision making, such as dual-process theories of cognition (Akinci & Sadler-Smith, 2012) and heuristics in decision making (Gigerenzer & Gaissmaier, 2011). This definition arises from years of advances in the conceptualization of what intuition is, and clearly contrasts with some of the earlier definitions which are shown in table 1. Several authors consider that defining intuition is still an ongoing process of the uttermost importance (Dane & Pratt, 2007; Khatri & Ng, 2000), as intuition can only be fully studied once it has been clearly defined. Some of the concepts which are mistaken frequently as being intuition are instinct and insight (Hodgkinson, Sadler-Smith, Burke, Claxton, & Sparrow, 2009). They are, however, very different concepts. As stated by Hodgkinson et al. (2009), "*instinct pertains merely to hardwired, autonomous reflex actions (...) or the behavior patterns of certain animals (such as the homing instinct in birds). Insight, on the other hand, is a sudden and unexpected solution to a problem, arrived at after an impasse has been reached and an incubation period has elapsed."* (Hodgkinson et al., 2009, p. 279).

Advances in the fields of decision making have led to a wider acceptance of intuition as tool for decision making, which was historically seen as feminine, illogical and somewhat unacceptable (Agor, 1986). Today, intuition is seen as one of the tools for tackling complexity in fast and changing environments (Dane & Pratt, 2007). With the rise of the prospect theory (Daniel Kahneman & Tversky, 1979) as an approach that is more connected to real world decision making, as opposed to the expected utility theory (Busemeyer & Townsend, 1993), intuitive decision making and consequent heuristics are being proposed as more viable tools for dealing with uncertainty (Tversky & Kahneman, 1992). Most notably, research about intuition and strategic decision making, which is by nature a situation where uncertainty is high, has been developed by researchers of intuitive decision making (Agor, 1986; Khatri & Ng, 2000; Woiceshyn, 2009).

Nonetheless, there is a lack of empirical research on intuition and decision making in scenarios of great uncertainty (Dane & Pratt, 2007), being one of the fields that requires further study about the possible links among intuition and uncertainty. As

seen in the works of Agor (1986) and Dane and Pratt (2007), researchers advance the idea that intuitive decision making is key to analyzing highly uncertain scenarios, but don't form a clear link between concepts (Agor, 1986; Dane & Pratt, 2007). Agor (1986) goes as far as showing that executives relied on intuition in scenarios of great uncertainty (Agor, 1986), but doesn't explore this link any further (for instance, trying to establish a concrete correlation between intuitive decision making and uncertainty). What this work intends to study is the link between the use of intuition and the variation of the level of uncertainty of a given scenario.

Table 1 Definitions of Intuition

Definitions of Intuition

Source	Definition of Intuition
Jung (1933: 567–568)	That psychological function transmitting perceptions in an unconscious way
Wild (1938: 226)	An immediate awareness by the subject, of some particular entity, without such aid from the senses or from reason as would account for that awareness
Bruner (1962: 102)	The act of grasping the meaning, significance, or structure of a problem without explicit reliance on the analytic apparatus of one's craft
Westcott & Ranzoni (1963: 595)	The process of reaching a conclusion on the basis of little information, normally reached on the basis of significantly more information
Rorty (1967: 204)	Immediate apprehension
Bowers, Regehr, Balthazard, & Parker (1990: 74)	A preliminary perception of coherence (pattern, meaning, structure) that is at first not consciously represented but that nevertheless guides thought and inquiry toward a hunch or hypothesis about the nature of the coherence in question
Shirley & Langan-Fox (1996: 564)	A feeling of knowing with certitude on the basis of inadequate information and without conscious awareness of rational thinking
Simon (1996: 89)	Acts of recognition
Shapiro & Spence (1997: 64)	A nonconscious, holistic processing mode in which judgments are made with no awareness of the rules of knowledge used for inference and which can feel right, despite one's inability to articulate the reason
Burke & Miller (1999: 92)	A cognitive conclusion based on a decision maker's previous experiences and emotional inputs
Policastro (1999: 89)	A tacit form of knowledge that orients decision making in a promising direction
Lieberman (2000: 111)	The subjective experience of a mostly nonconscious process—fast, alogical, and inaccessible to consciousness—that, depending on exposure to the domain or problem space, is capable of accurately extracting probabilistic contingencies
Raidl & Lubart (2000-2001: 219)	A perceptual process, constructed through a mainly subconscious act of linking disparate elements of information
Hogarth (2001: 14)	Thoughts that are reached with little apparent effort, and typically without conscious awareness; they involve little or no conscious deliberation
Myers (2002: 128–129)	The capacity for direct, immediate knowledge prior to rational analysis
Kahneman (2003: 697)	Thoughts and preferences that come to mind quickly and without much reflection
Epstein (personal communication, 2004)	The working of the experiential system

Source: Extracted from Dane and Pratt (2007)

2.3. Uncertainty

Uncertainty is a concept that is still not totally defined, and as such several different conceptualizations can be found (Lipshitz & Strauss, 1997). Table 2 shows some of these different concepts, and clearly highlights the confusion among researchers about what is risk and what is uncertainty. Uncertainty was very well defined in a book from 1921, from Frank Knight, which has undergone several reprints and remains very relevant in economic theory. In this book, Frank Knight distinguishes risk from uncertainty: "*Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated. (...) The essential fact is that 'risk' means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomena depending on which of the two is really present and operating. (...) It will appear that a measurable uncertainty, or 'risk' proper, as we shall use the term, is so far different from an unmeasurable one that it is not in effect an uncertainty at all."(Knight, 2012, pp. 19-20)*. As such, the main difference between risk and uncertainty relies on the capacity to measure (or not) a certain event. Lipshitz and Strauss (1997) advanced that not all uncertainty is the same, and that uncertainty may be defined by both issue and source. In terms of issue, the most basic variations of uncertainty are related with outcomes, situation and alternatives. In terms of source, the most basic variations of uncertainty are related with incomplete information, inadequate understanding and undifferentiated alternatives.

Uncertainty is a concept that is often confused with risk, but has very different implications for the rational decision making theories. It clearly sets the tone for a new way of approaching decision making theory, since the expected utility theory (Busemeyer & Townsend, 1993) shows key flaws when analyzing uncertain situations. The expected utility theory works based on probabilities, which can only be defined when there is enough information to measure and compare. In uncertain scenarios, the lack of information, either regarding inputs, relations among variables, or outputs, makes it impossible to expect anything. For instance, there is no feasible way of defining the probability of a dice landing on a given face if you don't know how many faces the dice has. Should someone know this information, landing on a given face

would have a probability, and therefore be risky. Without knowing any information, landing on a given face doesn't have a probability, and therefore is uncertain.

Studies on uncertainty have provided new definitions in economic behavior research, and new understandings of the limitations of forecasts ,as described in the paper by Makridakis and Taleb (2009): *"First, in most cases, errors are not independent of one another; their variance is not constant, while their distribution cannot be assured to follow a normal curve—which means that the variance itself will be either intractable or a poor indicator of potential errors, what has been called "wild randomness" by Mandelbrot (1963). Second, there is always the chance of highly unlikely or totally unexpected occurrences materializing — and these can play a large role (Taleb, 2007). Third, there is a severe problem outside of artificial setups, such as games: probability is not observable, and it is quite uncertain which probabilistic model to use."* (Makridakis & Taleb, 2009, pp. 717-718). In fact, the works of Mandelbrot (1997) on wild randomness and Taleb (2010) on black swans are cornerstones of the understanding of uncertainty, as well as the effects of uncertainty on long term decision making, forecasting and similar processes that rely on a highly unstable future.

Despite what has been said before, successes in these uncertain scenarios are very characteristic in the corporate world, and some are transformed into case studies of how intuition may generate value. Some of these cases are described in the work of Miller and Ireland (2005), from the purchase of the McDonald's brand by Ray Kroc to the launch of the iconic Dodge Viper. One of the most told stories is the one of the entry of Honda in the US motorcycle market, where despite very conservative reasons to enter the market, and amidst a very uncertain expectation of how consumers would adopt the product (lack of motorcycle culture, lack of retail spaces, etc.), the CEO decided against data and evidence and invested in this market, generating the results we know today.

Table 2 Conceptualizations of Uncertainty

Conceptualizations of Uncertainty		
Authors	Term	Conceptualization
I. Behavioral decision theory		
1. Anderson *et al.* (1981)	Uncertainty	A situation in which one has no knowledge about which of several states of nature has occurred or will occur.
2. Anderson *et al.* (1981)	Uncertainty	A situation in which one knows only the probability of which of several possible states of nature has occurred or will occur.
3. Humphreys & Berkeley (1985)	Uncertainty	The inability to assert with certainty one or more of the following: (a) act-event sequences; (b) event-event sequences; (c) value of consequences; (d) appropriate decision process; (e) future preferences and actions; (f) one's ability to affect future events.
4. Anderson *et al.* (1981)	Risk	Same as (1)
5. Anderson *et al.* (1981)	Risk	Same as (2)
6. MacCrimmon & Wehrung (1986)	Risk	Exposure to the chance of loss in a choice situation.
7. Arrow (1965)	Risk	A positive function of the variance of the probability distribution of expected positive and negative outcomes.
8. Hogarth (1987)	Ambiguity	Lacking precise knowledge about the likelihood of events (second-order probability).
II. Organization decision theory		
9. Thompson (1967)	Task uncertainty	The inability to act deterministically owing to lack of cause-effect understanding; environmental dependencies and internal interdependencies
10. Galbraith (1973)	Task uncertainty	The difference in the amount of information required to perform a task and the amount of information already possessed by the organization.
11. March & Olsen (1976)	Ambiguity	Opaqueness in organizations owing to inconsistent or ill-defined goals; obscure causal relations in the environment unclear history, and interpersonal differences in focus of attention.
12. Terreberry (1968)	Turbulence	Unpredictable changes in system-environment relations.
13. Weick (1979)	Equivocality	The multiplicity of meanings which can be imposed on a situation.
14. March & Simon (1958)	Conflict	Absence of arguments which clearly favor a particular course of action.

Source: Extracted from Lipshitz and Strauss (1997)

2.4. Relation between intuition and uncertainty

Agor (1986) is the first one that clearly shows that there is some sort of relationship between uncertainty and intuition and it clearly stands out, both by the importance of the discovery, especially at the time of the writing of the paper, and by the quality of the study, since it is still a relevant source of information today concerning intuition in corporate scenarios.

This study coincided with the rise of awareness of the value of intuition as a decision making approach. At the same time there was an increasing awareness of the flaws of reason-based decision making in strategic decision making, especially because of the uncertainty present in this kind of decision making (Agor, 1986). Developments in research on brain processes and cognition generated new discoveries in the fields of Decision Studies, thus being another factor of motivation for the realization of the study (Agor, 1986).

While intuition wasn't clearly defined at the time of writing of Agor's paper, which may hinder the findings as stated before, the methodology and findings are still of great importance to the study of the subject. The study concluded that except for one case, every executive acknowledged that they use intuition to guide the decision making process in their most important decisions. However, managers felt the need to clarify that intuition was only one of the processes they used in decision making, complementary to others. Executives described that good decisions based on intuition mostly derived from previous experiences, known facts and an ability to be open to subconscious processes.

More importantly for the perspective of this study were the following findings about the circumstances in which intuition helped the subjects the most and when did they seek to use intuition. The answers were the following: *"(1) when a high level of uncertainty exists, (2) when little previous precedent exists, (3) when variables are less scientifically predictable, (4) when "facts" are limited, (5) when facts don't clearly point the way to go, (6) when analytical data are of little use, (6) when several plausible alternative solutions exist to choose from, with good arguments for each, (7) when time is limited and there is pressure to come up with the right decision*" (Agor, 1986, p. 9). All of these are scenarios of high complexity, of which uncertainty is a part of. Thus, this is the first empirical finding that clearly shows a link between intuition usage and uncertainty. As such, this work by Agor is one the cornerstones of this thesis as it portrays a question which was only superficially explored both by this author and following researches. Of course it is necessary to look at this paper from Agor (1986) and realize that it is a very old study. Cultural, social, technological and many other changes in society; new insights about intuition's effectiveness; the evolution of data collection, processing and forecasting; all of these are aspects which foster the change of the status quo regarding the usage of intuition, which could alter the results of the study of Agor if conducted today. Nonetheless, further studies have been sustaining the same conclusions found by Agor (1986).

Burke and Miller (1999), in their interviews with 60 professionals of different sectors, whose jobs often involved decision making, found that these professionals reported using intuition in situations involving human interaction, time constraints and uncertainty, such as first time projects.

Bocco and Merunka (2013) studied the behavior and decisions from West African managers with the aim of understanding real life decision making in smaller institutions, as opposed to the regular focus on well-established corporations. Some of the differences that these institutions face are pointed out as key factors that may influence decision making, such as access to information, speed of decision and lack of managerial training and knowledge (Bocco & Merunka, 2013). Focusing on the definition of intuition developed by Dane & Pratt, they confirm that small and medium enterprise owners from West Africa have the perception that they follow their intuition, and these managers give the following reasons to do so: (1) trusting positive feelings (Bocco & Merunka, 2013), which relates to various studies concerning the "gut feel" and its importance in decision making (Sadler-Smith & Shefy, 2004); (2) lack of knowledge, (3) necessary speed of decision making, (4) trusting past experience, (5) allows for affective judgments in people related decisions. (Bocco & Merunka, 2013).

Although different from the objective pursued in this research, one must acknowledge some similarities between managing smaller companies with lack of means to collect and analyze data, and uncertain scenarios where data may be missing, or the relationship between variables may be unclear. As such, this study by Bocco and Merunka (2013) helps reinforce the belief that intuition is a key weapon for deciding in uncertain scenarios.

The study of Tat et al. (2010) aims to understand decision making in several aspects one of which is "*to identify the relationship between intuitive decision-making style and situation factors*" (Tat et al., 2010, p. 2). This objective clearly relates to the goal pursued by this study, and thus presents several similarities. One of the hypotheses of this study was to test, the relationship between uncertainty and intuitive decision making. However, after statistical testing the results showed no significant correlation between the intuitive decision making style and uncertainty. While this could be a very conclusive response, it is important to understand that the sample consisted of a very homogeneous group (faculty staff), which may introduce a bias to the results presented.

The work of Khatri and Ng (2000) approached the study of intuition in decision making with a focus on the empirical confirmation of results at a time where empirical research was very scarce. The authors were also concerned about the relation between intuition and organizational performance. Although the objective of the present study

disregards the link of intuition with organizational performance, one must acknowledge the tendency of engaging in a more active usage of intuition when such usage presents positive results. The authors hypothesize that *"use of intuitive synthesis in strategic decision making is greater in an unstable environment than in a stable environment*" (Khatri & Ng, 2000, p. 65). The authors focus on defining and clarifying the concept of environmental instability which is similar to the definition of uncertainty portrayed in this study, as they selected some variables which affect companies in ways which can't be measured quantitatively. By selecting three different industries (computer, banking and utility), the authors define three scenarios of different degree of instability.

They concluded that the use of intuition is clearly more prevalent in the unstable scenarios compared to the other scenarios.

Mousavi and Gigerenzer (2014) make a very clear point in suggesting that the business world is very different from a "roulette table", and often presents situations of uncertainty instead of situations of risk, and highlights the problems of current tools in dealing with uncertainty. "*Observe, however, that most of decision theory is based on a risk characterization of the uncertain world. But can risk based rules successfully apply to a world of uncertainty? It depends. The structural difference between risk and uncertainty calls for rules of dealing with uncertainty that are not compatible with risk calculations unless uncertainty can be reliably reduced to a form of risk. Unique situations, uninsurable risk, and lack of properties that satisfy the mathematics of probabilities are all cases in point. In a world of uncertainty, heuristics are indispensable tools, not second-best solutions*" (Mousavi & Gigerenzer, 2014, p. 1672). As such, their take on dealing with uncertainty relies on what heuristics and ecological rationality can do to help in understanding these uncertain scenarios and quickly generate analyses and decisions.

Lipshitz and Strauss (1997) also suggest that decision makers deal with uncertainty by creating qualitative frameworks that can guide their decisions. These qualitative frameworks do not quantify the risks, but provide strategies for acknowledging and reducing uncertainty (Lipshitz & Strauss, 1997). In short, one could advance that the intuitive system, based on its ability of constructing similar and comparable scenarios based on previous experiences, can provide a way to measure what is rationally immeasurable. By doing this, the intuitive system transforms

situations which are defined as uncertain, when using the rational system, into situations of risk, in the sense that it becomes measurable, when analyzed by the intuitive system. This "solution" encompasses what was referred above by Mousavi and Gigerenzer (2014), thus transforming this "uninsurable risk" into something that can be somewhat measured and taken into analysis.

One study that reflects the importance of the duality between intuition and deliberation in decision making in uncertain scenarios is present on the study of Locander, Mulki, and Weinberg (2014), where intuition and deliberation are weighed on their ability to deal with human emotions on the perspective of the salesperson. As the study highlights, dealing with people in sales scenarios requires very fast decision making, more associated with intuition, as changes in posture or tone from a buyer require an adaptation from the seller. These changes are uncertain, as is human interaction generally, and thus intuition is key to understanding and dealing with this uncertainty. Nonetheless Locander et al. (2014) recognize the importance of the deliberative process and suggest that an integration of both intuition and deliberation provides the best solution for salespeople, in order to adapt to unexpected changes in customer behavior and keep a rational analysis of key features and processes of a sale that do not change.

Zakay, Brauner, Weyers, Russo, and Usher (2011) developed a study on the quality of the intuitive cognitive system and the rational cognitive system for evaluating different scenarios, specifically in perceiving the quality, defined as the percentage of positive features in the total number of features, of cars or holiday packages based on their attributes. This study clearly separated the two cognitive systems by using the direct instruction method for directing the subjects towards one of the two cognitive systems, which is followed by an evaluation of their decisions. The group directed towards the intuitive cognitive system proved to be more accurate in perceiving the overall quality of the presented cars / holiday packages. This study inspired the methodology used in this thesis, and will be explored in more detail further on in the methodology section of this thesis.

3. Methodological issues and objectives

After this literature review some aspects become evident, and help shape the methodology of this thesis. Firstly, we highlight the fact that researchers, such as Tversky and Kahneman (1992) are now considering the intuitive cognitive system as a valid option for decision making after years of only considering the rational/deliberative cognitive system. Secondly, we point out that the intuitive cognitive system produces different decisions from those of the rational/deliberative cognitive system. As shown by Gigerenzer, ecological decisions hold value in certain scenarios (Gigerenzer & Gaissmaier, 2011). Thirdly, we observe that uncertainty exists in real world decision making and that uncertainty changes the way people perceive events and decide. Finally, there is a clear lack of empirical information on how the different cognitive systems react to uncertain situations and which cognitive system decision makers are more prone to use in decision making in uncertain scenarios (Dane & Pratt, 2007).

One of the main issues noted during the literature review, when critically analyzing similar studies about intuition and uncertainty in decision making, was the way intuition was measured. It remains a fact that measuring intuition is an extremely complex task, and requires much effort and expertise in order to be done in an acceptable way. One study that clearly approaches the difficulties and limitations of the measurement of intuition was done by Dane and Pratt (2009). It extensively analyses previous studies and organizes the way intuition was measured into either being (1) direct instruction, (2) retrospective reports, (3) incubational methodology, (4) scenario based, (5) neurological and physiological approaches. This study will measure intuition using both the scenario based method and the direct instruction method in conjunction.

The rational models of expected utility state that humans decide based on the expected value of a given choice. As such, they would be able to clearly analyze situations and define the utility value of each outcome. However, this model does not take into account uncertainty. In uncertain scenarios, the outcomes and/or probabilities of the outcomes are not known, and as a result, the expected utility of a choice is not measurable. Therefore in a rational model, we would expect that uncertainty would not affect the results, as uncertainty cannot be fitted into a purely rational analysis due to this issue of measurement. The main implication of this statement is that no rational

model can measure uncertainty, and therefore there all analyses that take uncertainty into account are, to some extent, intuitive.

As stated before, the main research question is related with the understanding of how uncertainty affects decision making. Formulating testable hypotheses that allow us to answer this question requires some additional explanations, mostly related to issues in the measurement of intuition. As such, and for an explanatory purpose, this question is divided into two sub-questions that, in conjunction, will allow us to answer the main question. The first sub-question "S.Q. 1" is "In decision making in uncertain scenarios are we more prone to use the intuitive cognitive system or the rational/deliberative cognitive system?". This question cannot be answered directly because, as explained before, measuring the decision making system that a person uses to decide is an extremely difficult task. We must develop an alternative question that can help us define the reaction of each cognitive state to uncertainty. Therefore, we will rely on the second sub-question "S.Q. 2", "How do the different cognition systems react to uncertainty?". This question can be answered, and this thesis will follow a methodology similar to the one used by Zakay et al. (2011) to answer it. We will also attempt to confirm their results in order to build a more solid foundation for our results. While we will explore more thoroughly their methodology further on, we can summarize the steps needed in the following way:

1- Define scenarios which vary in their ratio of good/bad attributes and introduce three different uncertain scenarios by restricting the amount of available information;

2- Direct the subject towards a cognitive system that fosters intuitive decision making and keep a record of the decisions made by the subjects, for each scenario;

3- Direct the subject towards a cognitive system that fosters deliberative decision making and keep a record of the decisions made by the subjects, for each scenario.

After obtaining the inputs specified in steps 2 and 3, we will be able to answer S.Q. 2. We will then proceed to perform the same experiment, but without manipulating

the subjects towards a specific cognitive state, obtaining the decisions one would normally make absent from any guidance.

Then, by comparison (using proper statistical methods) it is possible to establish a relationship between the decision that suffered from the manipulation towards one of the two cognitive systems and the unbiased decision, for each of the different scenarios. This comparison allows us to verify if in uncertain scenarios people drift towards a more intuitive or deliberative decision making cognitive mode.

As with any methodology, this particular one also suffers from some faults. We should highlight there is no direct measurement of cognitive modes of thought in uncertain scenarios, thus leading to a margin of doubt in the results. We must also underline that each individual may have a different propensity for using each of the cognitive modes of thought. Nonetheless, with a large enough sample we may accept that these flaws will fade and that the results will drift towards a normal distribution.

3.1. Method Design and hypotheses

As explained above, this methodology will follow an experimental design, inspired, to some extent, by the one used by Zakay et al. (2011). Although this paper clearly presented an interesting way of analyzing the differences between the two cognitive systems in decision making, it is not without its faults. More specifically, the study tried to adapt to the preferences of each subject, when developing the packages that would be evaluated afterwards, by asking subjects to start by developing a ranking between the several possible attributes (presented in a neutral way). The study then uses these perceived values to present packages that respect the rankings, for instance by presenting the eight best ranked attributes as positive and the four worst ranked attributes as negative. The goal of this ranking is to make sure that the packages are balanced and that no individual attribute would steer the results. However, by not considering that the ranking does not reflect the weight of a given attribute in the overall presented attributes it fails to presented the proposed balanced packages. For instance, in an extreme scenario we could say that a subject may give a weight of 51% to one specific attribute and a weight of 49% to the rest of the combined attributes. In this scenario the decision would rely solely on whether the most important attribute is

presented on a positive or negative way. As such, this ranking should have also considered the individual weight of each attribute when defining the ranking, and ultimately the packages.

Although we acknowledge these issues, we will not be able to act accordingly and develop this methodology reflecting what has been said above due to lack of technical knowledge in programming and lack of access to software that would make the technique above specified possible. However, we will also not adopt any kind of ranking as we believe that the attributes are, on average, similarly weighted and even more so when applied to a large number of subjects that will dissipate possible individual distortions.

In order to create a manipulation of the cognitive system that we want to evaluate, we will follow the direct instruction method, suggested by previous authors (Dane & Pratt, 2009). As such, in the beginning of the experiment the subjects receive a description of how they should attempt to think about their decisions, similar to that presented in the work of Zakay et al. (2011). The exact instructions used are presented in Annex A of this thesis. By applying the method of direct instruction, as used by authors in several other empirical papers that attempt to capture the differences between the dual decision making cognitive systems, we separate subjects by the cognitive system used for making the decision about the choices presented. Please note that the instructions given are very similar, and tested by Zakay et al. (2011), thus not creating any biases besides the intended one. The third group is not presented with any direct instruction that could manipulate the used cognitive system, so as to not create any bias. Therefore, this third group relies on the use of the default cognitive system, which is what this study aims to understand.

After this direct instruction for the two biased groups, and no instruction for the other group, the subjects are asked to rate a holiday package based on the attributes presented. Six packages are presented, three of them (packages C, A and E) following the methodology used by Zakay et al. (2011) and three others that comprise different levels of uncertainty (packages B, F and D). The first three packages (C, A and E) are presented from the most useful/desirable package to the least useful/desirable packages. The other three packages (B, F and D) are presented from the least uncertain package to

the most uncertain package. These packages are as follows (the full attributes used for the packages may be found in the Appendix):

- Package C will contain 12 attributes, 8 of which will be presented in a way that is considered useful/desirable, with the remaining 4 being presented in a way that is not considered useful/desirable;
- Package A will contain 12 attributes, 6 of which will be presented in a way that is considered useful/desirable, with the remaining 6 being presented in a way that is not considered useful/desirable;
- Package E will contain 12 attributes, 4 of which will be presented in a way that is considered useful/desirable, with the remaining 8 being presented in a way that is not considered useful/desirable;
- Package B will contain 12 attributes, 4 of which will be presented in a way that is considered useful/desirable, 4 being presented in a way that is not considered useful/desirable and the remaining 4 being presented in a way that can't be evaluated (for instance, we may say that the location of vacation package B is unknown, and thus not measurable in terms of usefulness or desirability).
- Package F will contain 12 attributes, 3 of which will be presented in a way that is considered useful/desirable, 3 being presented in a way that is not considered useful/desirable and the remaining 6 being presented in a way that can't be evaluated (for instance, we may say that the location of vacation package F is unknown, and thus not measurable in terms of usefulness or desirability).
- Package D will contain 12 attributes, 1 of which will be presented in a way that is considered useful/desirable, 1 being presented in a way that is not considered useful/desirable and the remaining 10 being presented in a way that can't be evaluated (for instance, we may say that the location of vacation package D is unknown, and thus not measurable in terms of usefulness or desirability).

As explained before, these packages were already tested by Zakay et al. (2011) so as to safeguard that each attribute is not significantly more important than the others.

Subjects will be asked to rate these packages on a scale of 1 to 10, with 1 being the worst classification and 10 being the best classification. After receiving the answers, we analyze which cognitive system tended to provide an answer closest to what is the

expected answer (a package that has more positive attributes should be chosen over a package that has more negative attributes, provided that the attributes have similar importance). Also, we compare the answers given in the uncertain scenario by the subjects that were pushed towards using one of the two cognitive decision making systems with the ones provided by the unbiased group. When the answer of the biased group's perceived value is closer to the unbiased group's perceived value, we may conclude that in uncertain scenarios, we are more prone to use a certain cognitive decision making system and less prone to use the other.

We will answer the following objectives and test several hypotheses, which were grouped in accordance with the objective that they will help answer:

1- Show that the decisions of subjects that were directed towards the intuitive cognitive system are effectively different from the ones of subjects directed towards the rational/deliberative cognitive system, and that the intuitive cognitive system is better at evaluating the overall quality of a given package, which is defined as the percentage of positive attributes versus the total number of attributes. The spread between the perceived values of the packages will allow us to evaluate the relative differences between the packages. In this case, an increase in the spread shows an increase in the difference of perceived quality in the two packages that are evaluated by each hypothesis. We aim to confirm the results obtained by Zakay et al. (2011), which showed that the intuitive cognitive system generated bigger spreads among packages, which means it perceived more differences in the quality of the packages. In simpler terms, it would mean that the intuitive cognitive system was better at weighing and evaluating the packages that were presented, and thus generated a better decision.

H1: The difference between the perceived value of package C and package A will be bigger in the group that was directed towards the intuitive cognitive system than in the group that was directed towards the rational/deliberative cognitive system.

H2: The difference between the perceived value of package E and package A will be bigger in the group that was directed towards the intuitive cognitive system than in the group that was directed towards the rational/deliberative cognitive system.

H3: The difference between the perceived value of package C and package E will be bigger in the group that was directed towards the intuitive cognitive system than in the group that was directed towards the rational/deliberative cognitive system.

2- Verify which of the manipulated groups is closer to the non-manipulated group in terms of answers. By doing this, we can conclude on which of the two cognitive systems is more used in normal decision making. H4 will compare the perceived values of the packages for each of the two manipulated groups with the perceived value of the same packages for the non-manipulated group. Our expectation for H4 is that it will show that our non-manipulated subjects were more likely to give the same perceived values as the group manipulated towards the intuitive cognitive system. However, we believe that these results will not be as clear as the results obtained in uncertain situations. The reason behind this belief is that when all the information is available, a rational analysis may appear to be better to the subject.

H4: The difference between the perceived value of package C and package E in the group directed towards the intuitive cognitive system will be closer to the spread between the perceived value of package C and package E in the group that was not manipulated than the spread between the perceived value of package C and package E in the group directed towards the rational/deliberative cognitive system.

3- Understand the impact of the variation of the uncertainty level on the perceived value of the packages. By doing this, we will be able to analyze the behavior of each cognitive system when faced with uncertain scenarios, and understand if they behave in accordance with our expectations. H5, H6 and H7 will compare the perceived values of packages B, F and D within each of the manipulated groups to understand the impact of the variation of uncertainty on the perceived value of the packages.

Our expectation for H5 is that these perceived values will be different. While the packages have the same ratio of desirable and non-desirable aspects, we believe that the subjects directed towards the rational/deliberative cognitive system will be affected by risk-averse behaviors and penalize more uncertain packages. However, we must acknowledge that these risk-averse behaviors give a negative perceived value to

uncertain aspects, which are, by definition, non-measurable, and thus should not be considered in a rational analysis.

H5: The perceived values of packages B, F and D will be equal in the group that was directed towards the rational/deliberative cognitive system.

Our expectation for H6 is that these perceived values will be different. While the packages have the same ratio of desirable and non-desirable aspects, we believe that the subjects directed towards the intuitive cognitive system will intuitively try to measure the uncertain aspects. We also believe that this group will be more affected by risk aversion behaviors, as they will not try to think rationally and ignore them.

H6: The perceived values of packages B, F and D will be different in the group that was directed towards the intuitive cognitive system.

Our expectation for H7 is that the perceived value of package D will be smaller than the perceived value of package B as the subject will penalize packages with more uncertain aspects despite the fact that the packages have the same ratio of desirable and non-desirable aspects. This penalization will be due to risk aversion behaviors.

H7: The perceived value of package D will be smaller than the perceived value of package B in the group that was directed towards the intuitive cognitive system.

4- Verify which of the manipulated groups is closer to the non-manipulated group in terms of answers in different levels of uncertainty. By doing this, we will obtain the answer to our research question. We will be able to define which cognitive system has the most use in less uncertain scenarios and in more uncertain scenarios H8 and H9 will compare the perceived values of the packages for each of the two manipulated groups with the perceived value of the same packages for the non-manipulated group.

Our expectations for H8 is that the perceived value of package B in the non-manipulated group will be closer to the perceived value of package B in the group directed towards the rational/deliberative cognitive system than to the perceived value of package B in the group directed towards the intuitive cognitive system. This reflects the fact that this package is the least uncertain package of the three uncertain packages. As such, a rational analysis is easier (there aren't as many unknown variables) in this package than on the other two packages. Thus, the non-manipulated group may feel

more tempted to perform a rational analysis of this package than of the other packages, which should be reflected in the perceived values given.

H8: The perceived value of package B in the non-manipulated group will be closer to the perceived value of package B in the group directed towards the rational/deliberative cognitive system than to the perceived value of package B in the group directed towards the intuitive cognitive system.

Our expectations for H9 is that the perceived value of package D in the non-manipulated group will be closer to the perceived value of package D in the group directed towards the intuitive cognitive system than to the perceived value of package D in the group directed towards the rational/deliberative cognitive system. This reflects the fact that this package is the most uncertain package of the three uncertain packages. As such, a rational analysis is more difficult (there are more unknown variables) in this package than on the other two packages. Thus, the non-manipulated group may feel more tempted to perform an intuitive analysis, which provides a better way of dealing with uncertainty, in this package than of the other packages, which should be reflected in the perceived values given.

H9: The perceived value of package D in the non-manipulated group will be closer to the perceived value of package D in the group directed towards the intuitive cognitive system than to the perceived value of package D in the group directed towards the rational/deliberative cognitive system.

3.2.Sample

All of the answers were obtained from the same samples. The total number of people subject to the experiment was 215 (N=215). These 215 people were distributed among the groups in the following manner: 52 people participated in the experiment that manipulated participants towards a rational/deliberative cognitive system (N=52); 121 people participated in the experiment that manipulated participants towards an intuitive cognitive system (N=121); 42 people participated in the experiment that did not manipulate participants towards any cognitive system (N=42). Our sample was mostly comprised of people between 18-22 years old (45,1%) and 23-26 years old (29,3%). The rest of the participants were either younger than 18 years old (12,1%) or older than 26 years old (13,5%). When dividing the participants by their academic

degree we found that more than half of the participants had a bachelor's degree (55,3%). Other participants had either a master's degree (15,3%) or a high school education (27,9%), with other degrees having a very small significance (1,4%).

Table 3 Sample Description

Groups	Intuitive Group	Rational Group	Non-Manipulated Group	Total Sample
N=	121	52	42	215

3.3. Results

Before testing the hypotheses that were defined above, a homogeneity test of the sample was conducted to ensure that any variations of the dependent values are due to voluntary variations of the independent variables. These homogeneity tests compare the age and academic degree of the subjects.

Table 4 Sample Homogeneity Tests

Groups	Age	Degree
Intuitive vs Rational/Deliberative vs Non-Manipulated	$X^2(6)=3,727$; $p = 0,714$	$X^2(8)=12,393$; $p = 0,135$

These values confirm that our samples are homogenous, and therefore our results will not be due to differences in the independent variables.

Statistical testing of the nine hypotheses presented above, in accordance with the proposed methodology, allowed us to obtain the following results.

H1 was tested using a two sample t-test assuming equal variances. This test showed that there were no significant differences between the group manipulated towards the rational/deliberative cognitive system (Mean= 0,9615 ; SD= 1,8360) and the group manipulated towards the intuitive cognitive system (Mean=1,0826 ; SD=

1,4865); t(171)= 0,457, p= 0,648. There was, however, an inclination in the mean results that was consistent with what we were expecting (the intuitive cognitive system is better than the rational/deliberative cognitive system at perceiving differences in the packages). Nonetheless, this inclination isn't statistically significant.

Table 5 Group Statistics for H1

Number		N	Mean	Std. Deviation	Std. error mean
Spread CA	Intuitive	121	1,0826	1,48653	0,13514
	Rational	51	0,9615	1,83604	0,25461

Table 6 Independent Samples Test for H1

		t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference
Spread CA	Equal variances assumed	0,457	171	0,648	0,12111	0,26511
	Equal variances not assumed	0,42	81,048	0,675	0,12111	0,28825

H2 was tested using a two sample t-test assuming equal variances. This test showed that there were no significant differences between the group manipulated towards the rational/deliberative cognitive system (Mean= -0,9615 ; SD= 1,8253) and the group manipulated towards the intuitive cognitive system (Mean= -0,9669 ; SD= 1,6580); t(171)= -0,019, p= 0,985. There was, however, an inclination in the mean results that was consistent with what we were expecting (the intuitive cognitive system is better than the rational/deliberative cognitive system at perceiving differences in the packages). Nonetheless, this inclination isn't statistically significant. More information about the statistic tests performed for testing H2 may be found in Annex C.

Table 7 Group Statistics for H2

Number		N	Mean	Std. Deviation	Std. error mean
Spread CA	Intuitive	121	-0,9669	1,65798	0,15073
	Rational	52	-0,9615	1,82533	0,25313

Table 8 Independent Samples Test for H2

		t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference
Spread CA	Equal variances assumed	-0,019	171	0,985	-0,0054	0,28348
	Equal variances not assumed	-0,018	88,831	0,985	-0,0054	0,2946

H3 was tested using a two sample t-test assuming equal variances. This test showed that there were no significant differences between the group manipulated towards the rational/deliberative cognitive system (Mean= 1,9231 ; SD= 1,7472) and the group manipulated towards the intuitive cognitive system (Mean= 2,0496 ; SD= 2,0035); t(171)= 0,395, p= 0,693. There was, however, an inclination in the mean results that was consistent with what we were expecting (the intuitive cognitive system is better than the rational/deliberative cognitive system at perceiving differences in the packages). Nonetheless, this inclination isn't statistically significant. More information about the statistic tests performed for testing H3 may be found in Annex D.

Table 9 Group Statistics for H3

Number		N	Mean	Std. Deviation	Std. error mean
Spread CA	Intuitive	121	2,0496	2,00354	0,18214
	Rational	52	1,9231	1,74722	0,2423

Table 10 Independent Samples Test for H3

		t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference
Spread CA	Equal variances assumed	0,395	171	0,693	0,12651	0,32014
	Equal variances not assumed	0,417	109,997	0,677	0,12651	0,30312

H4 was tested using a one-way between subjects ANOVA analysis, in order to compare the effect of different cognitive systems on the perceived values given by the subjects of the three different groups. There was no significant effect of the different

cognitive systems on the perceived values given by subjects at the p< 0,05 level for the different conditions [F(2, 212)= 0,234, p= 0,791]. Given the results, there is no significant relationship between the groups that we can highlight, and thus we cannot assume that one of the manipulated groups is closer to the non-manipulated group than the other manipulated group. More information about the statistic tests performed for testing H4 may be found in Annex E.

Table 11 Spread CE for H4

	N	Mean	Std. Deviation	Std. error mean	Minimum	Maximum
Intuitive	121	2,0496	2,00354	0,18214	-6,00	6,00
Rational	52	1,9231	1,74722	0,2423	-1,00	6,00
Non-Manipulated	42	1,8333	1,65156	0,25484	-2,00	6,00
Total	215	1,9767	1,87318	0,12775	-6,00	6,00

Table 12 ANOVA for H4

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,656	2	0,828	0,234	0,79
Within Groups	749,228	212	3,534		
Total	750,884	214			

H5 was tested using three paired samples t-tests to compare the results among the three uncertain scenarios for the group manipulated towards the rational/deliberative cognitive style. There was a significant difference between the perceived value of package B (M= 3,71 ; SD=2,003) and the perceived value of package D (M= 2,40 ; SD= 1,774); t(51)= 4,635 , p= 0,000. There was a significant difference between the perceived value of package B (M= 3,71 ; SD= 2,003) and the perceived value of package F (M= 3,19 ; SD= 1,633); t(51)= 2,635 , p= 0,011. There was a significant difference between the perceived value of package F (M= 3,19 ; SD= 1,633) and the perceived value of package D (M= 2,40 ; SD= 1,774) ; t(51)= -3,792 , p= 0,000. These results clearly show that the perceived value given by participants manipulated towards the rational/deliberative cognitive system changes with differences in the level of uncertainty presented in the package, with more uncertain packages having a smaller perceived value. More information about the statistic tests performed for testing H5 may be found in Annex F.

Table 13 Paired Samples Statistics for H5

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package B	52	3,71	2,003	0,278
	Package D	52	2,4	1,774	0,246

Table 14 Paired Samples Test for H5

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package B - Package D	1,308	2,034	0,282	4,635	51	0,000

Table 15 Paired Samples Statistics for H5

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package B	52	3,71	2,003	0,278
	Package F	52	3,19	1,633	0,227

Table 16 Paired Samples Test for H5

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package B - Package F	0,519	1,421	0,197	2,635	51	0,011

Table 17 Paired Samples Statistics for H5

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package D	52	2,4	1,774	0,246
	Package F	52	3,19	1,633	0,227

Table 18 Paired Samples Test for H5

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package D - Package F	-0,788	1,499	0,208	-3,792	51	0,000

H6 was tested using three paired samples t-tests to compare the results among the three uncertain scenarios for the group manipulated towards the intuitive cognitive

style. There was a significant difference between the perceived value of package B (M= 3,59 ; SD= 1,662) and the perceived value of package D (M= 1,78 ; SD= 1,221); t(120)= 12,837 , p= 0,000. There was a significant difference between the perceived value of package B (M= 3,59 ; SD= 1,662) and the perceived value of package F (M= 3,19 ; SD= 1,513); t(120)= 3,054 , p= 0,003. There was a significant difference between the perceived value of package F (M= 3,19 ; SD= 1,513) and the perceived value of package D (M= 1,78 ; SD= 1,221); t(120)= -12,311 , p= 0,000. These results clearly show that the perceived values given by participants manipulated towards the intuitive cognitive system change with differences in the uncertainty presented in the package. More information about the statistic tests performed for testing H6 may be found in Annex G.

Table 19 Paired Samples Statistics for H6

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package B	121	3,59	1,662	0,151
	Package D	121	1,78	1,221	0,111

Table 20 Paired Samples Test for H6

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package B - Package D	1,81	1,551	0,141	12,827	120	0,000

Table 21 Paired Samples Statistics for H6

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package B	121	3,59	1,662	0,151
	Package F	121	3,19	1,513	0,138

Table 22 Paired Samples Test for H6

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package B - Package F	0,397	1,429	1,3	3,054	120	0,003

Table 23 Paired Samples Statistics for H6

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package D	121	1,78	1,221	0,111
	Package F	121	3,19	1,513	0,138

Table 24 Paired Samples Test for H6

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package D - Package F	-1,413	1,263	0,115	-12,311	120	0,000

H7 was tested using a paired samples t-test to compare the results among package B and package D scenarios for the group manipulated towards the intuitive cognitive system. There was a significant difference between the perceived value of package B (M= 3,59 ; SD=1,662) and the perceived value of package D (M= 1,78 ; SD= 1,221); t(120)=12,837 , p=0,000. These results clearly show that the perceived value of package D is smaller than the perceived value of package B. More information about the statistic tests performed for testing H7 may be found in Annex H.

Table 25 Paired Samples Statistics for H7

Number		N	Mean	Std. Deviation	Std. error mean
Pair 1	Package B	121	3,59	1,662	0,151
	Package D	121	1,78	1,221	0,111

Table 26 Paired Samples Test for H7

		Paired Differences			t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. error mean			
Pair 1	Package B - Package D	1,81	1,551	0,141	12,837	120	0,000

H8 was tested using a one-way between subjects ANOVA analysis, in order to compare the effect of uncertainty on the perceived values of package B given by the subjects of three different groups. There was no significant effect of different cognitive systems on the perceived values given by subjects at the $p< 0,05$ level for the different conditions [F(2, 212) = 0,114 , p= 0,8929]. Given the results, there is no significant relationship between the groups that we can highlight, and thus we cannot assume that one of the manipulated groups is closer to the non-manipulated group than the other manipulated group. However, we can see that the mean perceived value for the non-manipulated group (M= 3,69 , SD= 1,760) is closer to the mean perceived value of the

group manipulated towards the rational/deliberative cognitive system (M= 3,71 , SD= 2,003) than to the mean perceived value of the group manipulated towards the intuitive cognitive system (M= 3,59 , SD= 1,662). Nonetheless, and as stated above, this remark is not statistically significant. More information about the statistic tests performed for testing H8 may be found in Annex I.

Table 27 Package B Ratings

	N	Mean	Std. Deviation	Std. error mean	Minimum	Maximum
Intuitive	121	3,59	1,662	0,151	1,00	8,00
Rational	52	3,71	2,003	0,278	1,00	8,00
Non-Manipulated	42	3,69	1,76	0,272	1,00	7,00
Total	215	3,64	1,761	0,12	1,00	8,00

Table 28 ANOVA for H8

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0,714	2	0,357	0,114	0,89
Within Groups	662,988	212	3,127		
Total	663,702	214			

H9 was tested using a one-way between subjects ANOVA analysis, in order to compare the effect of uncertainty on the perceived values of package D given by the subjects of three different groups. There was a significant effect of different cognitive systems on the perceived values given by subjects at the $p< 0,05$ level for the different conditions [$F(2, 212) = 4,176$, $p= 0,017$]. Post hoc testing with the Tukey HSD test showed that the mean perceived value of package D for the group manipulated towards the intuitive cognitive system (M= 1,78 , SD= 1,221) is significantly different than the mean perceived value of package D for the group manipulated towards the rational/deliberative cognitive system (M= 2,40 , SD= 1,774). Moreover, at the $p < 0,10$ level there is a statistically significant difference between the perceived value of package D for the group manipulated towards the rational/deliberative cognitive system (M= 2,40 , SD= 1,774) and the group that was not manipulated (M= 1,79 , SD= 1,116). These results demonstrate that we may infer that the non-manipulated group's results were closer to the group manipulated towards the intuitive cognitive system in scenarios of bigger uncertainty, as the perceived value of package D for non-manipulated group were significantly different from the group manipulated towards the rational/deliberative cognitive system but not significantly different from the ones

obtained from the group manipulated towards intuitive cognitive system. More information about the statistic tests performed for testing H9 may be found in Annex J.

Table 29 Package D Rating

	N	Mean	Std. Deviation	Std. error mean	Minimum	Maximum
Intuitive	121	1,78	1,221	0,111	1,00	8,00
Rational	52	2,4	1,774	0,246	1,00	9,00
Non-Manipulated	42	1,79	1,116	0,172	1,00	5,00
Total	215	1,93	1,377	0,094	1,00	9,00

Table 30 ANOVA for H9

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	15,388	2	7,694	4,176	0,02
Within Groups	390,566	212	1,842		
Total	405,953	214			

Table 31 Tukey HSD for H9

	(I) Number	(J) Number	Mean Difference (I-J)	Standard Error Mean	Sig.
Tukey HSD	Intuitive	Rational/Deliberative	-0,627	0,225	0,016
		Non-Manipulated	-0,009	0,243	0,999
	Rational/Deliberative	Intuitive	0,627	0,225	0,016
		Non-Manipulated	0,618	0,282	0,074
	Non-Manipulated	Intuitive	0,009	0,243	0,999
		Rational/Deliberative	-0,618	0,282	0,074

4. Discussion

Overall, the first three hypotheses results were consistent with our expectations. The results obtained did not show the differences we expected with statistical significance, though they did show a trend in the mean results that was similar to the results obtained by Zakay et al. (2011). Even though further research is needed, these results reflect the idea that the intuitive cognitive system is better at perceiving value between several options. Several reasons could be highlighted as potential causes of this lack of statistical significance. We would point out that one of the possible causes is that the difference in perceived value between the intuitive cognitive system and the rational/deliberative cognitive system is not dramatically different for the proposed choice, leading to mean values which are similar and fall within the range of lack of statistical significance. In other words, the decisions made by subjects are similar in these particular scenarios, regardless of the cognitive system used and the way that each cognitive system came to its conclusion. Other studies may try to elaborate on this, presenting subjects with choices that produce bigger differences between the intuitive cognitive system and the rational/deliberative cognitive system.

The results obtained in H4 showed no trend whatsoever, a situation which may be due to the lack of difference between the intuitive cognitive system results and the rational/deliberative cognitive system results in a full information scenario. As such, we are not able to confirm which of the cognitive systems, intuitive or rational, is the preferred cognitive system in scenarios of perfect information. Nonetheless, this falls within our expectations that in full information scenarios the rational/deliberative cognitive system does not face difficulties of measurement, and remains an easy method to use. As explained above, an experience where choices produce bigger differences between the intuitive cognitive system and the rational/deliberative cognitive system could also benefit the testing of this hypothesis and show if there is in fact a trend towards one of the cognitive systems. As advanced when presenting H4, we maintain the belief that in a full information scenario subjects may be more inclined to rely on their rational/deliberative cognitive system.

H5 results were aligned with our previous expectations, showing that subjects manipulated towards the rational/deliberative cognitive system still react to uncertainty in a significant way, preferring less uncertain packages to more uncertain packages. We

maintain that risk averse behaviors are the cause of these differences in perceived values, as advanced when introducing H5. This violates the assumption that the rational/deliberative cognitive system does not evaluate what it can't measure. However, it also introduces the question of how and how well the rational/deliberative cognitive system measures uncertainty. We would advance that the subjects manipulated towards the rational/deliberative cognitive system adopted one of the features of the intuitive cognitive system, which has been discussed, to intuitively measure these uncertain aspects. In that sense, further studies could invest in understanding this process of combining two cognitive systems into the same analysis. It would be interesting to know which cognitive system took part in each part of the analysis, and how they mix in order to create a decision.

H6 results were aligned with our previous expectations, showing that subjects manipulated towards the intuitive cognitive system react to uncertainty in a significant way, preferring less uncertain packages to more uncertain packages. We maintain that risk averse behaviors are the cause of these differences in perceived values, as advanced when introducing H6. In this sense, we believe that subjects intuitively measured the presented uncertainty, and then managed to include this factor into the overall intuitive analysis.

H7 allows us to confirm what we had already observed in H6, and further understand that uncertainty is viewed as a negative aspect by the subjects, thus showing us that subjects manipulated towards the intuitive cognitive style prefer less uncertain packages to more uncertain packages.

The results obtained in H8 and H9 were in line with what we were expecting. In H8 we noticed a trend in the mean perceived values of the non-manipulated group which was closer to the group manipulated towards the rational/deliberative cognitive system. In H9 we observed the opposite; the non-manipulated group was closer to the group manipulated towards the intuitive cognitive system. The main conclusion we would draw from these two hypotheses is that our subjects from the non-manipulated group tended to think more intuitively as uncertainty increased, as expected. Once again we faced the problem of statistical significance in H8, which was analyzed previously, which can be approached in further studies. However, in H9 the results were statistically

significant and clearly showed a preference for the intuitive cognitive system in more uncertain scenarios.

5. Conclusion

In the beginning of this dissertation we defined the following question as the key research question: “Do decision makers rely more on intuition as uncertainty increases or do they rely more on rational/deliberative decisions?”.

After this, our study focused on understanding how the different cognitive systems worked, namely the rational/deliberative cognitive system and the intuitive cognitive system, and on what uncertainty is. Having understood that these different cognitive systems have very different, almost dichotomic, characteristics our understanding was they would generate different decisions in uncertain scenarios. Nonetheless, we found that there was very limited number of studies that empirically analyzed cognitive systems and uncertainty. This lack of research was mostly due to difficulties in measuring intuition, as we discussed during this dissertation.

Our methodology focused on adapting a previous study by Zakay et al. (2011) and adding uncertain characteristics to it. Our subjects were faced with 6 different packages, which changed in their number of positive, negative and uncertain aspects, and asked to rate them in a scale of one to ten. By manipulating our subjects towards one of the two cognitive systems, using direct instruction, we were able to measure their perceived values of the presented packages. This result was then compared with the results obtained in the group that was not manipulated towards any cognitive system.

Our results were consistent with those obtained by Zakay et al. (2011), albeit without statistical significance, showing that the intuitive cognitive system was better at recognizing differences among the packages. We could not confirm our suspicion that the non-manipulated group was mainly using the intuitive cognitive system to rate the packages. We confirmed that the two manipulated groups preferred less uncertain packages to more uncertain packages, which we believe reflects risk averse behaviors. However, we highlight that uncertainty is different from risk, as explained in this dissertation, and there is no rational way of dealing with uncertainty as uncertainty is not measurable and the rational process states that inputs must be measurable in order to be analyzed and included in the rational decision making process. As we advanced, we suspect that the two manipulated groups used their intuition to assign a statistical distribution with a mean and standard deviation to the uncertain aspects instead of disregarding them. Even though something is not measurable, people may rely on their

intuition to present an estimation of its value. This is consistent with the processes of intuition, but not with rational processes. Thus, we would advance that even subjects manipulated towards the rational/deliberative cognitive system used their intuition as a tool for decision making in uncertain scenarios. Finally, and possibly the most interesting and innovative observation, we obtained the confirmation that people tend to rely more on their intuitive cognitive system in more uncertain scenarios (and less in less uncertain scenarios), which was consistent with our initial expectations.

With these results we are now capable of answering our key research question: "Do decision makers rely more on intuition as uncertainty increases or do they rely more on rational/deliberative decisions?". Our results showed that decision makers do rely more on intuition as uncertainty increases, as we suspected.

As we have covered so far, our study suffers from some limitations. We also acknowledge there are a few improvements that could be done, mainly in addressing these limitations. First, and possibly the most important limitation we faced was related with the manipulation towards intuition and measurement of when the intuitive cognitive system was actually used. Measuring intuition was a topic that we analyzed during this work in order to understand how we would advance in our methodology. Previous studies had already covered this topic, stating the inherent difficulties of accurately measuring intuition (Dane & Pratt, 2009). Nonetheless, we tried to manipulate subjects towards intuition by direct instruction, one of the several methods of inducing subjects into a certain cognitive state. However, there is always room to improve the used instructions, in a way that produces a better manipulation, in order to obtain better results. Due to a lack of technical knowledge, we were also not able to apply other techniques in order to confirm if a subject was actually using the intuitive cognitive state. For instance, restricting the available decision time for the subject manipulated towards the intuitive cognitive system would have allowed us to obtain a better manipulation. Second, the packages used could be improved by taking into account the overall value that each subject attributed to each aspect of the package, for instance, by asking participants to distribute one hundred points between all of the aspects, with the most important aspects receiving more points. By doing so, we would be able to create custom packages which would better reflect the distribution of positive and negative aspects and ultimately would have been a better tool to eliminate possible

deviations. We would also highlight, once again, that this particular decision did not create key differences in judgment when comparing decisions made by subjects manipulated towards different cognitive systems, as the perceived values did not change much between groups. Further studies can change the decision, and obtain results that provide more differences, and thus allow us to obtain results that are statistically significant.

Further studies could try to improve on the limitations portrayed above and also explore new fields within this range of uncertainty and decision making. For instance, new investigations could try to understand if decision making in uncertain scenarios changes in accordance with the topic of the decision. Decisions about professional matters and personal matters can be different, and may not change linearly with changes in uncertainty. For example, we may adopt the intuitive cognitive system in personal decisions in scenarios of low uncertainty, while in professional decisions we may adopt the intuitive cognitive system only in high uncertainty scenarios. Developing new ways of accurately inducing and measuring intuition are also needed, as the current tools are either not accurate enough or too sophisticated for widespread empirical testing which could grant us with new insights on decision making.

The study of decision making in uncertain scenarios is a topic that can easily become a cornerstone for corporate decision making, and the proposed topics of investigation cover only a very small fraction of what may be studied. Therefore, further studies are welcome and can help in establishing a bridge between academia and real life decision making in uncertain scenarios, with positive outcomes for both counterparts.

6. References

Agor, W. H. (1986). The logic of intuition: How top executives make important decisions. Organizational Dynamics, 14(3), 5-18. doi: 10.1016/0090-2616(86)90028-8

Akinci, C., & Sadler-Smith, E. (2012). Intuition in Management Research: A Historical Review. International Journal of Management Reviews, 14(1), 104-122. doi: 10.1111/j.1468-2370.2011.00313.x

Bocco, B. S., & Merunka, D. (2013). Do Leaders of Small and Medium-Sized Businesses Base Decisions on Intuition? An Empirical Investigation Among West African Managers. Global Business and Organizational Excellence, 32(5), 45-52. doi: 10.1002/joe.21502

Burke, L. A., & Miller, M. K. (1999). Taking the mystery out of intuitive decision making. Academy of Management Executive, 13(4), 91-98.

Busemeyer, J. R., & Townsend, J. T. (1993). Decision field theory: A dynamic-cognitive approach to decision making in an uncertain environment. Psychological Review, 100(3), 432-459.

BusinessDictionary.com. (2015). decision making. BusinessDictionary.com http://www.businessdictionary.com/definition/decision-making.html

Certo, S. C., & Certo, S. T. (2006). Modern management: Pearson/Prentice Hall.

Dane, E., & Pratt, M. G. (2007). Exploring intuition and its role in managerial decision making. Academy of Management Review, 32(1), 33-54.

Dane, E., & Pratt, M. G. (2009). Conceptualizing and measuring intuition: A review of recent trends. International review of industrial and organizational psychology, 24, 1-40.

Edwards, W. (1954). The theory of decision making. Psychological Bulletin, 51(4), 380.

Evans, J. S. B. T. (2008) Dual-processing accounts of reasoning, judgment, and social cognition. Vol. 59. Annual Review of Psychology (pp. 255-278).

Gigerenzer, G., & Gaissmaier, W. (2011) Heuristic decision making. Vol. 62. Annual Review of Psychology (pp. 451-482).

Hodgkinson, G. P., Sadler-Smith, E., Burke, L. A., Claxton, G., & Sparrow, P. R. (2009). Intuition in Organizations: Implications for Strategic Management. Long Range Planning, 42(3), 277-297. doi: 10.1016/j.lrp.2009.05.003

Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. American Economic Review, 93(5), 1449-1475. doi: 10.1257/000282803322655392

Kahneman, D. (2012). Rápido e devagar: Duas formas de pensar: Companhia das Letras.

Kahneman, D., & Tversky, A. (1979). PROSPECT THEORY: AN ANALYSIS OF DECISION UNDER RISK. Econometrica, 47(2), 263-291.

Khatri, N., & Ng, H. A. (2000). The role of intuition in strategic decision making. Human Relations, 53(1), 57-86.

Knight, F. H. (2012). Risk, uncertainty and profit: Courier Corporation.

Lipshitz, R., & Strauss, O. (1997). Coping with uncertainty: A naturalistic decision-making analysis. Organizational Behavior and Human Decision Processes, 69(2), 149-163. doi: 10.1006/obhd.1997.2679

Locander, D. A., Mulki, J. P., & Weinberg, F. J. (2014). How do salespeople make decisions? The role of emotions and deliberation on adaptive selling, and the moderating role of intuition. Psychology and Marketing, 31(6), 387-403. doi: 10.1002/mar.20702

Makridakis, S., & Taleb, N. (2009). Decision making and planning under low levels of predictability. International Journal of Forecasting, 25(4), 716-733. doi: 10.1016/j.ijforecast.2009.05.013

Mandelbrot, B. B. (1997). The variation of certain speculative prices: Springer.

McAfee, A., & Brynjolfsson, E. (2012). Big data: The management revolution. Harvard Business Review, 90(10), 4.

Miller, C. C., & Ireland, R. D. (2005). Intuition in strategic decision making: Friend or foe in the fast-paced 21st century? Academy of Management Executive, 19(1), 19-30.

Mousavi, S., & Gigerenzer, G. (2014). Risk, uncertainty, and heuristics. Journal of Business Research, 67(8), 1671-1678. doi: 10.1016/j.jbusres.2014.02.013

Press, G. (2014). 12 Big Data Definitions: What's Yours? , from http://www.forbes.com/sites/gilpress/2014/09/03/12-big-data-definitions-whats-yours/

Sadler-Smith, E., & Shefy, E. (2004). The intuitive executive: Understanding and applying 'gut feel' in decision-making. Academy of Management Executive, 18(4), 76-91.

Taleb, N. N. (2010). The black swan:: The impact of the highly improbable fragility (Vol. 2): Random House.

Tat, H. H., Hooi, P. S., Rasli, A. M., Chin, T. A., & Yusoff, R. M. (2010). The role of intuition in decision making: an empirical study on academic staff in a Malaysian public university.

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. Journal of Risk and Uncertainty, 5(4), 297-323. doi: 10.1007/BF00122574

Von Neumann, J., & Morgenstern, O. (2007). Theory of games and economic behavior: Princeton university press.

Woiceshyn, J. (2009). Lessons from "Good Minds": How CEOs Use Intuition, Analysis and Guiding Principles to Make Strategic Decisions. Long Range Planning, 42(3), 298-319. doi: 10.1016/j.lrp.2009.05.002

Zakay, D., Brauner, R., Weyers, M., Russo, Z., & Usher, M. (2011). The impact of the mode of thought in complex decisions: Intuitive decisions are better. Frontiers in Psychology, 2.

7. Annexes

Annex A. Experiment Description

Attributes for holiday-alternatives (as presented in Zakay et al. (2011))

- Good/bad weather
- Friendly/not friendly staff
- Easy/not easy access
- Variety of activities (limited)
- Nice/limited room view
- Many/few near restaurants
- Breakfast (not) included
- Many/no proximal shops
- Rooms are (not) air-conditioned
- There is (no) TV in the room
- (No) beautiful beaches
- Small/spacious rooms

Used packages:

a) Package A

- Good weather
- Friendly staff
- Difficult access
- Limited variety of activities
- Nice room view
- Few near restaurants
- Breakfast not included
- Many proximal shops
- Rooms are air-conditioned
- There is no TV in the room

- Beautiful beaches
- Small rooms

b) Package B

- Good weather
- Friendly staff
- No information on accesses
- Limited variety of activities
- Nice room view
- No information on the number of nearby restaurants
- Breakfast not included
- No information on the number of proximal shops
- No information on wether the rooms are air-conditioned or not
- There is no TV in the room
- Beautiful beaches
- Small rooms

c) Package C

- Good weather
- Friendly staff
- Easy access
- Limited variety of activities
- Nice room view
- Many near restaurants
- Breakfast not included
- Many proximal shops
- Rooms are air-conditioned
- There is no TV in the room
- Beautiful beaches
- Small rooms

d) Package D

- Good weather
- No information about staff
- No information on accesses
- No information on the variety of activities
- No information about room view
- No information on the number of nearby restaurants
- No information about breakfast being included or not
- No information on the number of proximal shops
- No information on wether the rooms are air-conditioned or not
- No information on wether there is a TV in the room or not
- No information about beaches
- Small rooms

e) Package E

- Good weather
- Friendly staff
- Difficult access
- Limited variety of activities
- Nice room view
- Few near restaurants
- Breakfast not included
- No proximal shops
- Rooms are not air-conditioned
- There is no TV in the room
- Beautiful beaches
- Small rooms

f) Package F

- Good weather
- Friendly staff
- No information on accesses

- No information on the variety of activities
- No information about room view
- No information on the number of nearby restaurants
- Breakfast not included
- No information on the number of proximal shops
- No information on wether the rooms are air-conditioned or not
- There is no TV in the room
- Beautiful beaches
- Small rooms

Experiment instructions (adapted from Zakay et al. (2011))

a) Reasoning condition

Imagine you have to choose a holiday package for your next vacation. You will be presented with information about six hypothetical vacation packages, described by various (positive/negative) attributes. You will then be asked to rate your evaluation of all six vacation packages (how "good" or "bad" you feel it would be to undertake the presented vacation) on a scale of 1–10. Research has shown that the best decisions are made using logic and rational thought. Therefore it is important that you think-carefully and logically about how much you like each vacation package. In particular, you should think about the reasons you have to prefer one vacation package to another one. You will be given as much time as you will need to make your judgment (but this will be done from memory, you cannot take notes). After you have made your decision you will be asked to justify it by giving the reasons for your choice.

b) Intuitive condition

Imagine you have to choose a holiday package for your next vacation. You will now be presented with information about six hypothetical vacation packages, described by various (positive/negative) attributes. You will then be asked to rate your evaluation of all six vacation packages (how "good" or "bad" you feel it would be to undertake the presented vacation) on a scale of 1–10. Research has shown that the best decisions are made using intuition rather than logic. Therefore, try to base your evaluation and choice

preference on your GUT-FEELING about how much you like or dislike the six vacation packages, rather than trying to think logically or rationally about them. You will be given as much time as you will need to make your judgment (but this will be done from memory, you cannot take notes). Remember that you should only use your intuitive feeling.

c) Unbiased condition

Imagine you have to choose a holiday package for your next vacation. You will now be presented with information about six hypothetical vacation packages, described by various (positive/negative) attributes. You will then be asked to rate your evaluation of all six vacation packages (how "good" or "bad" you feel it would be to undertake the presented vacation) on a scale of 1–10.. You will be given as much time as you will need to make your judgment (but this will be done from memory, you cannot take notes).

Annex B. Other results for H1

Table 32 Levene's Test for Equality of Variances for H1

		F	Sig.
Spread CA	Equal variances assumed	0,136	0,713
	Equal variances not assumed		

Annex C. Other results for H2

Table 33 Levene's Test for Equality of Variances for H2

		F	Sig.
Spread CA	Equal variances assumed	0,727	0,395
	Equal variances not assumed		

Annex D. Other results for H3

Table 34 Levene's Test for Equality of Variances for H3

		F	Sig.
Spread CA	Equal variances assumed	0,100	0,752
	Equal variances not assumed		

Annex E. Other results for H4

Table 35 Homogeneity of variances Test for H4

Levene's Statistics	df 1	df 2	Sig.
0,436	2	212	0,647

Table 36 Tukey HSD for H4

	(I) Number	(J) Number	Mean Difference (I-J)	Standard Error Mean	Sig.
Tukey HSD	Intuitive	Rational/Deliberative	0,12651	0,31172	0,913
		Non-Manipulated	0,21625	0,33668	0,797
	Rational/Deliberative	Intuitive	-0,12651	0,31172	0,913
		Non-Manipulated	0,08974	0,39001	0,971
	Non-Manipulated	Intuitive	-0,21625	0,33668	0,797
		Rational/Deliberative	-0,08974	0,39001	0,971

Table 37 Tukey HSD for H4

			Subset for alpha = 0,05
	Number	N	1
Tukey HSD	Non-Manipulated	42	1,8333
	Rational	52	1,9231
	Intuitive	121	2,0496
	Sig.		0,808

Annex F. Other results for H5

Table 38 Paired Samples Correlations for H5

		N	Correlation	Sig.
Pair 1	Package B & Package D	52	0,425	0,002

Table 39 Paired Samples Correlations for H5

		N	Correlation	Sig.
Pair 1	Package B & Package F	52	0,712	0,000

Table 40 Paired Sample Correlations for H5

		N	Correlation	Sig.
Pair 1	Package D & Package F	52	0,615	0,000

Annex G. Other results for H6

Table 41 Paired Samples Correlations for H6

		N	Correlation	Sig.
Pair 1	Package B & Package D	121	0,455	0,000

Table 42 Paired Samples Correlations for H6

		N	Correlation	Sig.
Pair 1	Package B & Package F	121	0,598	0,000

Table 43 Paired Samples Correlations for H6

		N	Correlation	Sig.
Pair 1	Package D & Package F	121	0,591	0,000

Annex H. Other results for H7

Table 44 Paired Samples Correlations for H7

		N	Correlation	Sig.
Pair 1	Package B & Package D	121	0,455	0,000

Annex I. Other results for H8

Table 45 Levene's Statistics for H8

Levene's Statistics	df 1	df 2	Sig.
2,885	2	212	0,058

Table 46Tukey HSD for H8

	(I) Number	(J) Number	Mean Difference (I-J)	Standard Error Mean	Sig.
Tukey HSD	Intuitive	Rational/Deliberative	-0,125	0,293	0,905
		Non-Manipulated	-0,104	0,317	0,943
	Rational/Deliberative	Intuitive	0,125	0,293	0,905
		Non-Manipulated	0,021	0,367	0,998
	Non-Manipulated	Intuitive	0,104	0,317	0,943
		Rational/Deliberative	-0,021	0,367	0,998

Table 47 Tukey HSD for H8

		N	Subset for alpha = 0,05
			1
Tukey HSD	Intuitive	121	3,59
	Rational	52	3,71
	Non-Manipulated	42	3,69
	Sig.		0,923

Annex J. Other results for H9

Table 48 Levene's for H9

Levene's Statistics	df 1	df 2	Sig.
6,166	2	212	0,002

Table 49 Tukey HSD for H9

			Subset for alpha = 0,05	
		N	1	2
Tukey HSD	Intuitive	121	1,78	
	Rational	52		2,4
	Non-Manipulated	42	1,79	
	Sig.		0,999	1