Decisions based on ratings, reviews, and recommendations - The cognitive processing of online information

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Guillermo Carbonell

from

Barranquilla, Colombia

1st Evaluator: Prof. Dr. Matthias Brand

2nd Evaluator: Prof. Dr. Oliver Büttner

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Articles

Article 1:

Carbonell, G., & Brand, M. (2018). Choosing a physician on social media: Comments and ratings of users are more important than the qualification of a physician. *International Journal of Human–Computer Interaction*, *34*(2), 117-128. doi:10.1080/10447318.2017.1330803

Article 2:

Carbonell, G., Meshi, D., & Brand, M. (2018). The use of recommendations on physician rating websites: The number of raters makes the difference when adjusting decisions. *Health Communication*, 1-10. doi:10.1080/10410236.2018.1517636

Article 3:

Carbonell, G., Barbu, C., Vorgerd, L., & Brand, M. (2018). The impact of emotionality and trust cues on the perceived trustworthiness of online reviews. Manuscript submitted for publication.

Erklärung über die eigenständige Verfassung der vorgelegten Dissertation

Hiermit versichere ich, dass die vorgelegte Dissertation gemäß §9 der Promotionsordnung der Fakultät für Ingenieurwissenschaften der Universität Duisburg-Essen vom 06. August 2015 eine selbstständig durchgeführte und eigenständig verfasste Forschungsleistung darstellt und ich keine anderen als die angegebenen Hilfsmittel und Quellen benutzt habe. Alle Stellen, die wörtlich oder sinngemäß aus anderen Schriften entnommen sind, habe ich als solche kenntlich gemacht. Die Arbeit lag weder in gleicher noch in ähnlicher Form einem anderen Prüfungsausschuss vor.

Duisburg, den 31.10.2018

Ort, Datum   Guillermo Carbonell, M.Sc.

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Abstract

The Internet allows consumers to find different kinds of information about products or services before a purchase. For instance, there is objective information provided by the platform or marketer, as well as different subjective opinions and several forms of ratings generated by users who already bought the product. This cumulative doctoral dissertation aims at depicting the cognitive process that consumers go through when choosing a product while using Internet information. More precisely, this thesis will focus on Internet platforms that contain objective and subjective information to facilitate consumer's decision-making (i.e. review websites). In order to do this, the decision-making model of Schiebener and Brand (2015) is taken as a theoretical reference. This model is characterized for understanding decision making as a process carried out by two systems that interact constantly. Thus, the reflective system, which is rational and calculative interacts with the impulsive system, which is based on emotional reactions and somatic activity in order to evaluate the options that lead to a decision. Based on this assumption, this thesis integrates the results of three empirical articles. Article 1 uses a Choice-Based Conjoint analysis to identify which type of information provided on review websites is more relevant for consumers and how executive functions are related to the preference for objective or subjective information. The results showed that participants preferred subjective information, such as reviews and ratings, and also that cognitive flexibility and categorization are cognitive abilities related to the preference for objective information. Article 2 used a Judge-Advisor System to measure the influence of both types of information on the final decision. In this study, participants correctly assessed which products were more advantageous based only on objective information. Furthermore, it was found that user recommendations are highly influential for consumers, especially when these come from a high number of users. Article 3 used an experimental design to investigate how Internet cues and the writing style influence consumers' purchase intention and their perceived trustworthiness of online reviews. The results showed that factual online reviews were perceived as more trustworthy, less fake and entail a higher purchase intention when compared to an emotional writing style. The results of the three articles are supported by literature using other dual-system approaches, such as the Elaboration Likelihood Model. Hence, these results and the subsequent discussions on a meta-level about the role of online descriptions, social influence, and decision confidence; contribute to the development of a theoretical model, based on Schiebener and Brand (2015), which explains how consumers process different types of online information in order to make purchase decisions.

1 Introduction

Since the appearance of the Internet and the web 2.0 many important aspects of everyday life have changed. The way we make decisions is one example of this. For instance, when looking for a restaurant, electronic devices, furniture, hotels or almost any other kind of product or service, people search for information on the Internet before making a purchase. Prior to the Internet, perhaps the most common way of getting information about a product was in traditional brick and mortar stores or asking family and friends about their experiences with the product, if they have had bought it.

Nowadays, terms like electronic commerce (e-commerce) and electronic word of mouth are a semantic proof that the way we purchase products is intrinsically related to our activity on the Internet. These terms are of common use in research fields, such as consumer behavior and information systems (e.g., Duarte, Costa E Silva, & Ferreira, 2018; Raphaeli, Goldstein, & Fink, 2017). Even though these concepts are perhaps not frequently used by laypersons, they constitute an important part of everyday life. For instance, the reader can remember the last time she or he intended to buy a product (e.g., a digital camera) or acquire a service (e.g., book a hotel)? Most probably, the reader looked for different options on a review website, which are Internet platforms that offer information about products, as well as ratings, reviews and recommendations from other consumers. One of the main goals of this thesis is to explain the decision-making process resulting from the integration of objective information provided by the platform or marketer, and the subjective opinions in form of reviews and ratings provided by other users.

Decision making is a field that has been growing intensively during the past decades (Wilhelms & Reyna, 2014). Business and economics, neuroscience, as well as social and cognitive psychology are examples of disciplines that study this process (Wilhelms & Reyna, 2014). One of the main goals of this doctoral thesis is to integrate perspectives coming from cognitive psychology -with an emphasis in neuropsychology- and in human-computer interaction. With this, we will understand how consumers process different types of information, such as product descriptions and user reviews when they are looking to acquire a product or service. This does not mean that there is no understanding of how this process functions. There are many theories and models that try to depict this process. Yet, this thesis takes the choice of consumers as a result of a cognitive process investigated through studies that highlight the role of executive functions, advice taking,

and processing systems working in specific brain regions. Hence, this dissertation takes cognition as a base to understand how consumers behave.

During the development of this thesis, many theories and models of cognitive psychology and consumer behavior will be presented. Some models will be explained in detail, while others will be mentioned as an anecdotal step in the evolution of a research field. Others will be explained only to argue why these are not sufficient to account for the cognitive process of decision making with support of the Internet. The theoretical models used in the present context might be of a descriptive, normative or prescriptive nature (French, Maule, & Papamichail, 2009): the descriptive models intend to show and explain human behavior; normative models show how individuals should behave; and prescriptive models integrate both, by considering the explanations and factors that influence behavior in order to ascribe how individuals should behave. The neuropsychological approach of decision making deals with descriptive models, which aim to identify the underlying mechanisms of the decision-making process, in this particular case, with support of review websites.

In the second chapter (*Theoretical background*), the topic of decision making, studied from a cognitive perspective, will be the cornerstone to develop main arguments and subsequent discussions. We will explore different decision-making approaches, which will lead to the identification of the decision-making model under objective risk of Schiebener and Brand (2015) as the frame of this doctoral thesis. Furthermore, the topic of advice taking will be introduced, since this will be helpful to explain how consumers use reviews and ratings of other users when choosing a product. In the second section, the research field of consumer behavior will be described. The main goal of this section is to get a basic understanding of the advances in consumer behavior, emphasizing on dual-system models similar to the theoretical perspective of Schiebener and Brand (2015). The last sections of the theoretical background consist of an introduction to the field of human-computer interaction and a brief description of the Internet with its characteristic user-generated content and some communication theories which will be helpful to integrate the decision-making perspective and consumer behavior.

Since this cumulative dissertation includes three scientific articles in international peer-reviewed journals (two published, one under review), the third chapter will show a summary of the proposed research questions and aims of this thesis, followed by a brief summary of each manuscript. To note, this thesis examines the behavior of consumers, which is not restricted to the

acquisition of products and goods, since it also includes the consumption of services. Therefore, the first two articles of this dissertation were framed in the health-care area, by means of investigating how individuals choose a physician to visit with help of physician-rating websites. The last manuscript uses a more traditional frame in consumer behavior, by means of using laptops as an example of a search product. The last chapter of the thesis will present a model of decision making using Internet information which will be discussed on a meta-level, by integrating the results of the three articles under the light of the theoretical background. This dissertation will outline the cognitive process of consumers when they check different types of information on the Internet, which include marketer- and user-generated content, and different types of Internet cues, such as ratings, and how these influence the purchase decision.

2   Theoretical background

2.1   Decision making: a cognitive perspective

Decision making is a cognitive process that involves different internal (i.e. psychological) and external (i.e. situational) factors (Schiebener & Brand, 2015). This complex cognitive process has been studied from many different perspectives, such as cognitive psychology, neuroscience, business and economics, etc. (Wilhelms & Reyna, 2014). The goal of these approaches is to describe and understand the decision-making process, considering the effects of individual and situational factors (Schiebener & Brand, 2015; Wilhelms & Reyna, 2014). To start, it is necessary to clarify and identify the different decision situations that are outlined among the different perspectives.

There are two capital distinctions when describing decision-making situations: decision making under certainty and decision making under uncertainty (Yates & Stone, 1992). The decisions under certainty are those in which a person knows the consequences of her/his decisions with absolute certainty (Schiebener, 2013). The decisions under uncertainty are those decisions in which there is no certainty about risks, possible outcomes or consequences (Weber & Johnson, 2009). In this case, the information about the decision-making scenario is not complete or is just not explicit enough to know exactly what will happen (Schiebener & Brand, 2015). Depending on the amount of information present in the decisions under uncertainty a further differentiation can be made: decisions under ambiguity (or ambiguous risk) are characterized by lacking information that allows individuals to calculate decision outcomes, whereas decisions under objective risk (Schiebener, 2013) present calculable information about the outcome probabilities. This differentiation between decision situations is important to formulate models that depict the decision-making process according to the amount and type of information. Most of the research is centered in understanding the decisions under uncertainty (Schiebener, 2013), which will be the focus of this thesis, since individuals usually count on different kinds of objective and subjective information that allows them to make inferences about the outcome of the decision. Furthermore, other relevant topics of decision making in cognitive psychology, such as decisions based on descriptions and advice taking will be explained. All these theoretical approaches will form a base upon which discussions on the cognitive process of making purchase decisions on the Internet can be built.

2.1.1   Decisions under ambiguity and risk

In cognitive psychology, decision situations are normally assessed with decision-making tasks which intend to grasp the decision-making process in a real-life scenario (Schiebener & Brand, 2015). These tasks usually present information about a situation, different options, and positive or negative outcomes after the decision is made. In the case of the decisions under ambiguity, the Balloon Analogue Risk Task (Lejuez et al., 2002) and the Iowa Gambling Task (Bechara, Damasio, Damasio, & Anderson, 1994) are perhaps the most relevant examples of decision-making tasks (Schiebener & Brand, 2015). The Iowa Gambling Task, which is frequently used in neuropsychology research (Toplak, Sorge, Benoit, West, & Stanovich, 2010) will be explained in order to give a more concrete idea of how decisions under ambiguity can be assessed. In this task, participants are presented with four decks of cards. Their task is to pick one card during 100 rounds. After each card is chosen, participants will gain or lose fictitious money. Two decks contain cards with larger gains and losses and the remaining two result in moderate gains and losses. Every gain and every loss is accompanied by a distinctive sound, providing feedback after every choice is made. Participants are not informed about which decks are more advantageous or how many rounds they will play. After several rounds participants usually realize that two decks entail low gains and losses, which in the long run result in less risky decision making, whereas the other two decks entail larger wins but also larger and more frequent losses, which in the long run are disadvantageous. At first, the decisions have to be taken randomly. However, thanks to the feedback, participants realize at some point that there is a pattern in the decks that allows them to make subsequently less risky choices. Based on studies with patients with frontal lobe lesions (Rogers, Everitt, et al., 1999; Rogers, Owen, et al., 1999), researchers have found that some decisions are based on bodily and emotional reactions resulting from the feedback after a decision is made (Bechara, Damasio, Damasio, & Lee, 1999; Bechara, Damasio, Tranel, & Damasio, 1997). After many repetitions of this behavior, individuals learn to choose advantageous options, by means of a bodily integration of previous experiences; this is called the somatic marker hypothesis (Bechara & Damasio, 2005; Damasio, Tranel, & Damasio, 1991). The somatic marker is one of the most important elements of the model of decisions under ambiguity (Bechara et al., 1997) and it is fundamental to understand dual-system models of decision making, which will be explained in the next section.

Decisions under objective risk are those decisions in which individuals have information about the possible outcomes and their probabilities. The information allows individuals to calculate and reflect upon what will happen, without having the certainty of what the outcome will be. Examples of tasks representing decisions under objective risk conditions are the Cambridge Gambling Task (Rogers, Everitt, et al., 1999), the Game of Dice Task (Brand, Fujiwara, et al., 2005), the Cups Task (Levin & Hart, 2003), the Probability-Associated Gambling Task (Delazer, Sinz, Zamarian, & Benke, 2007; Sinz, Zamarian, Benke, Wenning, & Delazer, 2008), and the Columbia Card Task (Figner, Mackinlay, Wilkening, & Weber, 2009). The Game of Dice Task has been used in many studies to assess decision making under objective risk (e.g. Bayard, Raffard, & Gely-Nargeot, 2011; Brand, Kalbe, et al., 2005; Brand, Recknor, Grabenhorst, & Bechara, 2007; Delazer et al., 2007; Gleichgerrcht, Ibáñez, Roca, Torralva, & Manes, 2010; Pawlikowski & Brand, 2011; Starcke, Wolf, Markowitsch, & Brand, 2008). In this paradigm, participants start out with a fictitious amount of money (€1000) to be used in the 18 rounds of the game. During each one of the 18 rounds, a die is thrown and participants have to bet on the possible outcomes. Participants can bet either €100, €200, €500, or €1000, depending on the risk they were willing to take. If participants bet €100, they choose one out of three combinations of four numbers each (winning probability of four out of six). If the die matches one of these four numbers, participants win €100, if not they lose the same amount. When they bet €200, they choose one out of two combinations of three numbers each (winning probability of three out of six). In the €500 bet, participants choose one out of three combinations of two numbers each (winning probability of two out of six), and for the €1000 bet, they only pick one number out of six (winning probability of one out of six). In every combination, the bet amount can be either gained (added) or lost (subtracted). The first two combinations (€100 and €200 bets) are considered "low risk", whereas the last two (€500 and €1000) are considered "high risk". Brand, Labudda, and Markowitsch (2006) developed a decision-making model under objective risk based on different results of this task in combination with other neuropsychological measures. Schiebener and Brand (2015) presented a new version of the model based on more recent findings. This thesis deals with decisions that have to be made in a scenario in which online consumers are provided with different kinds of information that allows them to make inferences about the product. Therefore, this thesis will focus on the decisions under risk and will take the Schiebener and Brand (2015) model of decisions under objective risk as a base to understand the decision-making process.

2.1.2   Model of decision making under objective risk

The model of decision making under objective risk is a dual-system model (Brand et al., 2006; Schiebener & Brand, 2015). Dual-processing models are theoretical frames characterized for the involvement of two systems that interact and work in two different ways, in order to explain behavior (Evans & Stanovich, 2013; Reyna, 2004). Dual-process theories in decision making started in the seventies (Wason & Evans, 1974) and became very popular thanks to the work of the Nobel Prize in economics, the psychologist Daniel Kahneman. In 1979, Kahneman and Tversky published the seminar paper "Prospect Theory: An analysis of decision under risk" (Kahneman & Tversky, 1979). This paper changed the field of decision-making research, since it revealed that individuals might make choices based on heuristics that are not always rational, and that do not necessarily lead to the most profitable outcomes (Tversky & Kahneman, 1992). Years later, Kahneman (2011) explained to the lay public how his dual-system theory works in his best-seller book "Thinking, Fast and Slow", where he describes System 1 as automatic, emotional, mainly unconscious, and fast. On the other hand, System 2 is effortful, conscious, calculative, and slow.

Similarly, the decision-making model of Brand et al. (2006), updated by Schiebener and Brand (2015) shows how individuals receive information (input) to make decisions based on two systems that constantly interact with each other (main inner processes), namely the impulsive and the reflective (see Figure 1). The information present in the decision scenario can be processed by these two systems that work in parallel, yet one of them "leads" the processing of the information. In the impulsive system, the processing involves emotional reactions, hunches and guesses about the situation outcome, having a close relation to the somatic marker hypothesis. On a brain level, the impulsive system is associated with the amygdala (processing of emotions and fear), the ventral striatum (processing of reward), and the orbitofrontal cortex (connection from emotional processing areas and rational areas – Schiebener & Brand, 2015). Contrasting this, the reflective system is associated with the dorsolateral prefrontal cortex and to the orbitofrontal/ventromedial prefrontal cortex, which are brain regions related to executive components, such as inhibition and control (Brand et al., 2006). After a decision is made (output: Behavior and consequences) the feedback serves as a source of new information that, again, can be processed by both systems.

Figure 1: Decision-making model under objective risk by Schiebener and Brand (2015)
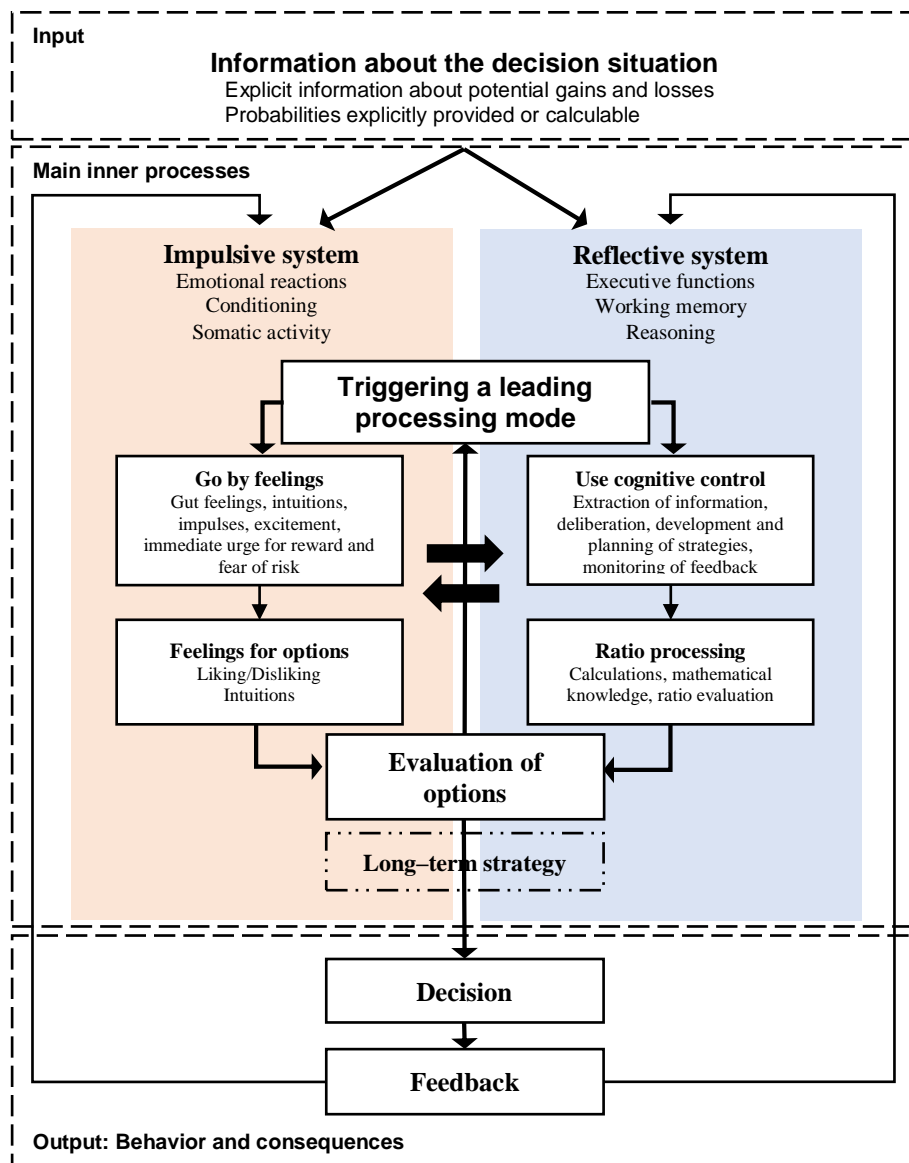
Figure 1. Decision-making model under objective risk by Schiebener and Brand (2015). Adapted from "Decision Making Under Objective Risk Conditions–a Review of Cognitive and Emotional Correlates, Strategies, Feedback Processing, and External Influences" by Schiebener, J. & Brand, M., 2015, Neuropsychology Review, 25, p. 185. Copyright: Springer Science+Business Media New York, 2015. Adapted with permission of the authors.

The Schiebener and Brand (2015) model is different from Kahneman's approach, because it is based on neuropsychological findings from different studies with psychiatric patients and healthy subjects. Researchers have tested in numerous occasions that high performance on executive

functions (e.g., self-control, calculation, working memory, etc.) is related to more advantageous decision making and fewer risky choices (Schiebener et al., 2014; Schiebener, Wegmann, Pawlikowski, & Brand, 2012; Schiebener, Zamarian, Delazer, & Brand, 2011). Based on the conclusions of Schiebener and Brand (2015), Kahneman would perhaps say that people with higher cognitive abilities tend to use System 2 (i.e. reflective system) more frequently, still considering the relevance of System 1 (i.e. impulsive system).

Besides the cognitive and neuronal functioning of decision making, there are many important aspects that need to be addressed in order to understand how individuals make choices under objective risk conditions. As can be observed in Figure 2, Schiebener and Brand (2015) suggest that individual attributes, information about the decision situation, and situational induced states and external influences have an effect on the interaction between the impulsive and reflective systems.

Figure 2: Internal and external factors of the decision-making process

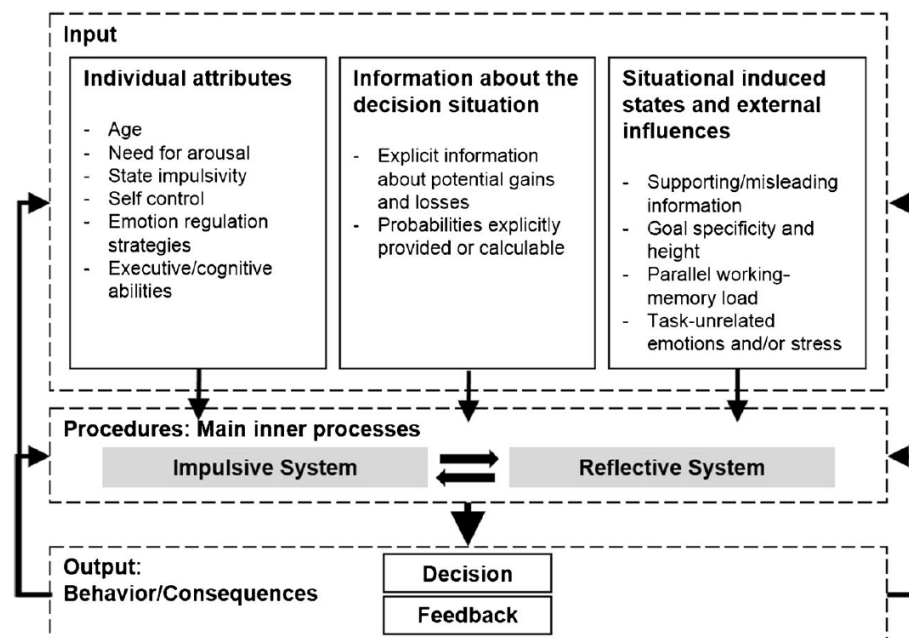**Figure 2.** Internal and external factors of the decision-making process. Reproduced from "Decision Making Under Objective Risk Conditions–a Review of Cognitive and Emotional Correlates, Strategies, Feedback Processing, and External Influences" by Schiebener, J. & Brand, M., 2015, *Neuropsychology Review*, 25, p. 192. Copyright: Springer Science+Business Media New York, 2015. Reproduced with permission of the authors.

The individual attributes are perhaps the most studied aspect in the Schiebener and Brand (2015) model. Individual aspects, such as age (Brand & Schiebener, 2013; Weller, Levin, & Denburg, 2011), impulsivity or executive functions (Brand, Laier, Pawlikowski, & Markowitsch, 2009; Brand et al., 2007; Brand & Schiebener, 2013; Buelow, 2015; Figner et al., 2009; Schiebener et al., 2014; Schiebener et al., 2011) play a fundamental role in the conception of this model. As mentioned before, one of the most important conclusions is that personal characteristics, such as high cognitive abilities, are related to the use of the reflective system when processing information.

The situational induced states and external influences are also relevant when making decisions. For instance, individuals experiencing positive emotions tend to follow simple heuristics and to be impulsive (Oaksford, Morris, Grainger, & Williams, 1996; Schiebener & Brand, 2015; Spies, Hesse, & Hummitzsch, 1996), whereas individuals experiencing negative emotions have a higher fear of loss and therefore are more controlled in their decisions (Bless & Schwarz, 1999; Clore, Schwarz, & Conway, 1994; Scholz, Dorner, Landherr, & Probst, 2013). Furthermore, the presentation of emotional stimuli also affects working-memory performance; decreases activation in the dorsolateral prefrontal cortex, which is related to executive control; and increases activation in the limbic system, which is associated with emotional responses (Schiebener & Brand, 2015).

The information about the decision situation is also relevant for this model and especially for this thesis. According to Schiebener and Brand (2015), the explicitness, quality and objectiveness of the provided information in a decision situation is fundamental for the interaction between the two systems. If the information provided is not sufficient for the individual to calculate possible consequences, the probability that decisions will be based on guesses and hunches (impulsive system) increases. On the other hand, a decision situation with clear information about probable outcomes will plausibly increase the likelihood of the information being processed in a reflective way, since individuals count with sufficient information to calculate probabilities. However, individual attributes seem to play a crucial role here again, since people with higher executive functions are better able to distinguish relevant from irrelevant information, to categorize options, and to process feedback, and thus they are able to make subsequent decisions based on calculations and probabilities (Brand et al., 2009; Brand et al., 2007; Brand & Schiebener, 2013; Buelow, 2015; Figner et al., 2009; Schiebener et al., 2014; Schiebener et al., 2011). Since the type of information is essential to develop this thesis, the next section will deal with different types of information that individuals count on when making decisions.

2.1.3   Decisions based on descriptions

There is plenty of work related to the information provided in a decision situation (Hertwig, Barron, Weber, & Erev, 2004). In the literature, there is a differentiation between decisions based on descriptions and decisions based on experience (Erev et al., 2010). The decisions based on descriptions are studied with tasks that provide clear information and probabilities about the outcomes (Newell & Rakow, 2007), moreover, individuals usually have to make one choice per problem and rarely receive feedback (Hertwig et al., 2004). In decisions based on experience, individuals need to learn the outcome probabilities by their own experience and observation (Newell & Rakow, 2007). The decisions based on descriptions are similar to the cognitive tasks that measure decisions under objective risk, since individuals need to assess the information in order to make decisions, yet in these tasks the feedback is usually integrated. This dissertation will focus on decisions based on descriptions, since the decisions that participants made on the different studies were based on descriptions about the product and there was no feedback present.

One of the main differences between these two types of decisions is the overweighting and overestimation of information when decisions are based on descriptions, as opposed to decisions based on experience. This phenomenon was observed when, in different experimental scenarios (Barron & Erev, 2003; Kahneman & Tversky, 1979), participants were asked to choose between: a) $4 with a probability of 0.8 or 0, otherwise; and b) $3 with certainty. Different findings have revealed that 64% (Barron & Erev, 2003) or even 80% (Kahneman & Tversky, 1979) of participants preferred option *a*. Contrary to this, when participants did not receive these options, but only the opportunity of pressing two buttons for several (Barron & Erev, 2003) or unlimited (Hertwig et al., 2004) rounds (i.e. based on experience), 63% (Barron & Erev, 2003) to 88% (Hertwig et al., 2004) of participants preferred option *b*.

These findings show how the outcome probabilities tend to be overestimated and overweight when there are only descriptions available. On the other hand, rare events do not have a major impact on the choices when the decision makers had previous experience in similar situations (Hertwig & Erev, 2009). Hertwig et al. (2004) explain this phenomenon with an example of vaccination for children. The number of concerned and dubious parents about child vaccination is growing (Glanz et al., 2013). Many parents are reliant to vaccinate their children because they have read that one out of thousands of children present high fiber and other symptoms. Solely

based on the descriptions, parents tend to overestimate the low probabilities for their children to get sick. Physicians on the other hand, know by experience that these cases are so rare that they do not doubt in recommending the vaccination. In this sense, having descriptions or experiences for the same situation makes a great difference regarding the decisions that individuals make (Hertwig et al., 2004).

As explained above, the process of decision making under objective risk combines many factors about the individual, the information provided, and the situation. These aspects might vary in relevance depending on the decision scenario. Since this thesis will deal with the processing of Internet information to make choices, it is necessary to characterize the information that individuals find on the Internet. Perhaps the most relevant feature about the Internet is that it allows users to make decisions with support of user-generated content. Thus, when looking for information on the Internet, individuals do not only encounter objective descriptions of a product or service they want to buy, but hundreds of subjective reviews, ratings, recommendations of other users in similar situations (Kwon, Kim, Duket, Catalán, & Yi, 2015). In other words, individuals make a decision based on descriptions, which can be directly related to the product or service, but also based on descriptions of other consumers. This indicates that there are two main information sources when making decisions on the Internet: objective marketer-generated information about the product and subjective user-generated information (Scholz et al., 2013). Therefore, it is important to understand how these two types of information interact in a decision situation. For this, the advice-taking topic can provide some insights about how individuals use different information when making decisions.

2.1.4   Advice taking

Before the appearance of the Internet, asking family or friends for advice and recommendations before acquiring a good was perhaps the most used method. In marketing research, this is called word of mouth (Dellarocas, 2003; Singh, 2000). Nowadays, the term electronic word of mouth is commonly used when referring to a similar situation, which involves the Internet as a source for recommendations (Dellarocas, 2003) For instance, if someone wanted to eat in a restaurant prior the Internet era, she or he might have asked her or his friends, who have already been there, if they would recommend the restaurant. Nowadays, everyone is able to check what hundreds of people think about many restaurants with different characteristics (Kwon et al., 2015). Can we compare

this digital version of getting recommendations to an advice-taking process? This question will be answered when discussing the results of the manuscripts of this cumulative work (see chapter 4 - *Discussion*). Before that, it is necessary to understand the psychological process of advice taking, in order to provide a background upon which we can build comparisons between offline and online behavior from a cognitive perspective, and to understand the influence of objective and subjective information when making purchase decisions on the Internet.

Researchers in cognitive psychology have studied different factors that account for the process in which individuals receive, use or discount advice. To start, characteristics of the advisor influence the use or discount of advice (Bonaccio & Dalal, 2006; Reyt, Wiesenfeld, & Trope, 2016). Many studies have identified the confidence (Phillips, 1999; Sniezek & Buckley, 1995; Sniezek & Van Swol, 2001; Yaniv, 1997) and the expertise (Goldsmith & Fitch, 1997; Jungermann & Fischer, 2005; Van Swol & Sniezek, 2005) of advisors as high influential attributes for decision makers. In this sense, advice coming from confident advisors tend to be followed more (Price & Stone, 2004). Moreover, advisor's expertise is a feature that triggers the use of heuristics in the judge (the one who makes the decision), who will probably use expert advice because of the security feeling that a knowledgeable person brings (Price & Stone, 2004; Sniezek & Van Swol, 2001). Even on a neuronal level, it has been tested that advice coming from experts is more intrinsically rewarding than advice coming from novices, since reward sensitive areas are more active when people receive advice from experts as opposed to that from novices (Meshi, Biele, Korn, & Heekeren, 2012). In this sense, trust in expert advisors is another important factor that influence the use or discount of advice (Jungermann & Fischer, 2005; Sniezek & Buckley, 1995; Sniezek & Van Swol, 2001; Van Swol & Sniezek, 2005). Jungermann and Fischer (2005) argue that in decisions under uncertainty conditions, individuals tend to base their decisions on their trust in the advisors, rather than on the analysis of possible choices. This happens when there is no sufficient information about the probable outcome, therefore, individuals use efficient mental shortcut strategies based on how much they trust the advisor (Jungermann & Fischer, 2005). This indicates that trust is another element that plays a role in the interaction between advisor and decision maker (Sniezek & Buckley, 1995; Van Swol & Sniezek, 2005).

Beyond the characteristics of the advisor, individual attributes of the decision maker and possible situational factors are also relevant (Bonaccio & Dalal, 2006). Some articles report how anxious participants tend to seek and follow more advice (Gino, Brooks, & Schweitzer, 2012).

Similarly, individuals who tend to process information more rationally are willing to pay for advice, contrary to those who process information more experientially (Godek & Murray, 2008). The role of the personal attributes and cognitive abilities of the advice recipient is particularly interesting for the outlined frame of decision making. To note, thus far, the influence of executive functions on advice taking has not been extensively investigated (Bonaccio & Dalal, 2006). In an example of the influence of executive functions on advice taking, Gomez-Beldarrain, Harries, Garcia-Monco, Ballus, and Grafman (2004) compared the performance in an advice-taking task of patients with frontal lobe lesions, and healthy individuals. They found that advice taking seems to be affected in these patients because of the difficulty of integrating information and poor planning skills (Gomez-Beldarrain et al., 2004). However, there are no other studies with healthy subjects, aiming to identify the role of executive components in advice taking.

When comparing offline advice taking and recommendation following on the Internet, a clear difference between the two scenarios can be identified: consumers encounter hundreds or even thousands of reviews (Kwon et al., 2015) that they can use to make informed decisions on the Internet, whereas in an offline scenario, people usually do not count with such an amount of advisors. Related to this point, some studies investigate how multiple advisors influence decisions. These studies "only" show the influence of a limited number of advisors. For instance, the influence of two (e.g. Yaniv, 1997), three (e.g. Budescu & Rantilla, 2000), four (e.g. Harvey, Harries, & Fischer, 2000), or even ten advisors (e.g. Rantilla, 2000) has been investigated. One of the main findings of these studies is that the aggregated opinions of advisors are perceived as more credible, since participants perceive that the accumulated opinions lead to the avoidance of biased advice. In other words, individuals prefer accumulated opinions than having just one. Similarly, relying on the opinions of many online reviewers or raters has increased credibility effects when making decisions on the Internet (DeAndrea, Van Der Heide, Vendemia, & Vang, 2015; Flanagin & Metzger, 2013; Grabner-Kräuter & Waiguny, 2015; Rui, 2017; Tong, Van Der Heide, Langwell, & Walther, 2008).

Until this point, the first parallels between the cognitive process of using advice and the use of Internet recommendations when making decisions can be drawn. We saw that advice coming from expert sources, as well as from multiple advisors tend to be followed more. In the coming sections, we will observe if there are Internet cues that allow a comparison between the role of expert advice in decision making; and the role of online ratings or reviews in the consumer's decision. This will

be explained in more detail in section 2.3.3 (*The warranting principle*) of this chapter. Even though all the above-addressed findings in the decision-making realm are fundamental to understand how users make decisions with help of user-generated content, there is still the need to characterize the decision situation on the Internet. With this, it will become clearer how online content, namely marketer-generated and user-generated, influences decisions.

2.2 Decision making in consumer behavior

According to Belch and Belch (2004), consumer behavior is "the process and activities people engage in when searching for, selecting, purchasing, using, evaluating, and disposing of products and services so as to satisfy their needs and desires" (in Karimi, 2013, p. 29). One of the core aspects of consumer behavior is decision making and all the actions that precede and follow a choice (Karimi, 2013). In this sense, Du Plessis, Rousseau, and Blem (1991) define decision making within this field as "behavior patterns of consumers, that precede, determine and follow on the decision process for the acquisition of need satisfying products, ideas or services" (in Karimi, 2013, p. 30). Since this thesis intends to outline the process in which an individual uses Internet information to acquire a product or service (e.g., appointment with a suitable physician or buying a laptop), it is necessary to frame some of our results in this area.

The first approaches in the economics realm that tried to depict how consumers search and process information to make decisions were introduced by George Stigler with his seminar work "The Economics of Information" (Stigler, 1961). This innovative work highlighted the fact that searching for product information had been neglected by economic science until that point (Stigler, 1961). He investigated on the time that consumers invest when looking for the ideal product in terms of quality and price. Hence, for Stigler (1961) the decision-making process is characterized by the interaction between the expected benefits of a product and the cost of searching time (J. Wang, Yang, & Brocato, 2018).

Many of Stigler's ideas are used until these days, however, after a couple of decades, some important adjustments and additions were suggested to this field. One of the most relevant improvements was the distinction between experience and search products (P. Nelson, 1970, 1974). The quality of some products can be determined even before the purchase, for instance, clothes (P. Nelson, 1974): a customer can go to a store and determine if the characteristics of a garment, such as size, texture or color are adequate for her or him; this is an example of a search

product. In contrast, it is hard to assess the quality of an experience product before the purchase; for instance, the taste of a specific brand of wine. This distinction is very important for the information search field in economics and serve as a base to make different assumptions about the searching times and costs of consumers (J. Wang et al., 2018).

There are some approaches in the consumer behavior context that try to understand how consumers choose different types of products from a psychological perspective (J. Wang et al., 2018). This perspective includes consumers' previous knowledge about a product, perceived risk and purchase intentions (Mitra, Reiss, & Capella, 1999). For instance, search products usually come with clear information about their features, therefore, consumers can gather objective information which entail a lower perceived risk (J. Wang et al., 2018). Experience products, on the contrary, entail a higher perceived risk (Mitra et al., 1999), since it is hard to use the provided information before the purchase (e.g., the quality of a haircut, friendliness and skills of a physician).

There are three traditional models in consumer behavior that address the decision-making process in relation to some psychological variables (Karimi, 2013). The model of Nicosia (1966) presents four main phases: consumer-attitude formation, information search and evaluation, the purchase and post-consumption feedback (Nicosia, 1966). Similarly, Howard and Sheth (1969) also propose four main phases in the process: inputs, perceptual learning constructs, outputs (behavior), and external variables (Howard & Sheth, 1969). The EKB model (named after authors' initials) also addresses four main divisions: information input, information processing, decision stage, and decision process variables (Engel, Kollat, & Blackwell, 1968). Within each one of these phases, some personal, social, and situational variables are proposed. Nevertheless, these models have been criticized for being specific for- and exclusively bounded to a purchase situation (Karimi, 2013). Other critiques focus on the vagueness of the models, which include many relations and poorly defined variables (Karimi, 2013; Voramontri & Klieb, 2018).

Even though there are many psychological aspects involved in the explanations about how consumers make decisions, there seems to be a disconnection between the behavioral research, taken as a psychological perspective which tries to explain choice behavior, and consumer research, as a perspective that tries to analyze the reasons and choices of a consumer (Foxall, 2001). There are, however some approaches that use psychological theories as a frame for understanding how consumers behave (Foxall, 2002). An example of a psychological model in

consumer behavior is the Behavioral Perspective Model (Foxall, 2002). This model, roughly explained, takes consumer choices as an interaction of different utilitarian reinforcement and punishment mechanisms that increase or decrease the frequency of a consumer behavior, such as buying. This means that, if a person has a nice experience in a restaurant or is satisfied with a purchased product, the repurchasing probability increases. Contrary to this, when customers spend more money than expected for a low-quality product, they might not repurchase it nor contact the retailer again (Fagerstrøm, 2010; Foxall, 2001). This psychological perspective is based on behaviorism, including classical conditioning and reinforcement aspects (Foxall, 2001). Though important, this model does not depict the cognitive mechanisms underlying decision making. Since this dissertation intends to explain the decision-making process of consumers framed in the cognitive psychology field, the next section will show different perspectives that explain how consumers process information in two different ways: a slow, effortful reflective process; and a fast, easy and gist-based process. In this sense, it will be shown how research in consumer behavior also has used dual-system approaches to explain how consumers search and process information.

2.2.1   Dual process in consumer decisions

Similarly to the already outlined decision-making model of Schiebener and Brand (2015), there are also dual-system perspectives that explain how consumers purchase products (Karimi, 2013). For instance, similar to the model of Schiebener and Brand (2015), the Reflective-Impulsive Model highlights the interaction of these two systems (reflective and impulsive) and explain how these are rooted in different brain regions (Strack, Werth, & Deutsch, 2006). Although these two models are based on the same theoretical assumptions, the Reflective-Impulsive Model focusses on the interaction of these two systems when a consumer is directly confronted with the product. In this sense, this model explains consumer behavior in an offline context without considering the role of Internet information (Strack et al., 2006).

Although many researchers do not explicitly describe a dual-system approach when explaining how consumers process information, many investigations are based on this assumption (Karimi, 2013). There are different termini in the scientific literature that point out differences between two ways of processing product information. For instance, the term category-based processing contrasts with piecemeal-based processing (Fiske & Pavelchak, 1986). The former depicts an effortful processing of product information that requires time and thorough

comparisons, whereas the latter makes reference to the processing of a gist and overall impression of the product based on previous experiences (Sujan, 1985). Similarly, Mantel and Kardes (1999) identify the attribute-based processing which is time consuming, requires the use of specific knowledge, and is effortful and accurate; as well as the attitude-based processing which requires less time and effort, is based on impressions and heuristics, and is mostly inaccurate (Mantel & Kardes, 1999). Furthermore, they suggest that an attribute-based processing is related to high need for cognition. In other words, individuals that are used to engage in thorough and cognitively demanding product comparisons are less impulsive when choosing a product (Mantel & Kardes, 1999; Sujan, 1985). These perspectives share some commonalities with the Schiebener and Brand (2015) model, since they show that there is an effortful way of processing product information similar to the reflective way of processing information. Moreover, there is also a fast way of processing product information based on impressions and fast heuristics, which can be related to the impulsive system.

In this regard, the influence of individual attributes on the decision is one of the most important aspects from a dual-processing perspective. Hence, researchers agree on the fact that higher cognitive abilities are related to more efficient strategies and less time spent when searching for information. For instance, Dutta and Das (2017) argue that consumers with higher education level and more experience on the Internet go through more information sources. Similarly, Monchaux, Amadieu, Chevalier, and Mariné (2015) showed how previous experience about a product improved participants searching performance (Monchaux et al., 2015). The role of experience is also relevant for the search performance of older people, since they are usually outperformed by younger counterparts when searching for new information, but show an improved performance when they have had previous experience with the product (Sanchiz et al., 2017). Other relevant cognitive abilities, such as higher reading skills helped young participants to efficiently select and evaluate information, allowing them to search for more input in less time (Hahnel, Goldhammer, Kröhne, & Naumann, 2018).

Scientific literature on information search and processing in consumer behavior is valuable since it depicts how consumers process marketer-generated information and it shows how cognitive abilities are involved in the search process, while distinguishing between different types of products (experience *versus* search) (De los Santos, 2018; Dutta & Das, 2017; Jun & Park, 2016; Roscoe, Grebitus, O'Brian, Johnson, & Kula, 2016; J. Wang et al., 2018) and systems involved in

the process (Strack et al., 2006). Even though there are some studies that include the role of user-generated content in information acquisition (e.g. Bei, Chen, & Widdows, 2004; Gupta & Harris, 2010; Luan, Yao, Zhao, & Liu, 2016), most of the literature is related to the information shown by product providers. It is well known that marketer-generated content is important for the consumers when looking for a product, however, investigating about the role of user-generated content is indispensable nowadays (Scholz et al., 2018). More about this will be introduced in section 2.3 (*Human-computer interaction*). For now, the next section will deal with the outcome of a decision situation, namely the behavioral consequences of the decisions from a consumer-behavioral perspective.

2.2.2 *Consumer satisfaction and confidence as a decision outcome*

If we take a step back and look into the cognitive tasks that assess decision making, we will notice that many of these tests encompass feedback, which is relevant for making posterior theoretical assumptions of how individuals deal with the outcome of their choices. For instance, in the Iowa Gambling Tasks, participants learn through the feedback which decks of cards are more advantageous even though there is no explicit information about this (see section 2.1.1 - *Decisions under ambiguity and risk*). Based on these findings and further neurobiological studies, researchers have been able to identify the neuronal circuits of feedback related to bodily reactions and rational processes (see section 2.1.1 – *Decisions under ambiguity and risk*). Contrary to this, the purchase outcome is a topic that has been underresearched in consumer behavior (Kamis, Koufaris, & Stern, 2008; Karimi, Holland, & Papamichail, 2018). Studies that deal with how consumers process the outcome of a purchase process focus on consumer satisfaction (Gu, Botti, & Faro, 2013; Karimi et al., 2018) or confidence in the decision-making process (Karimi et al., 2018; Thirumalai & Sinha, 2011; Y. Wang, Lu, & Tan, 2018). This topic is hard to investigate because of the difficulty to assess the outcome of a situation when participants have to make hypothetical choices in an experimental scenario, therefore, questionnaires about consumer satisfaction are normally used (LaTour & Peat, 1979; McKinney, Yoon, & Zahedi, 2002). However, more recent approaches are using mobile applications to manage consumer feedback (Mourtzis et al., 2018) and sentiment analysis (Y. Wang et al., 2018; Xu, 2018) to interpret consumer satisfaction in the current days, which is an interesting topic on which researchers need to keep track.

Consumer satisfaction has been tested with regard to two dimensions: satisfaction with the choice and satisfaction with the process (Karimi et al., 2018). Some findings suggest that cognitive abilities also seem to play a crucial role regarding the behavioral outcome of a purchase situation, since individuals with rational cognitive styles are more thorough when making decisions, which leads to higher satisfaction and more confidence about their choices. On the contrary, individuals who process information superficially are less satisfied and less confident about their outcomes (Karimi et al., 2018). This differentiation also shares some similarities with previous interpretations and findings about how consumers search and process information (section 2.2.2 – *Dual process in consumer decisions*) in a thorough, reflective manner, contrasting to a fast, impulsive manner. Thus, the similarities with the Schiebener and Brand (2015) model are evident, since two similar ways of processing information are also identified.

Many of the references cited in the current section (2.2 – *Decision making in consumer behavior*) are from the 1980s, 1990s, and early 2000s. The presented approaches are important to understand how consumers interact with the product, considering the role of individual attributes, the type of product and how consumers might process product information in two different manners (i.e. dual-system). However, these perspectives do not show much about the role of more recent market venues, like the Internet. Therefore, it is still necessary to understand how the different types of Internet information (marketer-generated *versus* user-generated) influence consumer decision-making.

2.3   Human-computer interaction

One of the main goals of this thesis is to depict the decision-making mechanisms underlying consumer choices in the social media era, in which consumers can base their decisions on opinions of hundreds or thousands of others. As noted by Foxall (2001) it is important to investigate on psychological mechanisms that explain consumer behavior. Therefore, it is also important to understand consumer's decision-making in the current days, when user-generated content is indispensable for making choices (Dhar & Chang, 2009; Flanagin & Metzger, 2013; Flanagin, Metzger, Pure, Markov, & Hartsell, 2014; Ye, Law, Gu, & Chen, 2011). In this sense, it is necessary to make a transition into a discipline that deals with the relation between individuals and new technologies. Precisely, human-computer interaction is "the study of the way in which computer technology influences human work and activities" (Dix, 2009, p. 1327). This implies

that the influence of computer technology, such as review websites with user-generated content, on decision making has to be understood under this theoretical frame as well.

2.3.1   The Elaboration Likelihood Model

Within the modern frame of human-computer interaction, a wave of psychological approaches, such as the Technology Acceptance Model (TAM - F. D. Davis, 1989) or the Theory of Planned Behavior (TPB - Ajzen, 1985) regained importance (Mathieson, 1991; Randolph & Hubona, 2006). By using these models, researchers try to explain how the Internet impacts marketing (Yang & Zhou, 2011), economics (Shin, 2008; Wu & Chen, 2005) and consumer behavior (Klopping & McKinney, 2004). The TAM and the TPB are important approaches, filled with many dimensions rooted in the psychological realm. For instance, the TAM (F. D. Davis, 1989) incorporates elements such as trust, perceived risk, or subjective norm to understand and predict behavior. Similarly, the TPB (Ajzen, 1985, 2002) also includes psychological elements, such as attitude towards the behavior, subjective norm or perceived behavioral control. These elements have become absolutely important to investigate consumer behavior (Awa, Ojiabo, & Emecheta, 2015). These approaches are mentioned, in order to show that there are psychological models that encompass the Internet and purchase behavior. However, these theoretical frameworks are still conveyed on a level that includes broader social, environmental and even historical (introduction of a new technology) aspects, which are outside the scope of this thesis. In this sense, it is necessary to look for models that, similar to the model of Schiebener and Brand (2015), comprehend cognitive aspects.

In this regard, the Elaboration Likelihood Model of persuasion is a model from communication science that explains the process of cognitive change (Petty & Cacioppo, 1986; Petty, Cacioppo, & Schumann, 1983). This dual-system model introduces two main paths in which the information can be processed: the central and the peripheral route. The central route makes reference to a system that involves motivation and cognitive abilities to process information and prove the validity of arguments. On the other hand, the peripheral route involves less effort and is based on peripheral cues such as attractiveness or positive/negative attitudes (Petty & Cacioppo, 1986; Petty et al., 1983). With this model, many researchers have explored which route is mainly used in consumer behavior contexts, such as personalization in advertisement (Ho & Bodoff, 2014; Tam & Ho, 2005); the use of information in social networks for experts (Fadel, Meservy, & Jensen,

2014); selection of physicians (Cao, Duan, & Gan, 2011); the impact of electronic word of mouth and online reviews on consumer decisions (Cheng & Ho, 2015; Cheung, Lee, & Rabjohn, 2008; Gupta & Harris, 2010; Lee, Park, & Han, 2008; Metzger, Flanagin, & Medders, 2010; Park, Lee, & Han, 2007; Sher & Lee, 2009); and marketing (Chu & Kamal, 2008). Interestingly, these articles have a clear tendency towards clustering objective and qualitative reviews, higher motivation, and higher cognitive abilities in the central route, whereas Internet cues, such as ratings, attractive user profiles, numbers of raters supporting a publication, low motivation, and low cognitive abilities are identified as facilitators of the peripheral route.

The Elaboration Likelihood Model has interesting similarities with the decision-making model of Schiebener and Brand (2015), since it depicts two main comparable systems regarding their functioning. The central route shares some features with the reflective system and the peripheral route is similar to the impulsive system. Being this the case, it is possible to make one of the most important assumptions of this work, namely that there is certain type of information on the Internet that is processed by a specific system. Based on the findings using the Elaboration Likelihood Model (Metzger et al., 2010), we could make the assumption that the reflective system (central route) is more focused on objective information, whereas the impulsive system (peripheral route) is related to the processing of subjective information. This statement is fundamental to develop forthcoming discussions on the role of review websites' information in the inner process of decision making. Although it is not easy to make this kind of direct inference with respect to the Schiebener and Brand model (2015) of decisions under objective risk, some arguments will be in favor of ascribing objective and subjective information to the reflective and impulsive system, respectively. This will be explained in more detail in chapter 4 (*Discussion*).

Literature about the Elaboration Likelihood Model has been useful to assess which route process certain kind of information (objective *versus* subjective). Although this model has been used to explain the influence of others on the opinion change of an individual (J. M. Davis & Agrawal, 2018), recent studies have delved further in the topic of social influence, intending to explain why consumers base their decisions on objective or subjective information. Thus, social influence has been recently studied to understand how online reviews affect users' decisions and not only which kind of information corresponds to the central or peripheral route (J. M. Davis & Agrawal, 2018; Sridhar & Srinivasan, 2012; Zhao, Stylianou, & Zheng, 2018). Consumer behavior research has identified three types of social influence when making purchase decisions (Bearden

& Etzel, 1982; Burnkrant & Cousineau, 1975): normative influence, value-expressive influence, and informational influence. The normative influence takes place when individuals are influenced by a person or group with a certain type of authority, in order to get a positive reaction from them. In this sense, the reason to adopt a behavior is the social outcome attached to it, instead of the actual relevance of the content. The value-expressive influence refers to the identification of a person with a certain group, which leads to an influence motivated by the value that the group represents for the person. Informational influence occurs when a person is influenced because the resulting behavior is beneficial and rewarding itself. Our interpretations will include informational influence, since the main goal of choosing a product on the Internet is to get the most benefits from it (Mitra et al., 1999; Stigler, 1961; Y. Wang et al., 2018). In other words, consumers want to acquire the product that brings them more benefits. Moreover, value-expressive influence is also relevant, since consumers might feel identified with online reviewers and make decisions accordingly (J. M. Davis & Agrawal, 2018). Normative influence is not important for the current theoretical background and coming discussions, since consumers do not expect to have a positive reaction from online reviewers (Zhao et al., 2018). These types of social influence will help us develop some interpretations about the role of marketer- and user-generated content when making decisions on the Internet.

Until this point, it has been shown that marketer-generated information can be processed in different ways, due to individual attributes and product characteristics (see section 2.2.1 – *Dual process in consumer behavior*). Furthermore, the Elaboration Likelihood Model showed that both, marketer- and user-generated content can be processed by two routes. In order to understand how the Internet integrates these two types of information, it is necessary to explain some characteristics of the online world, including some theories that will support subsequent discussions.

2.3.2   *User-generated content*

The focus shift from marketer-generated content towards user-generated content started with the rise of the web 2.0 (Riegner, 2007; Shin, 2008; Wirtz, Schilke, & Ullrich, 2010). The term web 2.0 refers to some characteristics of the Internet, which makes it a place where users can co-develop content, by harnessing collective intelligence and by promoting customer self-service, among other principles (O'Reilly, 2009). Since this term started to be commonly used, researchers started to investigate on the importance of user-generated content (Riegner, 2007; Shin, 2008).

After the emergence of the web 2.0, Internet users could voluntarily generate content, contributing with data for informational or entertaining purposes in form of wikis, videos, ratings or product reviews (Krumm, Davies, & Narayanaswami, 2008). According to BrightLocal (2018), 97% of US consumers used the Internet to find a local business. Additionally, 93% of consumers read reviews to check the quality of the business. Precisely, when judging the quality of a business, 54% of consumers consider the average star-rating to be the most important factor, whereas 46% considered the quantity of reviews to be the most important factor. Moreover, 68% reported that a positive review influenced their decision to use a local business. These values alone show the power of user-generated content and its influence in user's decisions (visit BrightLocal, 2018, for appreciating yearly surveys on the subject since 2013).

There is extended and rich work about the role of user-generated content in consumer behavior. Termini like e-commerce or electronic word of mouth are regularly used to explain how the opinions of users affect consumer choices. Ratings and reviews are so important that they even have an impact on sales elasticity, business models, platform design, among other relevant economical factors (Babić Rosario, Sotgiu, De Valck, & Bijmolt, 2016; Floyd, Freling, Alhoqail, Cho, & Freling, 2014; You, Vadakkepatt, & Joshi, 2015). The influence of online reviews and recommendations has been studied in different contexts, for example by investigating how these affect evaluations of physicians' quality (Grabner-Kräuter & Waiguny, 2015), movie recommendations (Flanagin & Metzger, 2013), or recommender systems (Zhu & Huberman, 2014). Furthermore, on a psychological level, several studies have looked at how different psychological dimensions affect consumer behavior. Some models suggest that user-generated content directly predicts consumers' perceived credibility (Jiménez & Mendoza, 2013), perceived usefulness (H. Hong, Xu, Wang, & Fan, 2017; Shan, 2016), perceived risk (Ukpabi & Karjaluoto, 2018), and online purchase intention (Adomavicius, Bockstedt, Curley, & Zhang, 2017; Bahtar & Muda, 2016) of a product. Furthermore, many studies have highlighted that consumer's trust in Internet platforms influences purchase choices (e.g.,Beldad, De Jong, & Steehouder, 2010; Utz, Kerkhof, & van den Bos, 2012). For instance, Filieri, Alguezaui, and McLeay (2015) found that consumers trust user-generated content depending on the quality of the information and on characteristics of the website (e.g., the design). They continue to argue that trust in the platform and in user-generated content leads to recommendation adoption (Filieri et al., 2015).

User-generated content is used by almost everyone to make purchase decisions online. As described above, many studies have identified that reviews and ratings directly affect consumers. Since reviews and ratings have such a high influence on consumer choices, many platforms have "attached" additional information to the reviews that users post online, in order to make the information more trustworthy. More precisely, the warranting principle explains how certain informational cues about a profile on the Internet can increase its credibility.

2.3.3   The warranting principle

It is clear that user-generated content influences consumer's decisions. Yet (un)fortunately, the Internet is a vast, free space where almost anyone can post information which can be malicious or fake. Hence, it is important that consumers are able to identify credible information on the Internet. With the purpose of doing so, many e-commerce platforms have developed trust cues, which are interface elements that help users to determine if user-generated content is trustworthy (Sacha, Senaratne, Kwon, Ellis, & Keim, 2016). Examples for trust cues are the "verified purchase" information, which shows that the user writing the review actually bought the product. Other platforms (e.g., Amazon) give the consumers the opportunity to vote if the review was helpful to make the purchase (e.g., "20 users found this review helpful") (Cao et al., 2011).

Integrating additional cues to the reviews helps consumers to identify credible information (Utz et al., 2012). This statement is supported by the warranting principle. This idea was developed in a time were computer-mediated communication theories were not integrated enough to understand human interactions in the Internet era (Walther & Parks, 2002). The notion of warranting information arises with the need of stablishing a connection between the profile that users encounter online, and the real person behind the screen providing that information. In Walther and Park (2002) words: "In interpersonal interaction in the physical world, it is a commonplace to warrant a relatively stable identity to a physical entity. But in cyberspace, the connection between the self and self-presentation becomes mutable" (Walther & Parks, 2002, p. 551). Therefore, it is necessary to have certain cues that accompany the information provided by the user, which can serve as a warrant that the information and the Internet profile are credible. These cues are usually not easily manipulated by thirds, so "in warranting terms, comments provided to Person B about Person A should be more valuable to B if they come from or are corroborated by another member of A's social network (a testimonial) than if they come from Person A directly (a disclosure)"

(Walther, Van Der Heide, Hamel, & Shulman, 2009, p. 232). The warranting principle is fundamental to understand how helpfulness votes, displaying the number of users rating a product, among other cues, affect the credibility of a product on the Internet. By using the warranting principle as a frame for understanding the credibility of Internet content and the trust that consumers can develop towards an Internet platform, we will be able to draw comparisons between the offline advice-taking process and the behavior of following online recommendations. Since it is hard to establish who is an expert on the Internet, the trust cues could influence the credibility of a product, leading to the adoption of online recommendations. This can be compared to the adoption of advice coming from trustworthy sources, such as experts.

Beyond this, we will also analyze other features that account for the trustworthiness of Internet content. For instance, some studies have found that the writing style of online reviews influences the attitude and purchase intentions of consumers (Furner & Zinko, 2017; Jiménez & Mendoza, 2013; Lin & Lu, 2010; L. Zhang, Wei, & Liu, 2017). Furthermore, some studies manipulated the emotionality of online reviews and have found that emotionally-charged comments are considered less trustworthy when compared to more a factual writing style. (Grabner-Kräuter & Waiguny, 2015; Y. Hong, Huang, Burtch, & Li, 2016). Additionally, gushy language, the use of sensationalist titles and comments filled with superlatives, are considered untrustworthy (Filieri, 2016). In line with these findings, Peng, Yin, Wei, and Zhang (2014) used crawled data from a review website and tested that the intensity of emotions in a review negatively correlates with review helpfulness. They argue that high emotional expression might be perceived as online fraud, as observed in other studies (Banerjee & Chua, 2014). These findings indicate that there are also some features of user-generated content, which are not directly calculable as star-ratings or the number of users rating a product, but that also influence how trustworthy a content is perceived. In this sense, warranting cues or the review's writing style might not only influence credibility, but the actual consumer choice.

3   Research questions and aims

The theoretical background offered an overview of theories, models and evolution of different fields necessary to understand the motivation for the current thesis and to establish the theoretical basis upon discussions will be developed. The first section of chapter 2 started by framing decision making from a cognitive perspective, highlighting the Schiebener and Brand (2015) model of decisions under objective risk. Hence, the questions, answers, and discussions of this thesis will be based on the assumption that individuals process information with two systems which are rooted in different brain areas and that constantly interact with each other. Furthermore, we identified the descriptions as an important factor that determines the way people process information, highlighting that, when calculable information is present in a decision situation, the individuals have the chance to use their cognitive abilities to reflect upon the outcome probabilities and make subsequent decisions.

This thesis proposes that the process of making purchase decisions with the help of Internet information is very similar to a regular, offline advice-taking process (see section 2.1.4 – *Advice taking*). It is clear that the advisor, or in the case of the current thesis, the multiple users that generate information on the Internet, play a fundamental role in this "online" advice-taking process. The descriptions of Internet users about a product or service influence subsequent decisions. As explained before, which system (impulsive or reflective) will be mainly used in the decision-making process, depends, among many other factors, on how specific the information is. Until this point, we can start formulating the first obvious questions about the decision-making process of consumers. For instance: which system (reflective *versus* impulsive) do consumers mainly employ to make decisions? Do executive functions play a role in the way consumers make decisions? Can the offline advice-taking process be compared to following recommendations of other users on the Internet? If this is the case, which system is involved in opinion change, use or discount of recommendations?

In section 2.2 (*Decision making in consumer behavior*), different psychological approaches that tried to grasp the choice behavior of consumers were explored. There are some approaches that, similarly to the model of Schiebener and Brand (2015), differentiated two ways of processing product information: a slow and effortful "system" and a fast and easy "system". Nevertheless, these models and theories explain consumer behavior in an offline context. Subsequent to the rise

of the web 2.0, relevant psychological theories of technology acceptance regained relevance, because they enabled researchers to explain how people adopted the "new", interactive Internet with user-generated content. Yet, these theories include so many psychological, social, and situational factors, that it is difficult to understand the internal cognitive mechanism that supports the decision-making process (Karimi, 2013).

The Elaboration Likelihood Model of persuasion is one of the most pertinent theoretical approaches that explain the influence of reviews and ratings on the consumer's behavior. This model was developed in the field of communication science and gained relevance because with it, researchers could identify a central and peripheral route, which are directly related to the processing of objective and subjective information, respectively. Though, is it really the case that consumers process objective information about a product with a central route (i.e. comparable with the reflective system), whereas other Internet cues and reviews are processed with a peripheral route (i.e. comparable with the impulsive system)? How do consumers process the calculable information present in the trust cues?

All things considered, there is no strong cognitive theory that explains how consumers make purchase decisions online (Karimi, Papamichail, & Holland, 2015). The goal of this thesis is not to develop a new theory of consumer behavior, but to suggest how this mechanism operates based on the theoretical model of Schiebener and Brand (2015). By doing so, we will count with a cognitive explanation of which processes are working internally when an individual (consumer) has to decide which product to buy when using Internet information. Contrasting this, the scientific literature has rather focused on explaining many variables in a purchase situation, including the role of the retailer, the product, the relationship between customer and retailer, credibility, trust, attributes, intentions, knowledge, expectations, etc. All these issues are absolutely important and even necessary in consumer behavior. However, with this large and rich frame, the basic decision-making process has been neglected, in order to account for a larger perspective that misses to explain the basic psychological step of processing information in form of descriptions. The idea is not to miss this explanation anymore, and focus on it for the rest of this work.

This cumulative dissertation consists of three different articles, addressing different hypotheses that will answer the questions raised above. In the first two articles, we used physician-rating websites as an example of how individuals make important health-related choices with help of objective and subjective information. In both, the decision situation consisted in choosing a

physician to visit. Hence, these studies used an experience product to address the decision situation. The third article uses a more traditional consumer behavior approach. The task of the participants was to evaluate reviews for a laptop. Thus, the last article used a search product.

The first article aimed at investigating the role of executive functions and cognitive styles when choosing a physician with support from physician-rating websites. With this work we aimed at answering the question: which individual attributes (i.e. executive functions and cognitive styles) play a role when choosing a physician on the Internet? Furthermore, we also aimed at answering which kind of information (objective, marketer-generated *versus* subjective, user-generated) is more important for users when making decisions. Moreover, we made the first inferences about the system (reflective *versus* impulsive) involved when choosing a physician on the Internet.

The results of the first article showed that participants preferred user-generated information when choosing a physician. Therefore, the second article focused on the influence of online ratings on the probability to visit a physician. We used an advice-taking task in order to answer if the process of receiving and using advice is similar to the use of online recommendations when making decisions. With this task, we were also able to differentiate between objective, marketer-generated and subjective, user-generated information at two different time points in the same trial in order to observe how these influence the decision and the confidence in the decision. Furthermore, we elaborated on the warranting principle of Walther and Parks (2002) and aimed at answering if the Internet cues not only have an effect on credibility, but an influence on the actual decision. Moreover, we were able to make inferences about the role of the impulsive and reflective systems when participants evaluate user-generated content that contains calculable cues.

Finally, the third article dealt with the influence of emotional and factual reviews on consumers. Since there are some features that make online reviews more objective, or at least more rationally interpretable, this article allowed us to make further assumptions about the objectivity of user-generated content and the system that process emotional information. Therefore, we intended to answer the question: how do consumers process emotional and factual reviews? Moreover, this article investigated on the role of trust in Internet platforms when choosing a product online.

As already addressed at different points before, the main goal of this dissertation is to understand the psychological mechanisms of decision making with support of Internet information, which can be characterized as objective, marketer-generated- and subjective, user-

generated content. By achieving a better understanding of this process, it will be possible to elaborate on practical implications of this thesis for users and platform administrators. Furthermore, the results of the three articles and further discussions based on the theoretical background and new literature will support additional interpretations that contribute to the creation of a model of decision making with Internet information. The following questions, raised on a meta-level, will be answered in order to accomplish the goals of this thesis (see Figure 3):

1. How are individual attributes related to the inner processing of objective and subjective information on the Internet?

2. How do user-generated and marketer-generated content influence consumers' purchase decisions?

3. How does the confidence about the decision outcome influence the decision-making inner process?

Figure 3: Relation between articles and research questions
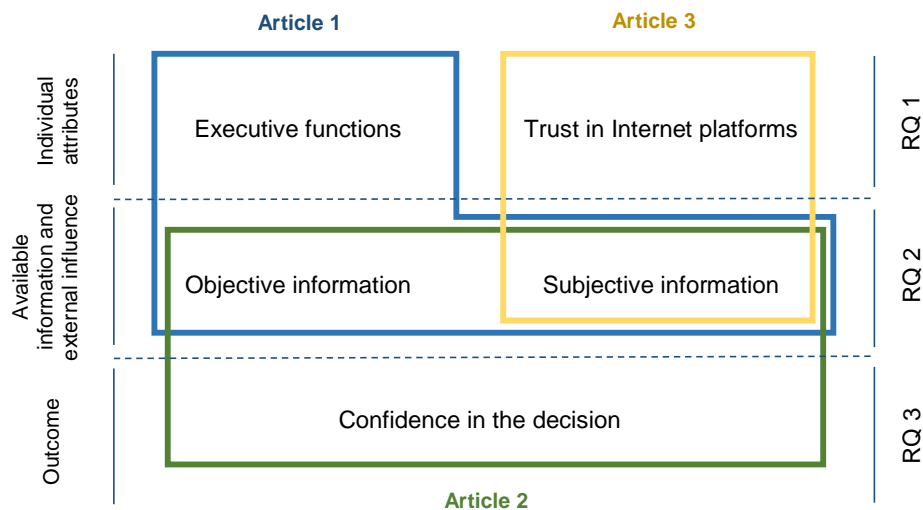
Figure 3. Graphic representation of the formulated research questions and the topics that were addressed by each article.

In order to answer these questions raised on a meta-level, the studies of this dissertation used different methods. A Choice-Based Conjoint analysis was performed in order to assess which information participants preferred when choosing a physician. This method is mainly used in economics and marketing fields to assess which characteristics of a product are relevant in consumer decision-making. Furthermore, we used a Judge-Advisor System which allowed us to

separate objective and subjective information at two different time points in the same trial and to observe how these influence the final decision. This task is mainly used in cognitive psychology and different decision-making fields to assess the influence of advice. Finally, we designed our own experimental scenario to account for the role of emotional and factual reviews, as well as "helpfulness votes" as an Internet cue, in the purchase intention and trust of consumers. Along with these, different questionnaires and tasks measuring executive functions were administered to the participants. We were able to use methods from different disciplines, which allowed us to perform interdisciplinary research that includes features from communication science, human-computer interaction, cognitive psychology, and business psychology.

3.1   Article 1: Choosing a physician on social media: Comments and ratings of users are more important than the qualification of a physician

Review websites provide consumers with descriptions, comments, and ratings from users to facilitate decision making. In this study, we assessed how individuals decided which physician to visit with help of physician-rating websites. These platforms provide users with physician's objective descriptions (e.g., specialty, availability) and also user-generated content, such as reviews and ratings provided by former patients. The available descriptions in a decision situation are fundamental to make subsequent choices (Hertwig & Erev, 2009). Individuals tend to overestimate and overweight the descriptions available to them when making decisions (Erev et al., 2010). In this sense, users are confronted with two types of information: an objective kind of information, which is a description of the characteristics of a physician; and subjective information in form of reviews and ratings from other users. Research in human-computer interaction has shown that user-generated content influences the attitudes and intentions of users (Flanagin & Metzger, 2013; Flanagin et al., 2014). Moreover, executive functions and cognitive styles were shown to play a major role when making decisions in situations with explicit information about possible outcomes (Schiebener et al., 2014; Schiebener et al., 2012; Schiebener et al., 2011), indicating that higher cognitive abilities are mainly related to rational and calculative strategies when making choices.

One of the main goals of this study was to observe whether participants tend to choose objective descriptions (directly related to the physician) or subjective descriptions (provided by other users). We inferred that participants would decide which physician to consult based on the reviews and

ratings of others. However, participants with higher cognitive abilities might use more objective than subjective information. Furthermore, we wanted to investigate how the participants' choices relate to their cognitive abilities and cognitive styles:

H1: Participants prefer subjective descriptions of physician-rating websites (e.g., comments and ratings) over objective descriptions (e.g., specialty and experience).

H2: Participants who prefer objective descriptions of physician-rating websites have higher executive functions in comparison to participants who prefer subjective descriptions.

H3: Participants who prefer objective descriptions of physician-rating websites have rational-oriented cognitive styles, whereas participants who prefer subjective descriptions have more faith in their intuitions.

We conducted a pre-study in order to select six features for a Choice-Based Conjoint design, and to evaluate which features provided by physician-rating websites are considered objective and subjective. Participants considered the reviews, ratings (user-generated), and the last participation at a medical conference as subjective attributes, whereas specialty, experience and availability (marketer-generated) were the most objective attributes when choosing a physician. In the main study, we used a Choice-Based Conjoint design that simulated a physician-rating website. In this task, participants chose one physician among four different options in 20 trials. With this method, we were able to identify the relative impact of the different objective and subjective features offered by review websites on the decision of the participants. Participants also responded to the following tests measuring executive functions: the Modified Card Sorting Test for cognitive flexibility and categorization (H. E. Nelson, 1976); the Color Word Interference Test for interference control and processing speed (Bäumler, 1985; Stroop, 1935); the Trail Making Test-B for inhibitory control and shifting (Reitan, 1958; Reitan & Wolfson, 1995); the 3-back test for working memory (Schoofs, Preuß, & Wolf, 2008); the Game of Dice Task for decision making under risk (Brand, Fujiwara, et al., 2005). Additionally, participants answered the Rational Experiential Inventory that assess rational oriented cognitive styles and faith in intuition (Keller, Bohner, & Erb, 2000).

The first hypothesis was confirmed, since participants significantly preferred the subjective attributes of physician-rating websites. This finding is supported by rich literature that highlights the influence of reviews and ratings on user's intentions (Adomavicius et al., 2017; Flanagin &

Metzger, 2013; Flanagin et al., 2014; Grabner-Kräuter & Waiguny, 2015; Walther, Liang, Ganster, Wohn, & Emington, 2012; Zhu & Huberman, 2014). To test the following hypotheses, we built two groups with a cluster analysis. These groups were categorized as objective- and subjective-oriented in their decisions. We found a significant difference in the Modified Card Sorting Test between the subjective-oriented and the objective-oriented clusters showing that the subjective-oriented cluster had lower executive functioning as measured by higher number of perseverative errors. There were no differences regarding the cognitive styles. We infer that people who make coherent inferences about possible categories, and who additionally are able to flexibly work with these in a complex task (Modified Card Sorting Test), are better able to process and consistently prefer those features that speak for the (objective) quality of a physician. We performed one further analysis in order to identify if previous familiarity with physician-rating websites was related to the preference for objective or subjective information and we found no significant differences.

3.2 Article 2: The use of recommendations on physician rating websites: the number of raters makes the difference when adjusting decisions

People can rely on the advice of those they trust when they want to make decisions. An example of an important decision in life is which physician to trust for consulting. Nowadays, Internet users can find information of physicians on physician-rating websites. Since users are confronted with objective and subjective information about physicians, we draw some parallels between the advice-taking process studied in an offline context and choosing a physician with Internet information. There are some Internet cues that serve as a warranting signal which indicates that some information is more trustworthy than other (see section 2.3.3 - *The warranting principle*). These Internet cues might have an effect on the decision maker, which is similar to the effect shown by individuals when following expert advice. The number of users an Internet profile has, serves as an example of how these Internet cues influence users' decisions (DeAndrea et al., 2015; Flanagin & Metzger, 2013; Grabner-Kräuter & Waiguny, 2015; Rui, 2017; Tong et al., 2008). We aimed at examining how, and to what extent, the number of raters on physician-rating websites influences the likelihood of choosing a physician. We achieved this by using an adapted version of the Judge-Advisor System paradigm (Bonaccio & Dalal, 2006), in which participants had to indicate their likelihood to visit a physician before and after seeing the recommendation of others. At first, participants saw four objective attributes of the physician (i.e. experience, specialty, distance,

availability). Their task was to estimate how likely the would visit that physician based on those attributes. The physicians' characteristics were manipulated and classified into six value-groups, having physicians with lower and higher quality (these values were not presented to the participants). After estimating the first likelihood and answering, in a 10-point Likert scale, how confident they felt about their estimate, participants saw high and low number of recommendations for a physician, and no recommendations (i.e. three conditions). Following this, participants had to give a second estimate about how likely they would visit the physician in question, followed by a second confidence rate. Taking this into account, the current study tested the following five hypotheses:

H1: The participant's first estimate (estimate means the likelihood -in percent- to visit a physician) is based on the physician's characteristics displayed on the physician-rating website.

H2: There is a significant difference between the likelihood of visiting a physician before and after seeing the recommendation for a physician (irrespective of the number of ratings).

H3: There is a significant difference in the likelihood to visit a physician in response to the number of ratings provided for a physician. In other words, the difference between participants' first and second estimate should be higher when the number of ratings for a physician is high.

H4: The second estimate is significantly closer to the recommendation when the number of physician ratings is high.

H5: There is a significant difference in the confidence after the second estimate among the three conditions. Confidence ratings are significantly higher when the number of physician ratings is high.

We found that, before seeing user recommendations, participants reported a higher likelihood to visit physicians with better characteristics, according to the pre-established value-groups. In other words, participants were able to adjust their decisions to the objective features of a physician. However, we observed a significant difference between participants' first and second estimates. This means that the first "objective-like" decision was significantly modified by the recommendation of others. We also found that participants adapted their likelihood to visit a physician according to the recommendation. Additionally, this adaptation between likelihood and recommendation was closer when the number of users rating the physician was high. Similarly,

the analysis of participants' confidence ratings showed that when seeing high number of users recommending a physician, they experience more confidence in their judgment.

The Judge-Advisor System allowed us to assess the influence of raters and their recommendations in the participants' decisions. Thus, the current study allowed us to infer that the cognitive process underlying advice taking might be similar to the one consumers go through when seeing recommendations on the Internet. Furthermore, we observed that consumers are able to correctly calculate which information is more advantageous, yet the user-generated content produced a significant change and led to a higher confidence.

3.3   Article 3: The impact of emotionality and trust cues on the perceived trustworthiness of online reviews

Social interactions and decision making are two of many aspects that are evolving since the appearance of the web 2.0 and its characteristic user-generated content. One of the most relevant examples that combines both aspects is the electronic word of mouth (Hussain et al., 2018). Thanks to e-commerce platforms, users can receive automated recommendations about products and services that might be of interest to them (Ricci, Rokach, & Shapira, 2011). Furthermore, users can also actively intervene in the decision of other online customers, by means of writing reviews and by responding to questions about products or services. We highlight the fact that emotional reviews are considered less trustworthy (see section 2.3.3 - *The warranting principle*). E-commerce platforms can also support users in their decisions by offering certain hints about the trustworthiness of online reviews. These so-called trust cues can be, for example, ratings of a product or "helpfulness votes" of a review (Cao et al., 2011). Studies have shown that these cues have a great influence on the decisions of consumers (Cao et al., 2011; Utz et al., 2012). In this study, we investigate the relation between the writing style (emotional *versus* factual) of a review and its helpfulness, as a trust cue. We used laptops (search product) as an example of an e-purchase.

H1: Factual reviews, compared to emotional reviews, entail a larger purchase intention, and are considered more trustworthy and less fake.

H2: High number of helpfulness votes is considered more trustworthy, less fake, and entails a larger purchase intention when compared to a low number of helpfulness votes.

H3: The relation between participants' institutional-based trust (trust in the Internet) and their perceived trust in high number of helpfulness votes is mediated by the participants' trusting beliefs (trust in online shops).

A pre-study was conducted to assess the emotionality of reviews used in the main study. The main study was conducted online and contained a task, in which participants evaluated online reviews for a laptop, followed by two subscales of the Trust Questionnaire (McKnight, Choudhury, & Kacmar, 2002) to measure trust in e-commerce: Institution-Based Trust and Trusting-Beliefs. In the main task, participants viewed 20 reviews: ten emotional and ten factual. For each one of the five laptops, participants saw two emotional and two factual reviews. Their task was to answer, in a six-point Likert scale, how much they considered the review to be: a) trustworthy; b) fake; and c) how likely it is that they would buy the laptop based on the review. In addition, below each review, there was the number of helpfulness votes, either high (in the range 21-25 votes) or low (in the range 1-5 votes).

We found that participants significantly rated factual reviews as more trustworthy, less fake, and entailing a higher purchase intention when compared to emotional reviews. Regarding the trust cues, we found that the experimental variation (low or high) displayed to the participants represented no significant differences in their responses. Apparently, the writing style seems to be more important than the trust cue. We also found that participants' trust in the online shop (trusting beliefs) mediated the relation between participant's trust in the Internet (institutional-based trust) and their trust in high number of helpfulness votes. We infer that users' trust on relevant cues offered by the platforms depends on how trustworthy the users consider the e-commerce platforms and the Internet to be. We were able to investigate further in different trust stances and how they relate to trust cues. Furthermore, we showed how emotional and factual writing styles of online reviews are related to perceived trust and fakeness, and also how these influence the purchase intention.

4   Discussion

The main goal of this dissertation is to understand the underlying cognitive mechanisms of consumers' decision making on the Internet. In order to achieve this, three studies that measured different cognitive aspects and Internet features were conducted. The three situations utilized for testing the behavior of participants can be addressed as decisions under risk (Schiebener & Brand, 2015). This implies that participants counted with information that allowed them to objectively appraise the outcomes of their decisions (this will be explained in more detail in section 4.3 – *Dual processing of Internet information*). Similarly, this thesis proposes that almost any buying situation on the Internet, which includes the combination of objective, marketer-generated information and subjective, user-generated information can be understood as a decision-making situation under risk conditions. Being this the case, the Schiebener and Brand (2015) model of decisions under objective risk serves as a frame of reference to achieve the main goal of this thesis.

The next sections will deal with the above outlined research questions (see chapter 3 – *Research questions and aims*) in a slightly different order. First, we will explore how objective and subjective information of review websites influence consumer choices. Then we will deal with the role of individual attributes in the decision-making process. Section 4.3 will integrate some of these two aspects, when discussing the results from a dual-system perspective. Next, a discussion about the confidence in the decision process as an outcome will be developed. All these sections are fundamental to present a model of consumer decision-making with Internet information in section 4.5. Finally, some limitations and final conclusions will complete the thesis.

4.1   The role of objective and subjective information

With the first article we aimed at answering what kind of information (objective *versus* subjective) is more important for consumers when making decisions. To start, we performed a pre-study in which participants identified two types of information, namely objective and subjective. When observed in detail, the subjective information depicts user-generated content, such as star-ratings and reviews, whereas objective information included features provided by the platform, such as experience, specialty or availability of a physician. Our main results showed that the subjective, user-generated information was more important than the objective information provided by the platform. This influence of user-generated content on consumer decisions is supported by rich literature (Adomavicius et al., 2017; Bahtar & Muda, 2016; Flanagin & Metzger,

2013; Grabner-Kräuter & Waiguny, 2015; H. Hong et al., 2017; Jiménez & Mendoza, 2013; Shan, 2016; Ukpabi & Karjaluoto, 2018; Zhu & Huberman, 2014). Moreover, this phenomenon is also supported by the fact that a high percentage of consumers check online reviews and ratings prior to purchasing services or products (BrightLocal, 2018). In sum, the findings of the first article show that consumers prefer the subjective information coming from users, instead of objective information about the experience product provided by the platform.

In order to delve further in the difference about objective and subjective information, the second article used these two types of information at two different time points in the same task. Participants used objective information (i.e. experience, specialty, distance, and availability) as a basis for making decisions, and subjective information in form of "advice" or user recommendations, in order to generate a potential opinion change. The recommendations (i.e. subjective information) were experimentally manipulated in order to have different conditions (i.e. high number of users' recommendations, low number of users' recommendations, and no recommendations). Our results showed that the recommendations coming from high number of raters entailed higher confidence, a larger opinion change, and a closer adaptation of the opinion to the recommendations. Similarly, studies in cognitive psychology show how advice provided by experts is more followed and trusted than advice provided by novices (see section 2.1.4 – *Advice taking*). We think that the Judge-Advisor System allowed us to assess the influence of the number of raters on the participants' decisions, similarly to studies in cognitive psychology that also show how experts or many advisors influence decisions (see section 2.1.4 – *Advice taking*). Therefore, we suggest that the cognitive process underlying advice taking might be similar to the process consumers go through when receiving recommendations from other users through the Internet.

It is also important to understand how Internet cues influence not only credibility, as assessed in many studies (DeAndrea et al., 2015; Flanagin & Metzger, 2013; Grabner-Kräuter & Waiguny, 2015; Rui, 2017; Tong et al., 2008), but the actual decision of consumers. The results of the second article showed that participants' confidence ratings were higher in the condition in which high number of raters recommended a physician. This indicates that consumers experience greater confidence in their judgment when there are certain cues that warrant the credibility of the product. With this in mind, we suggest that participants' confidence can be interpreted as another measure of the credibility in the recommendation. This interpretation is in line with some studies that show how users who observe many user-ratings attached to movies (Flanagin & Metzger, 2013),

physicians (Grabner-Kräuter & Waiguny, 2015) or restaurants (Lim & Van Der Heide, 2015) increase their purchase intention, and perceive these products as more credible and positive. Based on these studies and on our results, we infer that the number of reviewers serves as a warranting cue, which not only influences the confidence in the decision, but the actual decision of which physician to visit. In this sense, Internet cues are generated by the subjective appreciations of users, yet they also contain objective information that consumers count on when adjusting their estimations about the likelihood of acquiring a product.

Following on this idea, the third article delved further in the notion that even subjective information provided by users involve objective features that allow consumers to make inferences about possible outcomes. In order to do so, we decided not only to focus on warranting cues, but to follow a more comprehensive approach. We told participants to take for granted that the objective attributes of the laptop they wanted to buy fulfilled their needs and that the price was within budget. With this, we focused on the investigation of written reviews and trust cues without considering the objective information. We found that reviews written with a factual style entailed a higher purchase intention and were considered more trustworthy and less fake than emotional reviews. This indicates that in a scenario involving review websites, having ratings or other type of calculable information is not a precondition to make inferences about the possible outcomes of the decision. As seen in section 2.2.1 (*Dual process in consumer decisions*) certain reading skills also constitute an important individual attribute that allow individuals to efficiently select and evaluate information (see section 4.3 – *Dual processing of Internet information* for further discussion on this topic). In other words, even if online reviews do not contain numbers that allow to make calculations, consumers are able to discern between emotional and factual information and make decisions based on these differences. All this imply, that even subjective information has certain objective features. More about this topic will be discussed in section 4.3 about dual processing of consumer decision-making.

4.2   The role of individual attributes

In the first article we investigated which individual attributes (i.e. executive functions and cognitive styles) play a role when choosing a physician on the Internet. In this regard, we found that cognitive flexibility and categorization were the only executive functions related to the preference of objective features, since participants with fewer perseverative errors on the Modified

Card Sorting Test tended to base their decisions on objective information. This result allowed us to infer that individuals who make coherent inferences about categories, and who are able to flexibly work with these in a complex task, are better able to process and consistently prefer those features that speak for the (objective) quality of a physician.

On the other hand, the cognitive styles did not yield significant differences in the participants' preferences in article 1. Previous findings suggest that higher cognitive abilities are related to better results when searching and processing information (Dutta & Das, 2017; Hahnel et al., 2018; Jun & Park, 2016; Karimi et al., 2018; Mantel & Kardes, 1999; Mitra et al., 1999; Roscoe et al., 2016; J. Wang et al., 2018). This assumption is in line with our findings which suggest that cognitive flexibility is related to the use of objective information on the Internet. Although these results are comparable, we need to look in more detail why cognitive styles play such an important role in other studies (e.g. Dutta & Das, 2017; Hahnel et al., 2018; Jun & Park, 2016; Karimi et al., 2018; Mantel & Kardes, 1999) and not so much for this article. These studies take into consideration cognitive abilities, yet they focus on how participants search and gather information to make subsequent decisions (Dutta & Das, 2017; Hahnel et al., 2018; Jun & Park, 2016; Karimi et al., 2018; Mantel & Kardes, 1999). This means that differences between objective and subjective information were not relevant in these studies. Rather, their results focus on the thoroughness of participants searching behavior, which leads to differences in the information they count with in order to make decisions. In our study (article 1), we did not measure how thorough participants were when looking for information. We rather aimed at showing how individual attributes, such as cognitive abilities determine the preference for the type of information (objective *versus* subjective) consumers see online. This means that, according to our results, cognitive styles do not constitute an individual attribute that determines the preference for objective or subjective information.

Another relevant point regarding the individual attributes is the experience of consumers with the product (Hussain et al., 2018; Karimi et al., 2015; Monchaux et al., 2015). In article 1, we formed two groups of participants based on their familiarity with physician-rating websites and found no significant differences in their preferences for objective or subjective information. We interpreted this result as another confirmation of the influence of user-generated content on consumers, since, regardless of their previous experience with this kind of platform, participants tend to follow the recommendations of other users. Even though there are studies that highlight

the role of experience in the consumer's decisions (Hussain et al., 2018; Monchaux et al., 2015; Sanchiz et al., 2017), a recent study also showed that previous knowledge sometimes does not influence consumers (Zhao et al., 2018). Zhao et al. (2018) argue that "user reviews are mostly about personal experiences of the product and provide case-by-case customized knowledge. They facilitate better understanding of the product performance from various perspectives, so even knowledgeable consumers are open to others' opinions" (p. 26). This explanation is closely related to the nature of decisions based on descriptions and the importance of these in the internal processing of probable outcomes. This topic will be addressed in detail in the coming section 4.3 about the inner process of consumers when making decisions on the Internet.

Along with experience, trust in the system is also a well-studied topic in consumer behavior (Corritore, Kracher, & Wiedenbeck, 2003; Furner & Zinko, 2017; McKnight et al., 2002; Utz et al., 2012). In article 3 was found that trusting beliefs mediated the relation between institution-based trust and trust in high number of helpfulness votes (attached to the online review). This implies that the way consumers perceive user-generated trust cues, will be influenced by the extent to which consumers trust in the system. This explanation is supported by different literature in consumer research (Liang, Choi, & Joppe, 2018; Lin & Lu, 2010) and serves as another example of how individual attributes, such as trust in the Internet, influence the decision-making process.

4.3   Dual processing of Internet information

The above outlined topics about the type of information that users prefer and the individual attributes involved in the decision-making process, allow to make the first inferences about the system (reflective *versus* impulsive) mainly used when choosing a product on the Internet. Based on the Elaboration Likelihood Model, it could be suggested that objective information is processed with the central route, whereas user-generated content is mainly processed via peripheral route (see section 2.3.1 – *The Elaboration Likelihood Model*). The methodology and results of the second article are helpful to argue that this assumption taken from the Elaboration Likelihood Model holds. The three articles show how important user-generated information is. However, the second article displayed objective and subjective information at two different time points within a trial. Thus, article 2 allowed us to assess how consumers process objective and subjective information at different times within the same trial in a task. As can be observed in the design of the Judge-Advisor System, we manipulated the objective information in such a way that the

physicians could be distributed into different value-groups. With this design, we could test that the participants' first estimates corresponded to the value previously assigned in the manipulation. In other words, consumers make decisions according to the objective information provided by review websites. We suggest that consumers are able to recognize the objective information and make decisions that are processed reflectively, which is in line with the findings on the Elaboration Likelihood Model about the central route being responsible for objective information (Metzger et al., 2010). However, when user-generated information was presented, participants' first objective estimates changed significantly. This means that, without user-generated content, consumers are able to choose physicians with the best objective attributes. Then, the influence of user-generated content translates into a significant change of this estimate. According to studies using the Elaboration Likelihood Model as a frame (Cheng & Ho, 2015; Cheung et al., 2008; J. M. Davis & Agrawal, 2018; Gupta & Harris, 2010; Lee et al., 2008; Park et al., 2007; Sher & Lee, 2009), certain Internet cues, such as the number of raters of a product, are usually processed in the peripheral route.

As pointed out in section 4.1 about the role of objective and subjective information on consumer decision-making, there are certain objective features that allow subjective, user-generated content to be processed in a more objective way. This observation is based on the results of the second article which showed that the adaptation of the estimates was closer to the recommendation in the condition with high number of raters, when compared to the condition with low number of raters. Furthermore, the third article showed that a factual writing style is significantly perceived as more trustworthy, less fake and entails a larger purchase intention. We do not suggest that processing warranting cues or identifying emotions in a review necessarily entails an effortful, rational calculation. Most probably, this process functions as a heuristic: the more users rating a product, the more credible the information is (Cheng & Ho, 2015; Flanagin & Metzger, 2013; Walther et al., 2012; Zhao et al., 2018). This heuristic is most probably processed in the impulsive system, since it does not require an effortful consideration of the different aspects of the information (Metzger et al., 2010; H. Zhang, Zhao, & Gupta, 2018). In this sense, in a scenario where a consumer is looking for a product on review websites, the impulsive system might lead the inner process when using heuristics. For instance, consumers might look for products with a star-rating higher than four stars, rather than three stars; or they might look only for a product that was already acquired by many consumers without considering the actual objective features in a reflective

manner. With this heuristic, consumers use simple numerical input of subjective opinions and make subsequent decisions based on a gist that a product is better than others.

Following on this idea, the third article investigated on the emotionality of written reviews and their influence on the inner processes. Since we found that consumers perceive factual reviews as more trustworthy, less fake and that these entail a larger purchase intention, we suggest that even the writing style has certain features that allow consumers to identify advantageous and disadvantageous components when choosing a product. We do not argue that identifying emotional reviews is a task that is processed reflectively. This might depend on certain cognitive abilities, such as reading skills, since these allow users to select the most useful information (Hahnel et al., 2018). However, making a fast differentiation about the helpfulness of a review based on emotional wording or exclamation marks could be more related to a general impression of- or feeling about the trustworthiness of the comment. This feeling or general impression is usually associated with the impulsive system.

Regarding the influence of individual attributes on the inner process of consumers, it is suggested that executive functions are related to the reflective system (Schiebener & Brand, 2015). The results of the first study are in accordance with this assumption, since participants with higher cognitive flexibility and categorization preferred objective attributes of a physician, rather than the subjective information. However, other relevant individual attributes, such as cognitive styles or experience did not play a major role according to our results. In other words, there are certain individual attributes that influence the system that is used when processing information. Yet, the influence of user-generated information on consumers' choices is so determinant, that it apparently undermines the role of individual attributes. Thus, the process of choosing a product on review websites might be mainly guided by the impulsive system. If this is the case, it is necessary to find suitable explanations of why user-generated content is so influential for consumers.

The nature of decisions based on descriptions is one of the explanations of why user-generated content is so influential. Objective information is concrete and does not allow interpretations. If consumers look for an experience product, namely a physician, the fact that the physician is a cardiologist cannot be objected or changed. If consumers are looking for a search product, namely a laptop, the different features of it are stable among all the different versions. For instance, a RAM of 8.00 GB or a 20 cm screen are features that are equal for every laptop with these characteristics. The thing that sets the comparable laptops apart is the experience that other consumers have had

with it. Therefore, user reviews are a feature that allow consumers to assess the quality of a product supported by actual experiences with it. Contrary to the quality that can be assessed with the objective information which might be identical among different options. Online reviews facilitate the understanding of the product performance, and this valuable information might be more relevant than previous knowledge about the product or other cognitive abilities (Zhao et al., 2018). For instance, if an expert on digital cameras checks different options on a review website, she or he might pay attention to the objective descriptions, but will also look for relevant information about the experience of others with the camera. Therefore, even though she or he knows a lot about the product, the reviews of others are helpful to identify other important features, such as performance after constant use or simply a general good or bad experience based subjective opinions. These descriptions might be overestimated and therefore more important than previous experience, as observed in the results of the first article, or in Zhao et al. (2018).

Another explanation about the influence of user-generated content is related to the different types of social influence that might be present in a decision-making process that involves users and marketers. As seen in section 2.3.1 (*The Elaboration Likelihood Model*) the value-expressive and the informational influence might be present when making purchase decisions. Studies that tried to test the social influence of online reviews used the perceived review quality (Zhao et al., 2018), usefulness of a review (Cheng & Ho, 2015), or behavioral intention (Z. K. Zhang, Lee, & Zhao, 2010) as a dependent variable. Instead of this, article 2 used the Weight of Recommendation index, which quantifies the influence of ratings on the actual behavior, whereas in the third article, participants were asked about their purchase intention, using the same variable as in Z. K. Zhang et al. (2010). Studies have used different methodological approaches with certain limitations, such as the use questionnaires about previous experience (Z. K. Zhang et al., 2010), the use of crawled data that needed to be coded in order to identify the variables (Cheng & Ho, 2015) and the implementation of an experimental design that did not control for the objective information and how this influenced the final decision (Zhao et al., 2018). Contrary to this, in article 2, we controlled that objective and subjective information would be assessed at different time points in the same trial. In article 3, we worked solely with the subjective information in form of online reviews to concentrate on how these influence perceived trustworthiness and purchase intentions. These comparisons are relevant at this point, because they show that it is unclear how to assess the social influence of online reviews and find the reasons as to why these are so relevant for

consumers. Our intention is not to imply that our methodology is the right one, but it is definitely a pertinent one to assess decision making from a cognitive perspective while including social aspects of opinion change. Using social influence is a relatively new approach when explaining the role of online reviews, therefore the factors that play a role on this process are still being investigated.

Despite the differences in methodology, the results of this dissertation and of the above mentioned studies (Cheng & Ho, 2015; Z. K. Zhang et al., 2010; Zhao et al., 2018) lead to an akin interpretation of the data: aggregated opinions in form of ratings have a social influence effect on consumers. Similarly to the results found in the advice-taking area, it seems that aggregated opinions of different advisors are trustworthy since possible errors and biases of the advice are avoided (Budescu & Rantilla, 2000; Budescu, Rantilla, Yu, & Karelitz, 2003; Harvey et al., 2000; Rantilla, 2000; Yaniv, 1997). Studies in the field of human-computer interaction have also arrived to similar conclusions, by stating that information coming from many reviewers is considered more credible (DeAndrea et al., 2015; Flanagin & Metzger, 2013; Grabner-Kräuter & Waiguny, 2015; Rui, 2017; Tong et al., 2008).

In the first place, it could be inferred that the value-expressive influence is represented in this process, since consumers might feel identified with the good or bad experience of the reviewers, which leads to the adoption of their recommendations. Reviews and ratings of review websites show consumers how others relate to the product they intend to acquire. In this sense, the high social presence of accumulated reviews and ratings might facilitate the identification with online reviewers (Zhao et al., 2018). In this context, Zhao et al. (2018) argue that accumulated opinions of reviewers facilitates the development of trust, even if these are unknown to the customer. This is in line with article 3, which found that trust in a high number of helpfulness votes (i.e. Internet-cues) depends on how trustworthy consumers perceive e-commerce platforms and the Internet (e.g. Beldad et al., 2010; Filieri et al., 2015; Utz et al., 2012). Thus, the identification of consumers with the subjective experiences of others, as well as their trust in the Internet cues, might trigger the impulsive system. In other words, it can be inferred that user-generated content generates value-expressive influence, since consumers identify with the experience of other users. This influence might be even larger with the presence of warranting cues, such as the accumulated ratings of users, which are processed with heuristics. All this imply that the value-expressive influence is closely related to the functioning of the impulsive system.

On the other hand, informational influence might be related to the impact of objective information in the decision. Since consumers are able to adequately assess which product features are more convenient for them based on objective descriptions (article 2), we infer that marketer-generated content facilitates informational influence on consumers. Informational influence refers to the actual benefit for individuals after making use of the provided information (see section 2.3.1 – *The Elaboration Likelihood Model*). In this sense, when consumers identify which features are more convenient and make decisions accordingly, they might be influenced by the actual information and the benefits these entail. This does not mean that user-generated content cannot be the base for informational influence. Consumers might find the information of users so helpful that they follow their recommendation because of the benefits that the information brings to them. Still, it is also possible that user-generated content is more related to the value-expressive influence, since consumers apprize this information based on the subjective experiences of others and not on the information itself, which is perhaps more complete and thorough in the marketer description.

Consumers might be influenced by the objective information provided by the platform and by the opinions of other consumers that experienced a similar situation. Based on the interpretations about the overestimation of user-generated information, and the involvement of trust in the process, we infer that consumers might be more influenced by the users (value-expressive influence) and therefore use more the impulsive system when comparing different types of information on review websites. User-generated content is very influential, therefore, the identification with others (i.e. value-expressive influence) might have a higher impact on the final decision. In relation to this, the overestimation of numerical input in form of Internet cues, as well as consumers' trust in online platforms and in user-generated content might also increase value-expressive influence. These results are speculative at this point, since there were no variables measuring social influence on the articles, yet this explanation seems to fit into our understanding of consumer decision-making with support of Internet information.

4.4   Outcome: confidence in the decision

As mentioned in section 2.2.2 (*Consumer satisfaction and confidence as a decision outcome*), the outcome of a purchase situation has not been extensively investigated (Kamis et al., 2008; Karimi et al., 2018). One possible explanation of this, is the difficulty of adequately

operationalizing the variables that assess the consequences of participants' choices. For instance, in order to measure the behavioral consequences of choosing a certain physician or a laptop, we could let the participants go to the physician they chose or let them work with a laptop they bought. Afterwards, participants could report if they were satisfied with their experiences and with the decision-making process. Since this is just impossible to do in a controlled experimental scenario, many researchers use questionnaires to assess user satisfaction and thus investigate on this topic (LaTour & Peat, 1979; McKinney et al., 2002). The main variable among the three studies that grasps the concept of behavioral consequences is tested in the second article as a confidence rating. Other studies have also used confidence in the decision to account for the satisfaction with the decision-making process (Karimi et al., 2018; Thirumalai & Sinha, 2011; Y. Wang et al., 2018). In our study, higher confidence ratings were reported after participants used the recommendations of other users. The experimental manipulation showed that high number of raters entails higher confidence in the decision. In the case in which no recommendation was shown the confidence rating was significantly lower.

According to some studies in the field of neuroscience, confidence in the decision can also be understood as a positive reward consequent to making the right decision (Deco, Rolls, Albantakis, & Romo, 2013; Kepecs, Uchida, Zariwala, & Mainen, 2008). This field has engaged in the topic of advice taking with remarkable outcomes. For instance, in an functional magnetic resonance imaging (fMRI) study, Meshi et al. (2012) used a version of the Judge-Advisor System in which participants had to guess the price of apartments in New York before and after receiving advices from experts and novices on real estate. The results showed that participants valued and used more the advice from experts, and that reward sensitive areas (ventral striatum and frontal areas) were more active when participants saw that advice was coming from an expert, even before they saw the actual advice (Meshi et al., 2012). With these results we can imply that, on a neuronal level, people tend to anticipate a reward when receiving advice from a trustworthy person. Similarly, Schilbach and colleagues (2013) also used the Judge-Advisor System to test the change in the opinion of participants in a fMRI-scanner and found differences in the way information is processed when the advice comes from an expert or from a novice (Schilbach, Eickhoff, Schultze, Mojzisch, & Vogeley, 2013).

These findings are important because they show that high confidence might be similar to processing rewards when making decisions. In section 2.1.1 (*Decisions under ambiguity and risk*)

was mentioned that individuals learn to choose advantageous options after repeatedly receiving feedback in a decision-making task. This allows the development of a somatic marker, which integrate the bodily reactions connected to previous responses with subsequent similar decisions (Bechara & Damasio, 2005; Damasio et al., 1991). This happens in the impulsive system, which, as explored until this moment, might be the most important system when making decisions supported with user-generated content. Thus, we infer that consumers make choices based on subjective information, not only because of the overestimation of warranting cues or the role of social influence. Consumers might also base decisions on user-generated content because it entails a reward-like reaction on the brain, comparable to a feeling of confidence.

4.5   Model of consumer decision-making with Internet information

The model of consumer decision-making with Internet information is an adapted version of the Schiebener and Brand (2015) model. The current model summarizes the different findings of the three articles and integrates interpretations based on the literature search of this dissertation. It is important to note that it is rather artificial to separate the different factors and steps of a decision-making process. In reality, the aspects of a decision process do not necessarily occur in a rigid sequence. This division of the different steps in the process is helpful to have a theoretical understanding of the variables involved. This is why this model differs from the graphic representation of Schiebener and Brand (2015) shown in Figure 2, in which the individual attributes, the information, and the external influences were presented as part of the input. The current model is applied to an online context, showing results of the three articles and discussions based on different theoretical approaches, therefore, accommodating the three influential aspects of the Schiebener and Brand (2015) model along the input and the inner process, does not necessarily constitute a change in the way that the original model is perceived, but a different way of depicting a process which steps are intrinsically related to each other, yet are artificially divided for theoretical purposes.

The model starts out by depicting the objective and subjective information of review websites. With the results of the three articles and the discussions on the Elaboration Likelihood Model, we suggest that the marketer-generated information is related to the reflective system and the user-generated information to the impulsive system. The functioning of the reflective system depends on cognitive flexibility (article 1) and on the ability to process objective information (article 2).

The impulsive system is related to the fast an effortless processing of Internet cues and review's writing styles. This is based on the results of articles 2 and 3, on discussions about the processing of descriptions (Hertwig & Erev, 2009), and on some authors (e.g. Metzger et al., 2010) who also suggest that such cues are processed with fast heuristics. Which system leads the processing of information might depend on the type of social influence present in the process. We suggest that the value-expressive influence is mainly related to user-generated content and that the informational influence is related to the marketer-generated content. Apparently, the influence of other consumers and their experience with a product is stronger that the influence of the objective information. After evaluating the different types of information and options a decision is made. This decision is related to a confidence in the process. We infer that high confidence might be related to a reward-like reaction on the brain, which influences again the impulsive system. Based on the results of the articles and on the discussions, we were not able to find a possible relation between the confidence in the decision and its influence on the reflective system.

Figure 4: Model of consumer decision-making with Internet information
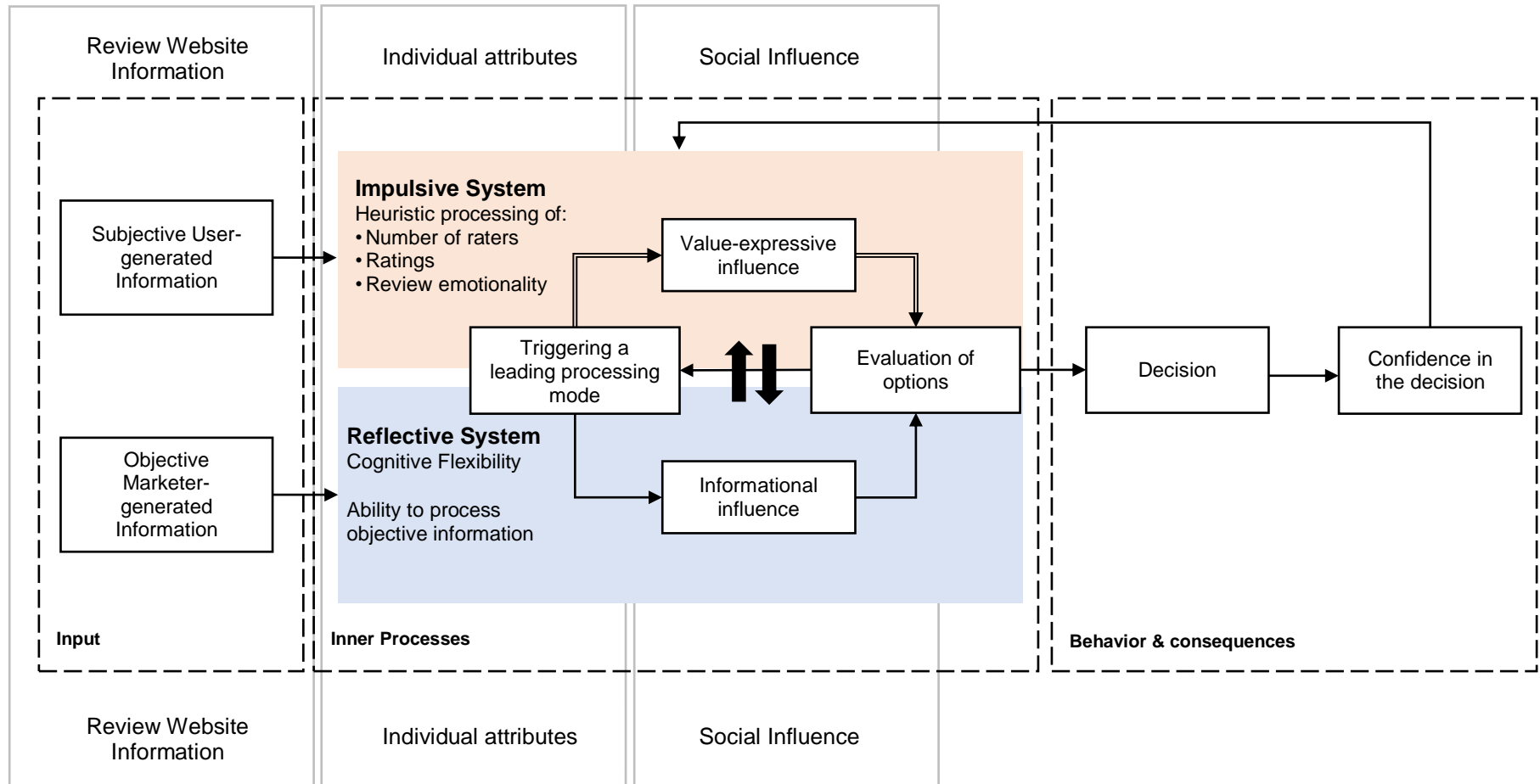

Figure 4. The model of consumer decision making with Internet information depicts how internal and external attributes play a role when making decisions with objective and subjective information on review websites.

4.6   Practical implications

The results of the three articles and the clarifications that this thesis provides to the decision-making process of consumers using online information can be used to suggest possible practical applications for users and review websites' administrators. For instance, platform administrators could show the consumers which attributes of a product are trend among user reviews. For example, many users might be frequently commenting a special feature of a product which is extremely important for the consumer. Identifying this type of information can be very helpful for consumers when making decisions. With this in mind, web-designers and platform administrators can benefit from Natural Language Processing to exploit user-generated content that consumers can use to their benefit. Furthermore, sentiment analysis can help identify positive or negative comments of a product attribute, which are helpful for the consumer (Feuerbach, Loepp, Barbu, & Ziegler, 2017). In this sense, a customer of a review website can identify not only which features are being reviewed, but also if these are perceived as positive or negative.

Moreover, these platforms can promote a well-use of the reviewing tools that facilitates decision making. For instance, online reviews that tell a story are useful for consumers (Gretzel, 2006; Gruen, Rauch, Redpath, & Ruettinger, 2002). This is especially the case for the physician-rating websites, since usually, online reviews of patients are formulated as a short story that includes information about the problem or illness; the experience of visiting the physician; and the outcome (e.g., improvement of health). If patients are encouraged to write reviews with details about their experience, including objective information and subjective valuation, new potential patients can use this factual-oriented information to make better decisions.

Different Internet cues proved to be important throughout the three studies. These cues provide the users with the opportunity to make fast and effortless inferences about the product, influencing their final decision (article 1 and article 2) and their purchase intention (article 3). Based on these findings, it is suggested that platforms make use of these cues, in order to facilitate the decision-making process of users. This, however, is a common feature of almost every review website, since probably of all them use Internet cues to help users with their decisions. Therefore, it is suggested that administrators carefully control these trust cues. Since these are used as easy heuristics that allow users to make fast choices, Internet platforms need to ensure that these correspond to customers who actually have had an experience with the product. In other words, review websites

need to ensure that all their cues are transparent and belong to the reviewers that purchased the product in order to avoid disclosing fake information.

In recent years the discussion about fake reviews has been gaining major importance (Luca & Zervas, 2016). In the second article, we argued that physicians are worried about the reviews that alleged patients post on their profiles, since these might be misleading (Daskivich et al., 2018; Patel, Cain, Neailey, & Hooberman, 2015). Our results confirmed that these worries are not banal, since the number of raters influences decisions, even after having made an objective evaluation of the physician. The risk of having malicious, fake reviews on these platforms is high for users and for physicians as well. The same applies for other marketers because their image might be compromised. The third study showed that emotional reviews are considered as fake, when compared to factual reviews. We argue that reading factual reviews is processed as a fast heuristic which implies that these kind of reviews are more trustworthy when compared to emotional buzzwords. However, there is more than that when dealing with fake reviews. Warranting cues and different trust cues generated by the platforms are developed to help consumers and also to avoid fake reviews. Therefore, it is important to continue with these efforts in two ways: firstly, use the warranting cues as a tool for users to filter information and correctly identify users who had previous experience with the product. Secondly, platform administrators must certify that the reviews, ratings and further cues are trustworthy. This is a difficult task for many types of review websites. For instance, how can physician-rating websites' users know that the review comes from a real patient? How can these platforms manage an online reviewing process that unequivocally shows that a review was written by the patient of a certain physician? What role do health insurance companies play in the process? These are some of the issues that platform administrators need to deal with in order to bring transparency and to facilitate the decision-making process of users.

4.7   Limitations

There are some limitations of this thesis, which are centered on a meta-level and the reach of the theoretical implications and conclusions already described. Decision making is a broad field, studied in multiple disciplines and understood under different perspectives. This thesis intended to bring together two perspectives, by trying to outline the specifics of purchase behavior into a cognitive decision-making model of decisions under risk conditions. Although we were able to

understand how consumers process different kinds of information on the Internet, we are also aware of the fact that there are other relevant topics that were beyond the scope of this dissertation.

For instance, scholars in the topic of e-commerce have identified the large information load of the Internet as barrier that in some cases frustrates the identification of information (Gao, Zhang, Wang, & Ba, 2012; Krumm et al., 2008; Wheeler & Arunachalam, 2009; H. Zhang et al., 2018). This idea is rooted in cognitive psychology, with the classical work of George Miller about the limited (7 +/- 2 chunks of information) memory capacity (Miller, 1956). Researchers in computer-mediated communication and human-computer interaction have found that Internet cues and filter options help consumers to process the large amount of information of review websites (Groissberger & Riedl, 2017). This topic is interesting and quite relevant for both, cognitive and consumer behavior research, nevertheless it was not part of the scope of the three articles of this dissertation.

Along with this, it is also relevant to note that although the results about the individual attributes affecting the processing of information are in line with previous research, these were not as strong as expected. In the first article we only found that cognitive flexibility and categorization influenced participants' decisions. In the other articles, measurements of executive functions, personality or cognitive styles were not reported, yet they were actually performed during the experiments. We decided not to report many of these variables because they did not yield results that were worth showing in a scientific publication. Individual attributes are indeed relevant when making decisions; why did these not play such an important role when analyzing our results? Some possible answers were elaborated in section 4.2 (*The role of individual attributes*), however more research is needed in this area.

4.8   Final conclusions and future research

User-generated content is the most influential type of information for users, even more so than objective information about the product. This statement is perhaps the most important finding from the three articles of this dissertation and it is supported by the literature in human-computer interaction and in line with ideas from cognitive psychology. We focused on reviews (article 1 and article 3) and on different Internet cues, like ratings (article 1), numbers of users recommending a product (article 2), and helpfulness votes (article 3). Regarding the reviews, our findings reveal

that these are the most important user-generated information (article 1 and article 3). Furthermore, we found that factual reviews provide a better support to the users.

The model of consumer decision-making with Internet information presented in this dissertation is based on the findings of the three articles and on discussions that helped to explain how consumers make decisions on the Internet. Since the current model is based on the Schiebener and Brand (2015) model which has a strong neuropsychological focus, it is important to keep investigating in the neuronal mechanisms underlying the decision-making process with Internet information, as well as other social factors that might play a role when processing subjective opinions of other consumers when making decisions.

With the intention to investigate on this, the authors of article 2 used the above mentioned Judge-Advisor System in a fMRI setting in order to account for the influence of online recommendations on a brain level. The task presented some minor modifications in relation to the task of article 2. For instance, there was no confidence rating; there was no control condition (condition with no recommendations); and there were minor variations in the information display, since the task had to be adapted to a fMRI study. Until this point, only preliminary results can be reported, since we are currently analyzing the functional images for an upcoming manuscript. The behavioral results of this study are in line with article 2. With a much smaller sample (24 participants) we found significant differences in opinion change and in the Weight of Recommendation index, showing that participants adapted their opinions closer to the recommendations in the condition with high number of raters, when compared to low number of raters. Regarding the results on a neuronal level, we can report that there are no significant differences when contrasting the images of the high condition when compared to the low condition. This indicates that participants presented similar activation patterns when they observed that the recommendation was coming from high and low number of raters. When analyzing the activation in those conditions alone, we notice that both conditions present activation in frontal areas, which are related to executive functions and calculation. Especially, the high condition presents activation in the left middle temporal gyrus, which is related to the processing of social information, such as intentions, and mentalizing (e.g. Atique, Erb, Gharabaghi, Grodd, & Anders, 2011). Even though these results are just preliminary, it is important to highlight that relevant research in the field is currently ongoing. By analyzing these results, we will be able to observe

the relation between the activation patterns in these conditions and brain areas related to different processes, such as reward expectation, calculation, and mentalizing.

Perhaps the results of the functional brain images will also shed light on the role of the decision outcome for both conditions. With the studies of this dissertation, we were not able to provide concrete interpretations about the role of the confidence as a decision outcome with respect to the reflective system. As explained in different part of the thesis, our tasks dealt with decisions based on descriptions. This type of decision scenario usually does not provide feedback. We made interpretations about how, on a brain level, confidence can be understood as a rewarding feeling after following advice, which can increase the likelihood of basing decisions on subjective, user-generated information. However, nothing can be claimed about the relation between objective features and confidence, or feedback processing. Future studies could design experimental scenarios that include feedback in consumer situations in order to provide clear conclusions about how individuals integrate feedback when making decisions online.

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