Behavioral Effects in Consumer Evaluations of Recommendation Systems

Behavioral Effects in Consumer Evaluations of Recommendation Systems

Gedrag effecten in de wijze waarop consumenten online aanbevelingssystemen evalueren

Thesis

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Erasmus University Rotterdam

Doctoral Committee

Promotor(s): Prof. dr. ir. B.G.C. Dellaert
Prof. dr. T. Li

Other members: Prof. dr. B. Donkers
Prof. dr. ir. E. van Heck
Dr. ir. M.C. Willemsen

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Rotterdam, April 2018

Το μυαλό δεν είναι ένα δοχείο που πρέπει να γεμίσει, αλλά μια φωτιά που πρέπει να ανάψει

The mind is not a container that must be filled, but a fire that needs to be ignited
Plutarch (45 – 127 AD)

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1

Introduction

The rapid evolution of information technology in the past couple of decades has exponentially increased the number of products that consumers can view and purchase online. Every minute that passes, generates over $222.283 in online sales for Amazon. In 2015, $1.7 bn was spent in e-commerce websites, a figure which is projected to increase to $2.3 bn by 2018 (Statista, 2016). Whereas this impressive boom in product availability has the potential to improve consumers' decisions, it also is well known that consumers are inherently limited when it comes to how much information they can search through, assimilate and process (Murray & Haubl, 2011). Information Systems scholars have identified this phenomenon as being a source of virtue (variety of options) and menace (information overload) and, as such, have proposed the use of electronic decision aids[1] as a solution to this paradox (Chiasson et al., 2002; Hanani et al., 2001; Swaminathan, 2003).

Research in psychology, economics and decision-making has also demonstrated a similar conflict between greater choice and complexity. On the one hand, there are clear benefits in having the freedom to choose. Being able to choose freely between alternatives has been shown to increase intrinsic motivation, task performance, decision-making and ultimately life satisfaction (Deci, 1976; Deci & Ryan, 1985; Glass & Singer, 1972;

1 The terms "Decision Aids" and "Recommendation Agents" are treated as having equal meaning in this dissertation. In essence, RAs are Decision Aids for consumers. Our studies focused on consumer decisions and it is suggested that findings from Decision Aids literature applies to RAs as well. The opposite might not be true.

Taylor, 1989; Taylor & Brown, 1988; De Carlo & Agarwal, 1999). However, this phenomenon comes with some adverse consequences; the decision-maker ends up being confronted with an overwhelming set of alternatives that prevents him from making optimal decisions. Miller (1956) was one of the first to identify the adverse effects of too much information on decision-making. According to his view, our short-term memory can handle no more than approximately seven items at a time. When relevant information exceeds this number, people become confused and are likely to make poorer rather than better decisions. Later, researchers refined the relationship between choice complexity and decision-making quality by highlighting the role of heuristics as a way to balance decision outcome quality and decision effort (e.g., Payne, Bettman, & Johnson, 1993).

Far more recently, research on consumer behavior has addressed the choice overload hypothesis, and investigated if an increase in the number of options to choose from may lead to choice deferral (e.g., Scheibehenne, Greifeneder & Todd, 2010; Iyengar & Lepper, 2000; Chernev, 2003; Iyengar, Jiang, & Huberman, 2004). The findings suggest that an IT-enabled overabundance of information and choice alternatives can decrease decision quality, as well as increase the number of consumers delaying or deferring choices (Iyengar, Huberman, & Jiang 2004; Iyengar & Lepper, 2000; Willemsen et al. 2016). Unfortunately, decision avoidance often works against individuals' goals. Delays transform into lost opportunities, and adhering to the status quo is frequently suboptimal, especially in the presence of advantageous alternatives (Anderson, 2003). Adverse consequences for the consumer also include a decrease in decision satisfaction, an increase in preference uncertainty (Chernev, 2003b; Iyengar & Lepper, 2000), and in negative emotions, including disappointment and regret (Schwartz, 2000). Ultimately, this phenomenon can create the Paradox of Choice, because while individuals are often attracted by variety, an excess of options to choose from may lead to a society of stressed out and unsatisfied customers (Schwartz, 2004).

Fortunately, one promising response to the ever-increasing search and decision challenges that information technology imposes on individuals comes from the technology itself. In particular, it allows for the develop-

ment of online decision aids that support decision makers, and more specifically consumers, in dealing with complex decisions (e.g. Benbasat & Wang, 2005; Qiu & Benbasat, 2009; see Xiao & Benbasat, 2014 for a recent review). Online decision aids (DAs) are software tools that have the aim of improving the quality of the decisions individuals make while simultaneously reducing the effort required to make those decisions (Haübl & Trifts, 2000). Prior consumer research has demonstrated that such tools for assisting consumer decision-making — typically called Recommendation Agents (Haubl & Murray, 2003) — can be very effective when consumers decide to use them, and when the tools have the opportunity to sufficiently learn about the individual consumer's preferences (Diehl, Kornish, & Lynch, 2003; Häubl & Trifts, 2000; Senecal & Nantel, 2004; Urban & Hauser, 2004).

The legacy of recommendation agent research can be traced back to Decision Support Systems (DSS) as DSSs has been a paradigm in IS research almost from the very conception of the IS field (Power, 2002). In fact, the ubiquitous nature of decision support — from aiding online movie choices and directing consumers buy products to business intelligence tools — provides a wealth of research areas. As such, a number of reference disciplines have emerged examining (DSS), "Interactive computer-based systems to help decision makers use data and models to solve unstructured problems" (Sprague and Carlson, 1982). Discipline diversity gave rise to differences in terminology as well. Consumer researchers that study DSS that assist consumer decisions refer to these systems as "decision aids", certain IS scholars name the "Recommendation Agents" whereas investigators in the human-computer interaction field study "Recommender Systems", "web technologies that pro-actively suggests items of interest to users based on their objective behavior or their explicitly stated preferences" (Pu, Chen & Hu, 2012, p.1). RA literature which is also the primary focus of this thesis has evolved the past 3 decades around two questions: "How do RA use, RA characteristics, and other factors influence consumer decision-making processes and outcomes?" and "How do RA use, RA characteristics, and other factors influence users' evaluations of RAs?" (for a review see Xiao & Benbasat, 2014). HCI researchers have focused on the accuracy of recommendation algorithms (e.g. Herlocker, 2004; Sarwar et al. 2002) whereas the they

have also recognized that superior algorithm performance is not enough for users to be satisfied and willing to use RAs (McNee, Rield & Konstan, 2006). Studies on RA design have been looking into different preference elicitation methods, recommendation presentation, diversity and context (for a review see Pu et al. 2012).

Independently of the reference discipline, RAs can be classified into collaborative filtering (CF) and content filtering (CB). Content filtering RAs generate recommendations based on product attributes the consumer likes; collaborative filtering RAs mimic "word-of-mouth" recommendations and use the opinions of like-minded people to generate recommendations. Xiao and Benbasat (2007) provide a review of the RA literature which also identifies hybrid RAs which integrate content filtering and collaborative filtering methods in generating recommendations. Content filtering RAs can be further classified into compensatory or non-compensatory. Compensatory RAs allow trade-offs between attributes. All attributes simultaneously contribute to computation of a preference value; non-compensatory RAs do not consider trade-offs between attributes. This dissertation studies content-filtering RA with either compensatory or non-compensatory properties. The experimental studies that follow allow us to discover differences in their evaluation and use.

Despite the scholarly attention, reflecting also their potential value, the adoption of RAs by consumers in real-world complex decisions is not at the level one would expect given their benefits for decision-making (Sieck & Arkes, 2005; Breugelmans et al., 2012). Consumers seem to exhibit strong tendencies to use established routines of searching and are reluctant to change them (Johnson, Bellman, and Lohse 2003; Ratchford, Talukdar, & Lee, 2007). In addition, due to the power law of practice, which states that practice improves individuals' proficiency in a task by becoming more efficient in a familiar environment (Johnson et al. 2003), consumers can become locked into a particular behavior (Bhatnagar & Ghose, 2004; Murray & Häubl, 2007), although a new action might be easier to use and generate better results. Such behavior can also include the use of information technology.

In an otherwise technology-driven world, there are plenty of cases

where information technology (IT) innovations do not have a satisfactory outcome. Million-dollar investments in IT have failed to deliver value due to a variety of reasons which have drawn the attention of the scientific community. Scholars in this area propose that one of the main factors hindering the success of IT is the lack of user willingness to actually use the respective information technology (e.g. Upton & Staats, 2008; Malhotra & Galleta, 2004; Martinko et al., 1996). Davis (1986) suggests that although actual performance gains are the desired outcome from the use of new information systems. These gains will not be obtained when users fail to adopt the new system.

Mobile and Internet-enabled communication services are an integral part of everyday life and subsequently of increased economic and business interest. Thus, understanding how companies interact with their customers through electronic commerce is of imperative importance (Parasuraman & Zinkhan, 2002). Despite the attractiveness and capabilities of modern technology, only a small fraction of new products ideas is commercially successful, as consumers' resistance to trying new products is considered a significant obstacle for most companies that attempt to introduce them (Oreg, 2003).

The question, then, is how we can still nudge consumers towards using recommendation agents. Which are the specific technology characteristics that stir consumers towards recommendation agent acceptance? Researchers have been studying the general factors that lead to technology adoption and use since the mid-1970s (Compeau & Higgins, 1995). In 1994, Markus and Keil still wondered, "Why are some information systems that companies have invested millions of dollars in developing never used or avoided by the very people who are intended to use them?" More recently, various studies (e.g. Venkatesh et al., 2003; van der Heijden, 2004; Kim & Kankahalli, 2009) still attempt to answer the previous question. Consequently, it is apparent that an answer is neither definite nor straightforward.

1.1 Research Objectives & Outline

The goal of this dissertation is therefore to identify research gaps in our current knowledge on decision aid acceptance, and provide practical recom-

mendations on how designers and marketers can further promote their use. Such use will eventually lead to improved decision-making quality.

Our research model looks at two different ways through which one can influence consumer behavior: evaluation of RA characteristics (RA type (Chapter 2), RA Output (Chapter 3) and acceptance through appealing to consumer emotions.

In this way, we attempt to provide an alternative view of user behavior with respect to recommendation agents, through which the value of RA characteristics and emotions can be appreciated and used in order to increase user acceptance and use.

Accordingly, relevant questions which are answered through this investigation include:

1. Before using an RA: What is the impact of anticipated regret on the likelihood of deciding to use an RA?
2. When using an RA (1): How does RA decision strategy elaborateness impact RA evaluations?
3. When using an RA (2): What is the impact of RA recommendation set composition on the evaluation of the RA and the likelihood of using the RA?

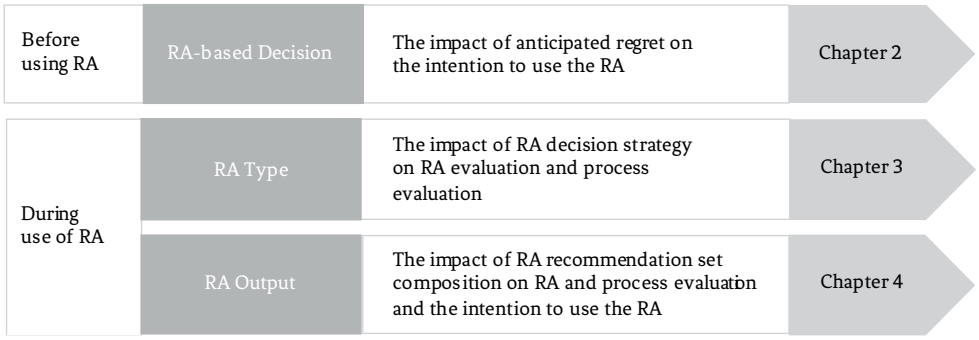


Figure 1 – Dissertation Map

In answering question one, a scenario-based fictional experimental design was set up. We tested whether the degree to which participants expected to regret a flight plan decision influenced their intention to adopt an online de-

cision aid to assist them with the decision at hand. Regret has long been suggested as an important driver of consumer decision-making. In this paper, we investigate whether anticipated regret can be used to overcome individuals' reluctance to use online decision aids that help them achieve better choice outcomes. In two experiments, we studied whether triggering anticipated regret about the outcome of a decision can increase user acceptance of online decision aids. In the first experiment, we implemented a controlled priming paradigm to induce anticipated regret among consumers. The second experiment tested whether anticipated regret can be induced in a more natural setting in which it is incorporated into messages aimed at promoting the use of decision aids. The results of both studies demonstrated that anticipated regret increases individuals' acceptance of online decision aids. We also investigated whether its impact is contingent on the complexity of the decision and individuals' subjective product expertise. We found main effects of choice complexity (positive) and expertise (negative) on online decision aid acceptance, but only a limited moderating effect of choice complexity (in Study 1 but not in Study 2) and no moderating effect of expertise (Study 1 and Study 2). We conclude that our results highlight the power of appealing to anticipated regret as a generic means to persuade consumers to use decision aids to further improve their (complex) decision outcomes.

For the second question, we built an actual recommendation agent. In a lab experiment, we asked participants to use two different versions of the RA. What varied between the two versions is the degree of extensiveness of the decision strategy each RA used. Subsequently and based on prior knowledge of RA acceptance and decision-making, we theorize on the otherwise neglected role of User Effort in relation to the evaluation of Decision Quality and RA Quality. The results give rise to the mediating role of User Effort. Users believe that a RA using a more extensive decision strategy is of higher quality because it saves them from effortful processing. Conversely, individuals believe that they are arriving at a better decision when using a limited strategy RA because it saves them from putting effort into the decision-making task themselves. This study sheds light on the prior inconclusive empirical evidence on the relationship between User Effort and Decision Quality.

The last study tested the hypothesized effects by using an online agent that recommends digital cameras. Recommendation Agents (RAs) aim at reducing individuals' decision effort and improving decision quality by presenting users with a list of alternatives that closely matches their preferences. An RA's list of recommended alternatives is typically compiled in a multidimensional way, in that individuals' preferences regarding multiple product attributes are used as input to rank alternatives in terms of their predicted attractiveness. Therefore, the most highly recommended alternatives on the list are likely to be balanced and characterized by variation in which attributes are relatively more and less attractive across alternatives. As a consequence, individuals are confronted with difficult trade-offs between product attributes, which may lower their acceptance of the RA. Based on theory concerning choice context effects and dominance valuation, we propose that if, instead, a clearly superior, dominant alternative is presented at the top of the RA list, individuals will more easily make decisions. More specifically, we hypothesize that switching from balance to dominance in the attribute levels of the alternatives that are most highly recommended by the RA improves individuals' perceptions regarding decision process and decision outcomes, and increases their RA acceptance. The results of an online lab experiment with a personalized RA support the hypothesized impact of balance versus dominance in RA sets. The main findings of the lab-experiments are also validated by real-world choice data from an RA website. Thus, this research provides a novel perspective on constructing RA sets and suggests a system design approach which improved decision process and outcome evaluations as well as RA acceptance.

Dissertation Overview

Chapter	Key Topic Investigated	Dependent Variables: RA Evaluation	Dependent Variables: Process Evaluation	Study Design
2	Anticipated Regret and RA Use	Intention to use the RA, Usage Likelihood	-	2 Lab experiments (N=421, N=302)
3	RA Type – RA Decision Strategy	RA Trust, RA Quality	Decision Quality, User Effort	Lab experiment with actual recommendations (N=199)
4	RA Output – Recommendation Set Composition	Intention to Use the RA	Perceived Decision Difficulty, Perceived Decision Quality	Lab experiment (N=273) & Clickstream data (N=35,113)

2

Increasing Online Decision Aid Acceptance by Triggering Anticipated Regret

2.1 Introduction

The rapid evolution of information technology in the past couple of decades has exponentially increased the number of products that consumers can view and purchase online. Whereas this impressive boom in product information availability has the potential to improve consumers' decisions, it is also well-known that consumers are inherently limited in how much information they can search through, assimilate and process (Benbasat & Taylor, 1982; Botti & Iyengar, 2006; Murray & Haubl, 2011). Information Systems scholars have identified this phenomenon as being a source of virtue (variety of options) and menace (information overload) and, as such, have proposed the use of electronic decision aids as a solution to this paradox (Chiasson et al., 2002; Swaminathan, 2003).

Research in psychology, economics and decision-making has also demonstrated a similar conflict between greater choice and complexity. On the one hand, there are clear benefits in having the freedom to choose. Being able to choose freely between alternatives increases intrinsic motivation, task performance, decision-making and, ultimately, life satisfaction (Deci, 1976; Deci & Ryan, 1985; Glass & Singer, 1972; De Carlo & Agarwal, 1999; Taylor, 1989; Taylor & Brown, 1988). This phenomenon does not come without adverse consequences; the decision maker ends up being confronted with an overwhelming set of alternatives that prevents him from making

optimal decisions. Miller (1956) was one of the first to identify the adverse effects of too much information on decision-making. According to his view, our short-term memory can handle no more than approximately seven items at a time. When relevant information exceeds this number, people become confused and are likely to make poorer rather than better decisions. Later, researchers refined the relationship between choice complexity and decision-making quality by highlighting the role of heuristics as a way to balance decision outcome quality and decision effort (e.g., Payne, Bettman, & Johnson, 1993).

More recently, research on consumer behavior addressed the choice overload hypothesis and investigated whether an increase in the number of options to choose from may lead to choice deferral (e.g., Chernev, 2003; Iyengar, Jiang, & Huberman, 2004; Iyengar & Lepper, 2000; Komiak & Benbasat, 2006; Maes, 1994).

Thus, an IT-enabled overabundance of information and choice alternatives can decrease decision quality, as well as increase consumers' postponing or deferring choice (Iyengar, Huberman, & Jiang 2004; Iyengar & Lepper, 2000). Unfortunately, decision avoidance often works against individuals' goals. Delays transform into lost opportunities and adhering to the status quo is frequently suboptimal, especially in the presence of advantageous alternatives (Anderson, 2003). Adverse consequences for the consumer also include a decrease in decision satisfaction, an increase in preference uncertainty (Chernev, 2003; Iyengar & Lepper 2000), and negative emotions including disappointment and regret (Schwartz, 2000). Ultimately, this phenomenon can create the Paradox of Choice, because while individuals are often attracted by variety, an excess of options to choose from may leave customers stressed out and unsatisfied (Schwartz, 2004).

To tackle the issue of increasing complexity in required searches and decisions due to information technology, companies developed online decision aids that support decision makers and, more specifically, consumers, in dealing with complex decisions (e.g. Benbasat & Wang, 2005; Qiu & Benbasat, 2009; see Xiao & Benbasat, 2014 for a recent review). Online decision aids (DAs) are software tools that have the aim of improving the quality of the decisions individuals make while simultaneously reducing

the effort required to make those decisions (Haübl & Trifts, 2000). Prior consumer research has demonstrated that such tools for assisting consumer decision-making — typically called recommendation agents (Haubl & Murray, 2003) — can be very effective when consumers decide to use them, and when the tools have the opportunity to sufficiently learn about the individual consumer's preferences (Diehl, Kornish, & Lynch, 2003; Häubl & Trifts, 2000; Senecal & Nantel, 2004; Urban & Hauser, 2004).

Yet, despite the potential value of DAs, their adoption by consumers for making complex decisions is not at the level one would expect given the benefits these online aids provide (Breugelmans et al., 2012; Murray & Häubl 2009; Sieck & Arkes 2005). Consumers seem to exhibit a strong tendency to use established routines of searching and are reluctant to change these routines (Johnson, Bellman, & Lohse, 2003; Ratchford, Talukdar, & Lee 2007). In addition, due to the power law of practice — that practice improves individuals' proficiency in a task by becoming more efficient (Johnson et al., 2003) — consumers can become locked into a particular mode of making decisions online (Bhatnagar & Ghose, 2004; Murray & Häubl, 2007), even though a decision mode may, over time, be easier to use and generate better results.

In this research, we take a novel perspective on what can stir decision makers to adopt DAs. In particular, we propose the use of prompting anticipated regret of making the wrong choice as a potentially powerful means to promote the use of online decision aids to improve decision outcomes. Interestingly, much of the previous research on regret offers suggestions for decreasing regret and for regret regulation (Zeelenberg & Pieters, 2007). However, the potential beneficial role of increasing anticipated regret as a self-control mechanism has received relatively little attention. We propose the use of anticipated regret as an emotion-based instrument beyond cognition-driven evaluation of potential outcomes; a promising way to promote the adoption of online decision aids. Along these lines, Inman (2004) envisioned extending the „How do I feel about it?" heuristic developed by (Schwarz & Clore, 1988) to a „How will I feel about it?" heuristic, which focuses on the post-decision feelings. Thus, while the research area of DA acceptance is predominately focused on the cognitive aspects of one's deci-

sion to use a DA (Benbasat & Wang, 2005; Qiu & Benbasat, 2009; Xiao & Benbasat, 2014), this study aims at uncovering the role that the anticipated emotion of regret may play in DA adoption decisions. Managerially, examining the effects of the emotion of regret on technology acceptance decisions becomes an interesting issue, as we can uncover whether regret-evoking framing should be employed in information technology use persuasion attempts.

To investigate the impact of this proposed approach we conducted two experiments in which we studied whether triggering anticipated regret about the outcome of a decision increases user acceptance of online decision aids. In the first experiment, we implemented a controlled priming paradigm to induce anticipated regret among consumers. The second experiment tested whether anticipated regret can be induced in a more natural setting in which it is incorporated into messages aimed at promoting the use of decision aids. The results of both studies demonstrate that anticipated regret increases individuals' acceptance of online decision aids. We also investigated whether its impact is contingent on the complexity of the decision and individuals' subjective product expertise. We found main effects of choice complexity (positive) and expertise (negative) on online decision aid acceptance, but only a limited moderating effect of choice complexity (in Study 1 but not in Study 2) and no moderating effect of expertise (Study 1 and Study 2).

The following section sets out the theoretical foundation of our hypotheses regarding the relationship of anticipated regret and DA acceptance. Subsequently, the two studies testing our hypotheses are explained. Finally, conclusions are drawn, limitations are pointed out and recommendations for future research are proposed.

2.2 Decision Aid (DA) Acceptance

Experimental work on DA evaluation and use can be grouped into two categories. Those examining (a) the impact of DA use on decision process and outcome variables, such us decision quality and information search; and (b) the factors which lead to adoption and use of these systems. DAs have important implications for consumers' perceptions of website attributes

(Zeithaml, Parasuraman, & Malhotra, 2002) and service quality (Parasuraman, Zeithaml, & Malhotra, 2005). They also affect the objective quality of consumer decisions (Aksoy et al. 2006; Häubl & Trifts, 2000), the relative importance of different product attributes (Diehl, Kornish, & Lynch, 2003; Häubl & Murray, 2003), users' decision-making strategies (Dellaert & Haubl, 2012), and they offer ways to improve customers' experience (Rayport, Jaworski, & Kyung, 2005).

The evaluation of these technologies is contingent upon contextual variables like past agreement with recommendations (Gershoff et al., 2003), product familiarity (Cooke et al., 2002), decision and personality similarity (Aksoy et al., 2006), source of recommendations (Fitzsimons & Lehmann, 2004), task transparency (Kramer, 2007), and temporal distance Kohler, Breugelmans, and Dellaert (2011) and how these influence the evaluation of decision assistive technologies. In sum, technology adoption and use of technology is an area that has received much scholarly attention for approximately the last 30 years. Nevertheless, IT use has been predominately studied through cognitive-based models and theories.

Whereas reasoned action models like TAM (Davis, Bagozzi, & Warshaw 1989), UTAUT (Venkatesh et al., 2003) and their variants focus almost exclusively on the cognitive component of individual behavior, emotions are also increasingly seen as partly formulating behavioral intentions (Ortiz de Guinea & Markus, 2009). The limited number of empirical IS studies which touch upon emotions, posit that emotional factors are fully mediated by cognition (Venkatesh, 2000; Venkatesh & Bala, 2008). Conversely, research on anticipatory and anticipated emotions suggests that emotions such as fear and excitement can independently drive intentions related to exercising behavior (Abraham & Sheeran, 2004), AIDS prevention (Richard et al., 1995, 1998), consumer behavior (Simonson, 1992), bodyweight regulation and studying behavior (Perugini & Bagozzi, 2001). There is therefore evidence suggesting the role of affect in choices and intentions, yet typically not related to human-computer interaction.

In a study on the effects of emotion on IT use, Beaudry and Pinsonneault (2010) provided an example of an initial effort towards breaking away from the "thinking-only" tradition in behavioral IS research. Acknowledging that

the cognitive based models cannot account for emotional reactions and their effects on IT use, they provide a framework of emotions during the anticipated period and its impact on initial use. Their results suggest that emotions experienced by anticipation of a new IT implementation are important antecedents of subsequent IT use and they call for further research on this "relatively unexplored area in our field" (Beaudry & Pinsonneault, 2010). Negative emotions are of particular research interest. As per the theory of loss aversion, decision makers tend to avert losses more than seeking gains (Kahneman & Tversky, 1979). That is, they tend to be more willing to avoid the potential of a loss (e.g. making a poor product choice) rather than seeking to attain the best gain possible (e.g. making the best product choice). Consequently, the utility of potential benefits caused by an action (rejoice) is less than the disutility of potential loss (regret).

2.3 The role of anticipated regret

In the rational-emotional model of decision avoidance, Anderson (2003) proposes two main factors that prompt humans to defer or postpone a decision: choice complexity and anticipated regret. Much evidence pinpoints to the notion that individuals seek to minimize regret resulting from decisions and that choice of an avoidant option is a domain-general vehicle for avoiding regret. "In other words, a higher level of anticipated regret resulting from a choice over all of the available alternatives motivates a search for the option that minimizes regret" (Anderson, 2003, p. 148).

The emotional aspect of regret in decision-making has received much recent attention. Zeelenberg (1999) defines anticipated regret as a negative, cognitive-based emotion people experience when they imagine that their situation will have been more positive if they would have behaved in a certain way. Anticipated regret, then, is considered to occur when, before or in the process of making a given decision; a person considers the possibility of post-outcome, future regret. There is also ample evidence that regret can affect people's choices before the decision is made, when they anticipate the regret they may feel later if the decision turns out badly (Zeelenberg et al., 1996; Zeelenberg & Pieters, 2004).

Studies show that "individuals seek to minimize regret resulting from decisions and that choice of an avoidant option is a domain-general vehicle for avoiding regret" (Anderson, 2003, p. 148), yet not the only one. In proposing the theory of regret regulation, Zeelenberg and Pieters (2007) exemplify a number of strategies, which decision makers use to manage their regrets; both realized and anticipated. The deployment of these regulation strategies and their relation to anticipated regret is primarily demonstrated in scenario studies. Zeelenberg et al. (1996) and Tsiros and Mittal (2000) for instance, show that decision makers anticipated less regret for decisions that are reversible and more for those that are internally rather than externally determined.

"Regret regulation strategies are decision-, alternative-, or feeling-focused, and implemented based on their accessibility and their instrumentality to the current overarching goal" (Zeelenberg & Pieters, 2007, p. 4). In their attempt to prevent future regret, people may deny or transfer the responsibility of a decision by, for instance, seeking for decision advice. Consumers are thus not only anticipating post-behavioral affective consequences of their actions and take these consequences into account when making decisions (Kahneman & Tversky, 1982; Loomes & Sugden, 1982; Van Dijk et al., 1999) but they are also motivated to make certain choices in order to avoid regret rather than maximizing choice utility (Connolly, Ordonez, & Coughlan, 1997; Josephs et al., 1992; Simonson, 1992). Consequently, it is likely that a stimulus that underlines the importance of regret will induce second thoughts, which are subsequently factored-in decisions and choices.

In their work on goal-directed emotions, Bagozzi and colleagues (1999) show that thinking about the emotions people will experience in the future once certain desirable or undesirable future events happen, has an effect goal-directed behavior and more specifically, behavioral intentions. Furthermore, in his critique of reasoned-action models Bagozzi (2007) postulates that past technology acceptance research have relied on naïve and over-simplified notions of affect or emotions. Especially "In the anticipation period emotions are triggered on the basis of the perceived likely impacts that the new IT will have" (Beaudry & Pinsonneault, 2010). Since we are interested in is the initial adoption of a DA, we expect that anticipated emo-

tions will be important factors in a user's decision to use a decision aid or not.

Psychologists have also found that people tend to take disproportionate credit for good outcomes, which they attribute to their own skills and effort, but generally duck responsibility for bad outcomes, which are attributed to bad luck or to the actions of others (Weiner, 1985). In relation to technology-assisted decision-making, computers are often seen as "scapegoats" of bad decisional outcomes. Thus, in the light of an unfavorable decisional outcome, people may attribute their failures to technology in their attempt to transfer responsibility and in the bottom line, avoid the pain of regret.

As mentioned earlier, individuals have multiple goals when engaging in a behavior. One of those goals is the minimization of negative emotions. One way through which this goal can be achieved, is the choice of the status quo option. When an individual is confronted with the decision to adopt a new technology, choosing to reject that technology and perform a task through the previously established routine, can be regarded as maintaining the status quo.

When making a decision using DAs, users are delegating part of the process to the technology. In that way they transfer control and responsibility (Bendapudi, Neeli, & Leone, 2003). Research in decision-making has consistently shown that decreased responsibility results into less regret with a negative outcome. Thus, by adopting the technology to make the decision the consumer could transfer part of the responsibility to the technology and avoid decision-focused regret. This technology adoption promoting effect is likely to be larger as anticipated regret regarding the possibility of making a bad decision is greater.

Hypothesis 1: Greater anticipated regret increases online decision aid (DA) acceptance.

2.4 The role of choice complexity

Anderson (2003) consolidated prior research to propose that complexity and anticipated regret are the main determinants of decision avoidance. The judgment and decision-making literature has devoted substantial attention

to difficulty factors influencing one's decision-making strategies (Payne, Bettman & Johnson, 1993). Factors such as the number of alternatives, attributes, attribute correlations, time pressure and others are all influencing the way people make decisions (Dhar & Nowlis, 1999; Payne, 1976; Payne et al., 1988; Redelmeier & Shafir, 1995; Simonson & Tversky, 1992)[2]. Given that our study focuses on the adoption of decision aids, which assist decision-makers through limiting the number of alternatives in the consideration set, we decided to focus on the complexity dimension of difficulty, referring to choice set size (the number of alternatives from which the individual is choosing) as well as the number of attributes characterizing a certain item. Both aspects of complexity have been shown to affect consumers decision-making (Dellaert, Donkers, & Van Soest, 2012).

Iyengar and Lepper (2000) conducted one the few studies where they examine the relationship between regret and the number of options available to the decision maker. Their research shows that an increase in the number of options that a consumer has, can reduce his motivation to purchase a product due to fear of future regret (Iyengar & Lepper, 2000). The psychological processes responsible for this are two. Firstly, variety increases the feeling of responsibility of the decision maker for the outcome he selects (Schwartz, 2000). In an extreme case where individuals only had one option to choose from, e.g., a regulated public health insurance, individuals may be dissatisfied with the service they receive but they are not responsible for they choice and would not anticipate regret. Feeling responsibility is a main precondition for the presence of regret (Zeelenberg, van Dijk, & Manstead, 1998). Thus, when multiple health plans are available, consumers feel that they are hold bound for their potentially worse choices. Secondly, anticipated regret occurs mainly in situations where consumers have to actively turn down alternatives. Each ruled out alternative can potentially turn out to be superior than the one selected by the decision maker. The more alternatives a consumer has to reject, the more regret he or she can anticipate for not having chosen a competing option (Wathieu et al., 2002). Such anticipation of making a regrettable mistake results in reluctance to decide and subsequently to decision avoidance (Anderson, 2003).

2 For a review see Anderson (2003).

Despite the fact that both future–oriented and actual regret has received considerable attention, the role of choice complexity in the form of the size of the consideration set, in the consideration of anticipated regret has received little attention. Given our interest in the impact of anticipated regret to promote the use of online decision aids for complex decisions, we investigate whether choice complexity can moderate anticipated regret's impact on decision aid adoption decisions. Relatedly, Jannis and Mann (1977) show that an important reason that regret is anticipated, is if the most preferred alternative is not necessarily superior to another alternative. The reason is that when there is one dominant alternative the decision maker does not spend much time thinking about the possible drawbacks of this alternative, because there is less self-recrimination if the obvious superior alternative results in a suboptimal outcome. When alternatives are highly similar in attractiveness however, the awareness of perhaps not choosing the best alternative is heightened much more.

This finding suggests that as perceived choice complexity increases, it is more likely that regret will be taken into account when deciding (cf. Sugden, 1985, Keren & Bruine de Bruin, 2003; Zeelenberg & Pieters, 2007). Based on these insights we can expect that anticipated regret motivates behavior when the decision task is of a certain minimum level of complexity. If the number of alternatives from which one has to choose is low, the possibility of regret is likely to be seen as be low by consumers. Consumers will tend be fairly confident that they can make a good decision. To this respect, it is expected that underlining the possibility of regret won't influence behavior in this case.

Hypothesis 2a: Greater choice complexity increases DA acceptance.

Hypothesis 2b: Greater choice complexity increases the impact of anticipated regret on DA acceptance.

2.5 The role of subjective product expertise

Literature examining the adoption of decision aids contents that only those without sufficient product knowledge would seek advice from online deci-

sion aids (Haubl & Trifts, 2000). Similar evidence in the literature indicates that experts are not motivated to use decision support technology (Xiao & Benbasat, 2007). Examining whether both experts and novices can be persuaded to use a decision aid is thus of major interest.

Consumers who are experienced in a given decision domain have a better understanding of "facts" about a task and have firm attribute preferences (Alba & Hutchinson, 1987). As a result, they are both more confident and certain that they don't need assistance in making a decision in the domain of their expertise. In the Theory of Technology Dominance (TTD), Arnold and Sutton deductively show that the degree of task experience of a decision aid user has a direct negative effect on an accountant's reliance on decision aids (1998). At the same time experienced individuals routinely resist reliance on decision technology (Arnold et al., 2004a).

Research on the adoption and acceptance of technology has more recently touched upon the characteristic of task experience. The first accounts of technology acceptance have provided evidence that the importance of different beliefs (ease of use, usefulness, and subjective norms) weight differently for experienced versus inexperienced users (e.g. Davis et al., 1989; Taylor & Todd, 1995).

When it comes to the use and evaluation of recommendation agents, experts and novices differ in terms of preference elicitation method evaluation and decision quality evaluation (Kramer, 2007; Xiao & Benbasat, 2007). Urban et al. (1999) also showed that less knowledgeable consumers expressed stronger preferences for a DA-enabled website, while those who were experts preferred the website DA capabilities. Lastly, highly knowledgeable subjects were generally less satisfied with the technology and therefore less reliant on it for choosing products than less-knowledgeable subjects (Spiekermann, 2001). Due to this literature evidence, residing in diverse literature streams, we expect that individuals who consider themselves to be novices will choose to adopt a decision aid to a greater extent than those who think of themselves as experts.

Maddux and Rogers, (1983) show that self-efficacy, people's beliefs about their capabilities, predicts attitude towards persuasive messages. A person's reactions are determined at least in part by the extent to which he or she be-

lieves that particular courses of action are within the range of capabilities. As Sanna (1997) notes, whether a person believes that she or he can efficaciously attain or avoid particular simulated outcomes appears to be an important moderator of reactions to upward and downward counterfactual thinking.

For a given domain, experts and novices are characterized by high and low self-efficacy respectively. It is thus reasonable to expect that experts should react differently than novices in light of the possibility of a bad outcome. "People can only behave consistently with their anticipated feelings to the extent that they have the skills, abilities, opportunities, and social cooperation, and that any lack of perceived control must obstruct the anticipated feelings-behavior relationship" (Manstead, 1997, p. 2003). As a result, we expect that the effect of regret on online decision aid acceptance is more strongly driven by individuals with high levels of expertise in the decision domain. Accordingly, Duhachek (2005) empirically demonstrates that when consumers experience threat emotions (like the one of regret) in conjunction with high self-efficacy, they will be more likely to engage in advice seeking behavior.

Hypothesis 3a: Greater subjective product expertise decreases DA acceptance.

Hypothesis 3b: Greater subjective product expertise increases the effect of anticipated regret on DA acceptance.

2.6 Study 1: The differential impact of anticipated regret

We first test the hypotheses in an online experimental study with participants from Amazon Mechanical Turk. We manipulated the salience of anticipated regret and the choice complexity. The experimental design of the study was a 2 (anticipated regret prime: absent vs. present) x 2 (choice complexity: low vs. high) between subjects' factorial design. Respondents were randomly assigned to one of the four experimental conditions. The participants were told that the experiment examined consumer decision-making processes, and asked to imagine themselves in a flight plan decision situation. More precisely, we presented subjects with a hypothetical flight book-

ing decision. A long distance destination was chosen for the task so that all participants would face a roughly equal flight length regardless their exact US location. According to the scenario, respondents were looking to book a flight through a specific website that offered two ways of making a decision; using an online decision aid or deciding on their own.

2.6.1 Experimental conditions

Anticipated regret. Research manipulating the impact of pre-outcome anticipated regret on behavior is scant. Regret in decision-making is typically examined at the post-decisional stage, as an outcome variable, rather than part of the decision-making process that is experimentally manipulated by the investigator (Petrocelli et al., 2012). Studies that have looked at the role of regret at the pre-decision stage and adopted priming strategies can be clustered in two groups (see Table 1 for a summary overview). One group of studies manipulated anticipated regret explicitly (activating regret consciously) and the second group of studies manipulated anticipated regret implicitly (by activating regret subconsciously). Within the explicit priming paradigm, researchers have used various techniques to activate the consideration of regret at the pre-decision stage. Such examples are autobiographical recall (e.g. Passyn & Sujan, 2012), mental process simulation (e.g. Zhao et al., 2011), mental imagery simulation (e.g. Simonson, 1992; Luce, 1998; Luce & Drolet, 2004; Reb & Connoly, 2009) and priming through the antecedents of regret (e.g. manipulation of feedback on forgone monetary gambles, Zeelenberg, 1999). The implicit priming technique is most commonly based on a scramble sentence test procedure that shows the effect of regret anticipation on monetary gambles (Reb & Connoly, 2009).

In this research we introduced a new way of priming regret that triggers prefactual thinking and that is most closely connected to the counterfactual thinking approach that was used in earlier work (Connolly & Reb, 2005). The reason we apply this approach is that Taylor and Bagozzi (2005) suggest that "the processes behind the functioning of anticipated emotions are akin to counterfactual thinking but may be termed prefactuals to stress the expected, forward looking aspects of the thought processes" (p. 294). Individuals imagine alternatives to events in terms of the implications of these events

for the future and people's behavior may as well be determined by what the prefactuals imply for the future (Gleicher et al., 1995; see also Bagozzi, Moore, & Leone, 2004). Thus, prefactual thinking is defined as the mental simulation of possible future outcomes and can trigger anticipated regret, which influences attitudes and behavioral responses (Gleicher et al., 1995; Sanna, 1996). Prefactual simulation of negative consequences is associated with negative anticipatory emotions (e.g. anticipated regret and guilt), which motivate individuals to react to prevent those emotions. Just as counterfactual thinking is a proxy for regret (Landman, Vandewater, Stewart, & Malley, 1995), prefactual thinking is a proxy for anticipated regret.

Table 1 — Priming Anticipated Regret: Literature Review

Explicit Priming	
Mental imagery, anticipated regret rating	(Simonson, 1992), (Reb & Connoly, 2009), (White, Lemon & Hogan, 2007), (Richard, de Vries, & van der Pligt, 1998), (Lemon, White, & Winer, 2002)
Opportunity to imagine outcomes	(Shiv & Huber, 2000)
Implicit Priming	
Scramble sentence task	(Bargh & Chartrand, 2000), (Reb & Connoly, 2009)
Autobiographical recall	(Passyn & Sujan, 2012)
Affective process simulation	(Zhao, Hoeffler, & Zauberman, 2011)
Elaboration on potential outcomes	(White, Lemon, & Hogan, 2007)
Counterfactual thinking	(Connoly & Reb, 2005)

Thus we propose that priming regret through asking people to engage in prefactual thinking is high on realism as it simulates the actual process of emotion anticipation. This priming technique allows us to mask the purpose

of our experimental procedures and minimizes demand effects (Bargh & Chartrand, 2000). More precisely, we primed regret by introducing the text explicated in Table 2. In order to reinforce the prime in the high anticipated regret condition they were also asked to list their thoughts in case of a poor flight plan choice.

Table 2 — Scenario 2[3]

For an upcoming business trip you need an airline ticket to Perth, Australia where you will meet with a new client. For that reason, you visit an online travel website that offers information and details about all the flights available to and from Australia. Your administrative assistant tells you that the number of different flight plans for a roundtrip to Perth, Australia is 3 [100]. In order to make this decision you are looking at the following flight plan information: Airline(s) name, Number of stop-overs, Departure time, Arrival time, Total Price [Airline(s) name, Total Flight time, Total waiting time, Excess Baggage charges, Number of stopovers, Departure time, Arrival time, Meals offered, Change of flight charges, Total Price].

[Regret prime: Consider that if you make a poor flight plan choice, you might find out that you would have done better if you had chosen a different flight plan, leading to regret. For this decision, think carefully of making a poor flight plan choice. Use your imagination and try to visualize the consequences a poor choice would have for you. Please take a minute and write down the consequences of making a poor flight plan choice that come to your mind. Write down a couple of them.]

Now, imagine that in order to make your final choice you have two options:

1. You can search for a flight yourself on the travel website.
2. The website also offers a new flight plan recommendation agent. This is an online tool which ranks all travel options for your trip in terms of attractiveness, based on past travelers' preferences.

Choice complexity. A main determinant of choice complexity is choice set size. Consequently, complexity was manipulated by varying the number of flight plan options available for respondents to choose from (3 vs. 100 plan

3 Wording in brackets refers to the alternative version of absent anticipated regret prime and high choice complexity.

options) and the number of attributes which the decision makers were to consider for the flight plan decision (5 vs. 10 attributes).

Online decision aid. Participants read the decision scenario about the airplane ticket choice and the availability of the DA. The specific DA that was suggested represented a collaborative filtering decision aid. This type of aids uses the opinions of likeminded individuals to generate advice. Well-known collaborative-filtering decision aids are offered by Amazon, and Netflix. The other type of decision aid that we could have proposed is a content filtering aid. Thus adopting the DA allows the user the (partial) relinquishment of decisional control, as the recommendations are based on others' preferences. Thus, they could manage anticipated regret by transferring decision responsibility. As a result, the anticipated regret prime is expected to affect the likelihood of accepting to use the DA.

2.6.2 Measures

Anticipated regret. This was measured with three items adapted from Luce, Payne and Bettman (1999) and that capture regret in relation to the emotional trade-off difficulty in the decision task. As regret priming in Study 1 was quite explicit we wanted to avoid demand effects and selected measures of regret in this study that were of a relatively implicit nature. Participants indicated on 7-point scales: "How likely it is that a very negative outcome will result from choosing a poor flight plan?" (1 = very unlikely; 7 = very likely), "How threatening (involving potential for unwanted outcomes or consequences) is this flight decision for you?" (1 = not at all threatening; 7 = very threatening), and "How stressful is the flight decision for you?" (1 = not at all stressful; 7 = very stressful).

Choice complexity. We adapted Chernev's (2003) decision complexity item. We asked participants to rate the following statement, "How would you rate the difficulty of this flight plan decision for you?" on two 10-point answer scales: 1 = not difficult at all to 10 = very difficult, and 1 = not at all simple to 10 = very simple (reverse coded).

Subjective product expertise expertise. We measured product expertise by adapting Dellaert and Stremersch (2005) and using three items on subjective expertise. Respondents responded on 7-point bipolar scales how "Familiar–

Unfamiliar", "Expert–Novice", and "Experienced–Inexperienced" they were with respect to making flight plan decisions.

Acceptance of the DA. This was measured by asking participants how likely it is that they would use the online decision aid:" How likely is it that you would use the recommendation agent?" Responses were on a 7-point scale ranging from 1 = very unlikely to 7 = very likely.

2.6.3 Data

Participants. We obtained responses from 404 adult U.S. citizens on MTurk. Workers on MTurk generally come from a more diverse background than the typical college undergraduate (Mason & Suri, 2012). Since this study was based on a fictional situation and our manipulation aimed to evoke realism, we asked participants to evaluate the realism of the task (Darley & Lim, 1993). We used two items ("I could imagine myself doing the things described in this scenario" and "I believe that the described situation could happen in real life" both on a 7-point scale from 1 "strongly disagree" to 7 "strongly agree"). On the basis of the responses to these items, we excluded 11 participants that did not find that the task was realistic (score 1 to 3). The mean score for the above two items was M = 5.99, SD = .74 and M = 6.16, SD = .77, respectively. The final size of the sample was N = 393. 44.8% of the respondents were females, 64.4% held a bachelor's degree or higher, and the average age (based on age category means) was 34.5 years old.

Scale reliability and manipulation checks. Confirmatory factor analyses showed that anticipated regret, choice complexity and expertise all loaded onto different factors as expected. The scale reliability of anticipated regret was good (α = 0.75), as was the reliability of the expertise scale was also good (α = 0.96). The manipulation of anticipated regret was in the expected direction and significant at the $p < .05$ level between conditions. Participants in the anticipated regret condition reported on average higher anticipated regret scores compared to participants in the no anticipated regret condition (M_{Regret} = 4.45, SD = 1.17; $M_{NoRegret}$ = 3.94, SD = 1.27; $t(391) = 4.12$, $p < .001$). The manipulation of choice complexity was also in the expected direction, but only significant at the $p < .10$ level. Participants in the high complexity condition reported on average higher choice complexity than in the

low complexity condition ($M_{HighComplexity}$ = 5.28, SD = 2.12; $M_{LowComplexity}$ = 4.88, SD = 2.29, t(391) = 1.79, p = .07).

2.6.4 Results

We test the hypothesized effects using multiple regression analysis (see Table 3). First we tested the main effect of anticipated regret on the likelihood of choosing the decision aid (H1: Model 1). The result was significant and positive (B_{Regret} = .23, p < .01).

Next, we added the effect of choice complexity and its interaction with anticipated regret (Model 2). In addition to the strong effect of anticipated regret, we find a positive effect of choice complexity on acceptance as hypothesized (H2a: B_{diff} = .10, p < .05) and that this effect strengthens the impact of anticipated regret (H2b: $B_{diff*regret}$ =.07, p <. 05). Thus we find support for H1, H2a and H2b.

Table 3 — Likelihood of Choosing a DA — Study 1

	Model 1		Model 2		Model 3	
	beta	s.e.	beta	s.e.	beta	s.e.
Constant	.00	.09	-.05	.09	-.04	.09
Anticipated regret	.23**	.07	.21**	.07	.19*	.07
Choice complexity			.10*	.04	.07	.04
Choice complexity x Antic. regret			.07*	.03	.09**	.03
Expertise					-.21**	.05
Expertise x Anticipated regret					.06	.04

** p < .05, ** p < .01*

Then, to test H3a and H3b, we conducted a regression analysis that further included the effect of expertise, and its interaction with anticipated regret (Model 3). We find that as expected there is a significant negative effect of expertise on online decision aid acceptance (H3a: B_{expert} = -.21, p = <.01). No significant anticipated regret x expertise interaction was found (H3b:

$B_{expert*regret}$ = .06, p >.05). Thus we find support for H3a but not for H3b. The results are robust with the inclusion of control variables such as age and gender. It is worth noting that when including expertise in the regression the significance of the main effect of choice complexity dropped below p = .05. This may perhaps be due to a correlation between expertise and perceived choice complexity (r = -.26, p < .01).

2.6.5 Discussion

Study 1 provides support for the effect of anticipated regret priming on the adoption of DAs. Individuals anticipating higher potential regret for making a poor flight plan decision are more likely to use a DA. Anticipated regret priming had a significant effect. We also find a significant effect of choice difficulty, with individuals being more likely to use a DA with more difficult choice. As hypothesized, the impact of anticipated regret is also dependent on the level of choice complexity. For more difficult choices, anticipated regret plays a greater role in DA acceptance. Furthermore, we find that experts are less likely to accept the use of a DA. However, in contrast to what we hypothesized there is no difference between experts and non-experts in terms of how anticipated regret affects DA acceptance.

2.7 Study 2: Triggering the impact of anticipated regret with practical message framing communications

Study 1 utilized a mental imagery manipulation adapted from Reb and Connoly (2009). The goal of Study 2 was to replicate the findings from Study 1 and to investigate the practical, actionable value of our findings. In particular, by building upon the literature of message framing and persuasion, we investigate whether regret anticipation can also be triggered by a persuasive text used to increase the adoption of online decision aids.

Previous research shows that message framing does appear to have an appreciable affective component (Nygren, 1998). Irvin et al. (1998) note that creators and presenters of persuasive communications must consider the emotional appeal of their overriding message as its valence and intensity influences whether people become risk seeking or risk averse. Research in po-

litical science has shown for example, that emotions can play a role in affecting behavior when coupled with message framing. For example, Druckman and McDermott (2008) demonstrated that anger and enthusiasm influence the relationship between gain-framed messages and risk-aversion behavior. Hetts et al. (2000) studied the impact of anticipate regret on insurance decisions and found that participants exposed to anticipated regret-evoking messages, were willing to pay higher premiums than in a control condition. While these results speak to the effect of emotion in framed messages, no research has examined the role of integral emotions—or emotions that are central to the message or decision—in framed message effects in the area of DA adoption.

2.7.1 Experimental design & procedures

The study consisted of a 2 (anticipated regret frame: absent vs. present) x 3 (choice complexity: absent vs. low vs. high) between subjects' factorial design.

Anticipated regret. In this study we constructed regret-framed messages based on the prefactuals generated by the participants in Study 1 and two pilot studies. In these studies, we asked respondents to list their thoughts in case of a poor flight plan choice. We coded all responses to the prefactuals that were elicited to support the respondents processing of the anticipated regret prime. Subsequently we performed conceptual content analysis to uncover clusters of decision-specific characteristics that elicit the respondents' emotional responses. The findings indicate the following main areas of concern regarding the risk of making a wrong choice: 1. In-flight services (e.g., poor meals, comfort), 2. Loss of luggage, 3. Delays, and 4. Failure to fulfill the trip's goal (missing the meeting with the client, arriving late for the meeting).

Based on these topics we constructed the following anticipated regret framed message: "What can go wrong with the flight plan choice? An unpleasant, overly expensive and long trip that leaves you stressed out and upset." This message was integrated as the regret prime for this study and was shown to half the respondents, while the other half did not see the regret prime (see Table 4).

Choice complexity. Choice complexity was manipulated in a similar way as in

study 1. For low complexity n = 3 was used for the number of alternatives and for high complexity n = 100. The number of attributes which the decision makers were to consider for the flight plan decision also varied between 5 (low complexity) and 10 (high complexity).

Table 4 — Scenario[4]

For an upcoming business trip you need an airline ticket to Perth, Australia where you will meet with a new client. For that reason, you visit an online travel website that offers information and details about all the flights available to and from Australia. [Complexity: - No statement about complexity, or - Your administrative assistant tells you that the number of different flight plans for a round-trip to Perth, Australia is 3 [100].] In order to make this decision you are looking at the following flight plan information: Airline(s) name, Number of stopovers, Departure time, Arrival time, Total Price [Airline(s) name, Total Flight time, Total waiting time, Excess Baggage charges, Number of stopovers, Departure time, Arrival time, Meals offered, Change of flight charges, Total Price] [Regret prime: What can go wrong with the flight plan choice? An unpleasant, overly expensive and long trip that leaves you stressed out and upset.] Now, imagine that in order to make your final choice you have two options: 1. You can search for a flight yourself on the travel website. 2. The website also offers a new flight plan recommendation agent. This is an online tool which ranks all travel options for your trip in terms of attractiveness, based on past travelers' preferences.

In addition, the experimental design in study 2 included a "no complexity" condition. In this condition, no information about the number of alternatives in the market is given in the scenario. The main reason for adding this third condition is that it may be more realistic as individuals do not always have complexity information prior to DA acceptance. As such, this design enriches the previous experimental results.

4 Wording in brackets refers to the alternative version of absent anticipated regret prime and high choice complexity.

2.7.2 Measures

Anticipated regret. For this experiment with used an alternative measure of regret. As regret priming in Study 1 was quite explicit there we wished to avoid the possibility of demand effects. In the current study, regret manipulation was more implicit. We therefore asked participants directly to rate on an 11-point bipolar scale (1 = Not at all to 10 = very much) item "How regretful would you feel if this flight plan choice would end up having a poor outcome?" (adapted from Baumgartner, Pieters and Bagozzi, 2008).

Choice complexity. We used the same approach as in Study 1 where we adapted Chernev's (2003) decision complexity item. We asked participants to rate the following statement, "How would you rate the difficulty of this flight plan decision for you?" on two 10-point answer scales: 1 = not difficult at all to 10 = very difficult, and 1 = not at all simple to 10 = very simple (reverse coded)).

Subjective product expertise. Here also, like in Study 1 we measured expertise with three items. Respondents responded on 7-point bipolar scales indicating how "Familiar – Unfamiliar", "Expert – Novice", and "Experienced – Inexperienced" they were with respect to making flight plan decisions.

Acceptance of the DA. This was measured by asking participants how likely it is that they would use the online decision aid: "How likely is it that you would use the recommendation agent?" Responses were on a 7-point scale ranging from 1 = very unlikely to 7 = very likely.

2.7.3 Data

Participants. Respondents were MTurk workers randomly assigned to one of the six experimental conditions. 302 adult U.S. citizens participated in this study. We asked participants to evaluate the realism of the task (Darley & Lim, 1993) using two items ("I could imagine myself doing the things described in this scenario" and "I believe that the described situation could happen in real life" both on a 7-point scale from 1 "strongly disagree" to 7 "strongly agree"). On the basis of the responses to these items, we excluded 10 participants that did not find that the task was realistic (score 1 to 3). The mean score for the resulting realism items was then, M = 6.01, SD = .68 and M = 6.18, SD = .69 respectively. The final size of the sample was N = 292.

48.3% of the respondents were females, 63.4% held a bachelor's degree or higher, and the average age (based on age category means) was 36.7 years old.

Scale reliability and manipulation checks. Confirmatory factor analyses showed that anticipated regret, choice complexity and expertise all loaded onto different factors as expected. The scale reliability of expertise scale was also (α = 0.97). The manipulation of anticipated regret was again successful. Participants in the anticipated regret-framed condition reported a higher anticipated regret (M= 7.35, SD= 2.83) than in the no message frame condition (M = 6.41, SD = 2.90), t(290) = 2.80 p <. 01). Conversely, participants in the high complexity condition reported higher choice complexity (M= 2.78, SD= 2.30) than in the low complexity condition (M = 2.26, SD = 2.32), t(198) = 1.82 p <. 10. Respondents in the condition where no choice complexity information was given, perceived marginally lower choice complexity (M = 2.31, SD = 2.30) than those assigned in the high complexity condition, t(187) = -2.56, p = .11), but not than those in the low complexity condition t(193) = .167, p = .87),. This suggests that when choice complexity information was not presented, respondents assumed a low level of complexity.

2.7.4 Results

We test the hypothesized effects using multiple regression analysis (see Table 5). First we tested the main effect of anticipated regret on the likelihood of choosing the decision aid (H1: Model 1). The result was significant and positive (B_{Regret} = .10, p < .01).

Next, we added the effect of choice complexity and its interaction with anticipated regret (Model 2). In addition to the strong effect of anticipated regret, we find a positive effect of choice complexity on acceptance as hypothesized (H2a: B_{diff} = .11, p < .05). However, in contrast to Study 1 we do not find a moderating effect of choice complexity on anticipated regret. Thus we find support for H1 and H2a, but not for H2b.

Then, to test H3a and H3b, we conducted a regression analysis that also included the effect of expertise and its interaction with anticipated regret (Model 3). We find no effect of expertise and that the effect of choice complexity also is no longer significant. Like in Study 1 this suggest a strong cor-

relation between choice complexity and expertise. This correlation is highly significant (r = -.473, p < .01). Hence we ran an additional regression only including expertise along with anticipated regret (Model 4). This shows a negative effect of expertise on acceptance of the DA as hypothesized (H3a: Bregret= -.14, p < .05, but no moderating effect of expertise on anticipated regret. Thus, in line with the findings from Study 1, we find support for H3a but not for H3b.

Table 5 — Likelihood of Choosing a DA — Study 2

	Model 1		Model 2		Model 3		Model 4	
	beta	s.e.	beta	s.e.	beta	s.e.	beta	s.e.
Constant	.00	.09	.01	.09	.00	.09	.00	.09
Anticipated regret	.10**	.03	.09**	.03	.10**	.03	.11**	.03
Choice complexity			.13**	.04	.08	.05		
Choice complexity x Antic. regret			-.01	.01	-.00	.02		
Expertise					-.11	.06	-.16**	.05
Expertise x Anticipated regret					.03	.02	.03	.02

** p < .05, ** p < .01*

2.7.6 Discussion

Study 2 provides further support for the effect of anticipated regret priming on the acceptance of DAs. It shows that messages evoking the cognitive-based emotion of anticipated regret can have a significant persuading role in the decision to adopt DAs. We also find that with higher choice complexity individuals are more likely to accept DAs and that individuals with higher subjective product expertise are less likely accept DAs. Unlike in Study 1 we didn't find support that the effect of anticipated regret is enhanced when choice complexity is high.

2.8 Conclusions

Study 1 establishes the existence of a strong positive effect of anticipated regret on decision aid acceptance. Regret anticipation steers decision aid users towards decision aid acceptance. This positive effect is mildly greater when the choice at hand is complex. We find significant support for a moderating effect in Study 1, but not in Study 2. Choice complexity also has a positive main effect on decision aid acceptance. We find that whereas experts are less likely than novices to use decision aids (negative main effect of expertise), the anticipated regret prime is not more effective for either of the two groups. In sum, anticipated regret priming is an effective means of DA use persuasion, and may be especially effective when the task is considered to be difficult.

Study 2 replicates the main finding of Study 1 in a more practically realistic setting. This second study built upon the literature of message framing and persuasion, and investigated whether regret anticipation can also be triggered by a persuasive text. In particular, it coupled the regret anticipation prime with message framing to provide a first instance of the way regret-appealing messages could be used to influence the acceptance of decision aids in practice. In addition, by introducing a "no complexity" experimental condition, this study adds validity and realism, as in practice decision makers may not be aware of the number of alternatives before they engage in search behavior.

2.8.1 Implications

This study investigates the impact of the anticipation of regret on consumer decision-making across various task characteristics (complexity) and individual differences (domain expertise) by synthesizing prior work on technology acceptance, anticipated regret, prefactual thinking and message framing. Taken together, our findings show that persuasive attempts appealing to the cognitive emotion of anticipated regret can successfully steer decision makers toward the adoption of decision aid technologies. Research in decision-making shows that when confronted with the anticipation of negative emotions, individuals choose either the problem-focused coping

strategy (put in more effort) or emotion-focused coping (decision avoidance) strategy (Anderson, 2003). How this theory translates to the domain of online decision aid adoption is not straightforward. In other words, there is no intuitive answer to whether someone anticipating negative emotions would prefer to require decision assistance through technology. Our experiments provide initial evidence on the motivating role of anticipated regret to obtain decision assistance. Given these findings, marketing managers and DA designers may want to incorporate anticipated regret-laden messages into the design of websites that use DAs, and steer users towards their adoption and use. In spite of the DAs' aim of improving the decision quality and minimizing decision effort (Haübl & Trifts 2000), consumers do not adopt them at high rates (Breugelmans et al., 2012; Murray & Häubl 2009; Sieck & Arkes 2005). Our current research shows that prompting anticipated regret of making the wrong choice can be a potentially powerful means to promotes the use of online decision aids.

2.8.2 Limitations & Future Research

Our research followed an experimental paradigm in showing the motivational character of anticipated regret in acceptance and use of technologies that support consumer decision-making. As such, our study inherits certain limitations that characterize experimental studies (control vs. realism). Firstly, rather than exposing the participants to a real technology, this was a scenario study where participants had to imagine being in a certain situation. As such, this design allows for higher experimental control but at the same time, realism is hampered. To confirm that the scenarios were adequately realistic, two items were used to assess subjects' perception of realism. Mean realism was satisfactory for all experiments (see Study 1 and 2). Further research is needed to validate our results in a real-world, decision aid setting.

Secondly, research in advice taking has shown that task complexity is not the only moderator of advice usage. For instance, advice taking behavior may depend on the perception of source expertise (e.g., Sniezek, Schrah, & Dalal, 2004). People are also more responsive to advice from older, better-educated, wiser, or more experienced advisors (Feng & MacGeorge,

2006). Whereas prior research has focused on the advisor's features, research on the characteristics of the advice is far more limited. Two variables have received attention in this area: the quality of advice and its cost. The higher the quality of advice, the less advice is discounted (Yaniv & Kleinberger, 2000), although good advice is still often discounted (see for instance Gardner & Berry, 1995). To that respect, and given the fact that — the perception of — complexity and decision quality may both be influenced by the level of expertise of the decision maker, exploring the interplay between anticipated regret, complexity and expertise may provide insights on the process through which our effects are manifested. Due to low statistical power on both our studies (<.60), the albeit interesting 3-way interaction was not included. Gino and Moore (2005) also showed that advice is weighed more heavily when it is costly, holding its quality constant. Nevertheless, decision assistance provided by decision aids is traditionally a free service embedded in the website of the provider. Monetization of decision support technologies is a relatively unexplored and possibly promising area.

A third aspect that might affect the extent to which advice is used are the features of the task, as those that we studied in our current research. Using a different task rather than a flight plan decision will add to the generalizability of our results. Additionally, priming techniques have been extensively studied in psychology research and have been successfully used to increase individuals' decision-making performance (Bartlet, Dennis, Yuan, & Barlow, 2013). Primes can be delivered through two different levels of awareness — subliminal or supraliminal. Our work employs a supraliminal priming technique, that is, individuals are provided with a conscious task, but they are not aware of the prime's effects. A subliminal priming technique, where individuals are not aware of any priming, can add to the reliability of our results and minimize possible demand effects of explicit manipulation.

What is more, we must note that although MTurk presents a valuable data collection opportunity, it suffers from certain threats to validity and generalizability (cf. Paolacci et al., 2010). Statistical power may also be hampered as participants are less likely to pay attention to experimental procedures (Goodman et al., 2012, Oppenheimer et al., 2009). Yet again, this problem is solvable, either through "catch trials" that identify subjects who

failed to pay close attention, or through instructional manipulation checks that identify inattentive subjects and remind them to pay more attention (Oppenheimer et al., 2009: Paolacci et al., 2010). Our experimental design implemented instructional manipulation checks by asking participants the number of flight plan options available for respondents to choose from (3 vs. 100 plan options) towards the end of the task.

Finally, a future research opportunity would be to follow up on research by Baumgartner et al. (2008) that indicates that the intention of people to pursue a behavior is followed by affective reactions related to future events, reactions that may influence goal-directed behavior. These authors distinguish between two types of future-oriented emotions:

- Anticipatory (emotions currently experienced due to the prospect of a desirable or undesirable event in the future — e.g. hope or fear).
- Anticipated (emotions expected to be experienced in the future once certain desirable or undesirable future events have occurred — e.g. anticipated joy or regret).

The authors suggest that both types of emotions motivate future behavior through their influence on behavioral intentions. Actually, a number of past studies in social psychology demonstrate that both anticipated and anticipatory emotions increase intentions even when controlling for other determinants of behavior, such as attitudes, subjective norms, perceived behavioral control or past behavior. More importantly, Baumgartner et al. (2008) demonstrate that negative emotions are more powerful determinants of behavioral intentions than positive emotions. "Perhaps negative emotions are more important motivators of behavior when the future event is associated with undesired outcomes, whereas positive emotions might have more effects when the future outcomes are desired".

The investigation of the effect of positive anticipated and/or anticipatory emotions on decision aid acceptance would be a natural extension of the current work, and garners further investigation. Research in message framing has shown that negatively framed messages are more persuasive than positive ones. Whether this is the case for anticipated emotion-laden messages in the context of decision aid acceptance remains an open question.

3

The Impact of RA Decision Strategy Extensiveness on User Effort and RA Evaluation

3.1 Introduction

Any decision between products that an individual is contemplating is inherently also coupled with the individual's choice of how to decide (Gershman, Horvitz, & Tenenbaum 2015; Lipman, 1991; Payne, Bettman, & Johnson 1993). In other words, when making a choice, consumers have a number of decision strategies in their decision-making toolbox, and they are called to utilize one or more of them in order to make a certain choice.

Since different decision strategies vary in how accurate, effortful, emotionally wrenching, or easy to justify they are, consumers select the decision approach that best fits a specific situation (Bettman, Luce, & Payne, 1998; Kurzban, Duckworth, Kable, & Myers 2013). There is a large body of literature on decision-making examining the characteristics of decision-making strategies and their effects on decision outcomes. Some strategies are more extensive and effortful (e.g., the weighted-additive decision strategy or WADD) and others are more selective, fast and less demanding of cognitive resources (e.g., the Elimination-By-Aspect decision strategy or EBA) (c.f Johnson & Payne 1985; Payne, Bettman, Coupey, & Johnson, 1992).

Product Recommendation Agents (RAs) aim to improve users' decisions by supporting their decision-making strategy. However, RAs themselves also use decision strategies to generate recommendations (Wang & Benbasat, 2009). For example, RAs may sort alternatives on the basis of a sin-

gle criterion such as price, or they may use more complex user models to generate a balanced ranking criterion to sort alternatives. The topic of RA decision strategies, along with RA evaluation, and RA user acceptance has enjoyed considerable scholarly attention (Xiao & Benbasat, 2007, 2014).

However, relatively little research has investigated the existence of an interplay between the perceived user effort involved in generating the recommendation and the user's evaluation of the recommendation that is provided by the RA as a consequence of this user effort. This is surprising, as similar to human decision-making, it is likely that there are trade-offs between how much effort a user needs to put into the recommendation process (e.g., by answering questions about his or her preferences) and the anticipated quality of the recommendation. Therefore, in this research we address the question of how the use of a more versus less extensive RA decision strategy affects users' perceived effort in interacting with the RA and their evaluation of the RA itself and the decision process.

More specifically, we are interested in the interplay between the three following elements: RA Type, Perceived User Effort, and User Evaluation of RAs. To investigate the impact of different decision strategies on User Effort and RA evaluation, we used an experiment by varying the type of RA decision strategies to attain a sufficient variation of decision strategy extensiveness, which allows for a reliable test of our hypotheses. For this purpose, we constructed a RA system that the subjects in the experiment accessed through a web browser.

3.2 Decision Strategy Extensiveness

We focus on the role of an RA's decision strategy on User Effort and RA evaluations (see Figure 1 for a graphical overview of the hypothesized relationships). These relationships fit within a more general model of RA evaluation process that has been proposed in the literature (see Xiao & Benbasat, 2007 and 2014 for an excellent review). A good starting point for theorizing about this relationship is the decision-making literature that establishes that consumers utilize different decision strategies when making choices (Bettman, Johnson, & Payne, 1991; Payne, Bettman, & Johnson, 1993). Two main deci-

sion-making goals compete in this process: decision quality maximization and effort minimization. For a given product choice, individuals choose between decision strategies that are characterized by a number of dimensions. In this research we focus mainly on the contrast between decision strategies that are more extensive and generate better decision outcomes (such as WADD) versus strategies that are more heuristic in nature and generate a reasonable outcome more quickly (such as EBA). Payne, Johnson and Bettman (1993) provide an excellent overview of these and other decision strategies that vary in complexity and accuracy in determining the best possible choice outcome.

The classification on individual decision strategies, as described by the framework of Payne and colleagues, can be characterized by extensive, limited, or variable amount of processed information. Normative decision strategies (such as WADD) are extensive, whereas heuristic decision strategies (such as EBA) are limited in the amount of information processed by the decision maker, or in our case by the RA.

Looking at how an individual utilized the more elaborative, normative strategy of WADD and how RA scholars have operationalized this in past IS studies (e.g. Wang & Benbasat, 2012; Tan, Teo, & Benbasat, 2010) a striking difference can be observed. The design of normative RAs takes into account the relative importance of a user's attribute preferences and allows for trade-offs among these preferences, fully using all of the information on available alternatives in making choices. On the same time though, the decision-making literature explicates one more step of normative processing. When deploying this strategy, an individual considers the values of each alternative on all attributes. One assigns importance weights to each of the attributes and then calculates a weighted value, which derives from multiplying the weights with the values if each alternative, for each attribute. The weighting is representative of the trade-offs which one has to make. However, RAs are typically hiding this process from the user, only asking for importance levels, without showing real-time changes to the values for other related attributes (Xu, Benbasat & Cenfetelli, 2014). Xu et al. (2014) is the first to examine the effect of trade-off transparency in the RA context. The study shows that medium levels of trade-off transparency benefits user

experience by increasing enjoyment and product diagnosticity. High trade-off transparency has opposite effects. Consequently, normative decision strategies are characterized by trade-off transparency due to their characteristic of weighting, whereas heuristic ones are scoring low on this dimension. The following table summarizes the characteristics of the RA strategies examined in this paper.

Table 1 — Characteristics of Decision Strategies

	Trade-off transparency	Amount of info processed	Selective vs. consistent	Attribute- vs. alternative-based
WADD	High	Extensive	Consistent	Alternative
EBA	Low	Limited	Selective	Attribute

3.3 RA Evaluation

A number of studies have demonstrated that the characteristics of a task play a role in user evaluations, behavior, task performance, and decision outcomes (e.g. Kamis, Koufaris, & Stern, 2008; Jiang & Benbasat 2007; Tan et al., 2010). The area involving the evaluation of different RA types has received considerable scholarly attention. Studies comparing the evaluation of content-filtering vs. collaborative filtering RAs (e.g. Schafer, Konstan, & Riedl, 2002), compensatory vs. non-compensatory RAs (e.g. Tan et al., 2010) and feature-based vs. needs-based RAs (Koehler, Breugelmans, & Dellaert, 2011) have shown that these RA characteristics influence the customers' decision-making processes and outcomes, as well as their evaluation of these systems. Among these types, one classification that is a central type to the working of an RA is the distinction between compensatory and non-compensatory decision strategies. Compensatory processes involve trade-offs among attributes, such that for a given alternative, a high value on one attribute can compensate for a low value on another attribute.

As per Wang and Benbasat (2012) this study focuses on the two most commonly studied RA decision strategies, that is, WADD (Weighted additive) and EBA (Elimination By Aspect). A WADD strategy evaluates each

product alternative based on all its relevant attributes. The user assigns each attribute an importance. The WADD-based RA generates a score for each alternative by adding up the products of each transformed (e.g., normalized) value and attribute weight. Users are provided with a list of recommended alternatives according to their weighted total scores upon completion of computations for these alternatives. The WADD strategy considers the importance of each user attribute preference and makes trade-offs among these preferences to generate product advice. With an elimination strategy (EBA), each alternative is evaluated along with its various attributes, and any alternative that violates a value threshold specified by the user for an attribute is eliminated. Unlike the WADD, the EBA strategy does not fully process users' preferences; that is, lower-valued attributes are not compensated by higher-valued ones (Wang & Benbasat, 2009). Many product alternatives with a satisfactory overall quality, risk being prematurely eliminated by an EBA-based RA.

A large body of evidence demonstrates the influence of RA type on different RA use outcomes. In an experimental task asking participants to buy a camera, Fasolo et al. (2005) show that individuals using more extensive WADD type RAs have more confidence in their product choices than those using less extensive EBA type RAs. In their comparison of a compensatory (WADD type) vs. a non-compensatory agent (EBA type), Tan et al. (2010) find that the WADD agent is evaluated higher in terms of quality than an EBA agent. Similarly, Lee and Benbasat (2010) found that alternative-based (WADD type) RA users made more accurate product choice decisions. However, Kamis et al. (2008) find a contrasting result in that an attribute-based (EBA type) RA is perceived to be more useful than an alternative-based (WADD type) RA. Thus, while the results in the literature are somewhat mixed, most findings point to a positive impact of more extensive RA decision strategies on users perceived decision quality and RA quality. Therefore we hypothesize:

Hypothesis 1a: An RA deploying a more extensive (WADD) decision strategy leads to higher perceived Decision Quality than an RA using a less extensive (EBA) decision strategy.

Hypothesis 1b: An RA deploying a more extensive (WADD) decision strategy leads to higher perceived RA Quality than an RA using a less extensive (EBA) decision strategy.

3.4 User Effort

Research in consumer decision-making provides evidence that individuals get more satisfaction out of a product when they exert considerable effort to obtain it (Cardozo, 1965). The effort heuristic suggests that individuals assign higher quality to products which require greater effort in producing them (Kruger, Wirtz, Van Boven, & Altermatt, 2004). These phenomena are explained by decision makers' tendency minimize the effort they put in a certain task. If their task is to evaluate a product they tend to use cues which allow them to make a judgment in a fast and frugal way (Gigerenzer & Gaissmaier, 2011). Accordingly, when it comes to the evaluation of an Information Systems (IS), users also tend to make effort-based judgments of quality.

In the RA research area, initial evidence on this proposition was provided by the early work of Todd and Benbasat (1991, 1992, 1993). In one of their more recent studies, they highlight that "it appears that the potential influence of decision aids on decision quality cannot be understood without taking into account the way the decision aid influences the effort required to use alternative decision strategies." (Todd & Benbasat, 2000, p. 104). This think-aloud protocol analysis is the first signal linking RA decision strategies and their evaluation with the effort required to use them. Users use RAs in such a way as to maintain a low overall level of effort expenditure and will employ a particular strategy if the RA makes it easier relative to competing alternative strategies.

Wang and Benbasat (2009) also discovered a positive relationship between user effort and one's intention to use the RA. User effort is a construct closely related to Perceived Effort to use and Perceived Ease of Use (Li & Tsekouras, 2012; Venkatesh et al., 2003). There is an inverse relationship between the two. The higher the ease of using an RA, the less effort is expected in using it. Users are, in general strongly influenced by the interface features of websites, such as the amount of iterations needed in using them (Wang &

Benbasat, 2012).

Ease of Use, is another effort-related construct that has been investigated in the literature. The relationship between Perceived Ease of use and the RA for a commercial shopping mall, has been investigated by Lee and Lee (2009). Through manipulating the amount of information collected by the website for providing recommendations, they found a positive relationship between perceived usefulness and expected personalization. However, they did not theorize on the relationship of RA characteristics and effort to use the RA.

Yang and Wang (2012) find a significant mediating effect of RA evaluation perceptions (i.e. usefulness, control, enjoyment) on one's intention to use an RA. On the same time though, they avoid developing hypotheses on the possible mediating effect of ease of use or perceived effort to use on the dependent variables. These findings indicate that effort plays a role in the evaluation of RAs. Nevertheless, to the best of our knowledge, no studies have investigated the relationship of RA decision strategies with users' perceptions of how easy — or effortful — it is to use the RA (Xiao & Benbasat, 2007; 2014). In addition, the current study also examines the mediating role of User Effort in the impact that different RA strategies have on the evaluation of both the evaluation of the RA and the decision-making process.

One of the main goal of using a recommendation agent is to minimize effort (e.g., Todd & Benbasat, 1992). At the same time, decision makers are experiencing elaborative thinking as decision difficulty (Roets & Van Hiel, 2011). In the human-technology interaction literature, researchers have recently also discovered that the extent to which choices made out of recommended alteratives are perceived to be difficult, is negatively impacting users' satisfaction with the choices they make (Willemsen, Graus & Knijnenburg, 2016). When we turn to the two decision strategies that we address in this research, WADD versus EBA, we see in previous research that despite having to make trade-offs between attributes, users of WADD agents tend to engage into less iterations with the agent, and spend less time inputting their preferences (Tan et al., 2010). Wang and Benbasat (2012) showed that the number of iterations users go through in interacting with an RA (an objective measure of user effort) is greater for an EBA-based RA than for

a WADD-based RA. They also show that users perceived to be expending more effort using the EBA-based RA than the ones using the WADD-based RA. However, Lee and Benbasat (2010) could not confirm their hypothesis that users of WADD-based RAs spend less time (an objective measure of user effort) making decisions.

Previous research on decision strategies and RA use has then shown, that an RA using an extensive decision strategy (WADD) is perceived to be less effortful than an RA using a more limited decision strategy (EBA). However it is worth pointing out that these studies have implemented the RA's decision strategy at the algorithm level while the RA's corresponding preference elicitation method did not precisely involve the required input and steps by the decision maker that correspond to the decision strategy. Both Lee & Benbasat (2010) and Wang & Benbasat (2012) created a WADD type RA where participants were required to indicate desirable attribute levels for each attribute and indicate the importance level of their choice on a nine-point scale. However, this design does not involve compensatory decision-making by the participant, a main characteristic of the WADD strategy.

In particular, the WADD strategy is "The weighted additive rule considers the values of each alternative on all relevant attributes and considers all the relevant importances or weights of the attributes to the decision maker. Further, the conflict among values is assumed to be confronted and resolved by explicitly considering the extend to which one is willing to trade-off attribute values, as reflected by the relative importances or weights" (Payne, Bettman & Johnson, 1993, p.24). It is exactly this trade-off process that is not reflected in previous designs. The process of assigning weights in a compensatory way is effortful and requires substantial processing. In our research we therefore require participants to actively make compensatory trade-offs as input for the WADD type RA. As a consequence, we also hypothesize an opposite effect to what has been found in the literature to date.

Hypothesis 2: An RA deploying a more extensive (WADD) decision strategy leads to higher User Effort than an RA using a less extensive (EBA) decision strategy.

3.5 The Impact of User Effort on RA Evaluation

Research in consumer behavior has shown that, although consumers do not enjoy exerting their own effort in making decisions, they welcome the effort exerted by others (Mohr & Bitner, 1995). Bechwati and Xia (2003) investigated whether "computers sweat" and found that consumers' satisfaction with the search process is positively related to their perception of effort that they save by using electronic decision aids. Thus, we expect that excessive effort to use a recommendation agent will negatively influence the evaluation of the decision process.

Similarly, when there are too many clicks required to obtain detailed information about recommended items (higher effort), users are generally less satisfied with the system. "The reason is that this type of effort of use of a RA indicates a cost increase without additional expected benefit" (Li & Tsekouras, 2012). Research within the Technology Acceptance paradigm has also shown that the easier a system is to use, the more useful it is perceived to be (for a review see Venkatesh & Davis, 2000).

Hypothesis 3a: Greater User Effort decreases perceived Decision Quality.

Hypothesis 3b: Greater User Effort decreases perceived RA Quality.

3.6 Mediating effect of User Effort

In the previous sections, we theorized about the fact that RA decision strategies extensiveness increases User Effort and decreases Decision Quality as well as the RA. Here, we hypothesize that user effort also functions as mediator of the effect of RA decision strategy extensiveness on decision quality and RA quality.

For decision quality and RA quality, we propose that besides the hypothesized direct effect of a more extensive strategy, individuals will also cognitively take into account that when they need to put in more user effort, the results that they obtain by using the RA will be of lower quality. In particular, we expect individuals to anticipate the negative effect of user effort on

decision quality and RA quality when considering the impact RA decision strategy extensiveness. For example, an individual may be aware of the fact that they will not have sufficient time or cognitive capacity to go through an extensive RA decision strategy in detail, and therefore project that the outcome of the recommendation process will be of lower quality. This awareness of the cognitive relationship between user effort and decision quality is also evident in the literature. In particular, Kamis and Davern (2005, p. 11) argue: "the effort-accuracy literature has shown that people generally have a preference for effort minimization, but that people do strive for increased accuracy, as long as the extra effort required is minimal.". Therefore, we hypothesize:

Hypothesis 4a: The effect of RA decision strategy extensiveness on decision quality is mediated by user effort.

Hypothesis 4b: The effect of RA decision strategy extensiveness on RA quality is mediated by user effort.

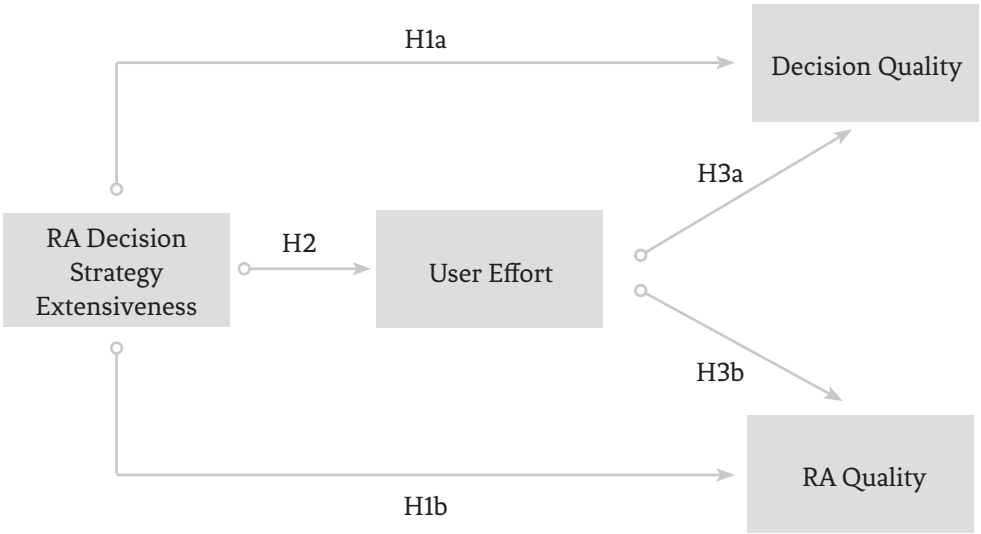


Figure 1 — Research Model

3.7 Research Methodology — RA Design & Procedures

We based our RA design on the principles of Multi-Attribute Utility Theory (MAUT) which provides an axiomatic foundation for choices involving multiple criteria (Dyer, Fishbun, Steuer, Wallenius, & Zionts, 1992). MAUT allows the evaluation of different product alternatives with regard to their utility for the current customer. In this context, each product is evaluated according to a predefined set of interest dimensions. This framework allows for a decision maker who chooses one (or a subset) of a set of alternatives evaluated on the basis of two or more criteria or attributes.

We developed a web-based platform incorporating three different recommendation algorithms' based on the choice heuristics corresponding to the elimination and additive-compensatory decision strategies (see appendix A, for the used algorithm). For the purposes of our experiment the RA targeted individuals looking to rent a home in the area of a major European city. They were told to imagine that they just found a new job in the city and one of the first things they had to do is to find a new home there. They were then asked to navigate to the "Home Advisor", a website that assists them to choose the best home in the city, according to their preferences, by filling in a number of home features. In order to make the RA as realistic as possible we collected data from the largest Dutch real estate website (http://www.funda.nl/). 322 homes were used in the database. Next participants were provided with a personal code and a link to our platform to start the experiment. To make it easier for mobile phone users, we provided the users a QR code so that they can simply scan it to access the RA instead of typing a URL, as it can be rather cumbersome on a small screen.

We asked the users to enter a code in a pop-up window to match their survey responses and their interactions with the RA. The first page of the website varied, depending on the condition to which each participant was randomly assigned to. The participants were either seeing bars (Elimination RA) or fill-in fields (Additive Compensatory RA) on the following 10 dimensions: number of rooms, type of apartment, living space, construction type, garden size, rental conditions, deposit type, construction period, price, neighborhood safety rating. On the results page, users were presented with

the results of their search (see appendix A for screenshot of the output). Last, participants were redirected back to the survey interface, after choosing one home to view.

3.7.1 Experimental Design

To test our hypotheses, we run a 2x2 between subjects' design, where we manipulate RA strategy (WADD vs. EBA) and the platform which is used to access the RA (desktop vs. smartphone). Mobile browsing and the app cultures is booming the last years, so it seemed relevant to rule out the possibility of a significant platform effect.

In order to achieve a high degree of internal validity in our results, a laboratory setting was used (Singleton & Straits, 1999). The success of the manipulation of RA decision strategy extensiveness was investigated by asking participants whether the first step of the RA was to require the assignment of importance levels to every home feature on the screen. This was correct for the WADD strategy but not for the elimination strategy.

3.7.2 Measures

The variables in our research model were measured with well-established multi-item measures. Cognitive effort is defined as the total amount of cognitive resources — including perception, memory, and judgment — needed to complete a task (Russon & Dosher, 1983). User effort refers to the (cognitive) effort expended in using a decision aid (Wang & Benbasat, 2009). Measures for User Effort (Wang & Benbasat, 2009) asked participants to rate the effort expended to use the RA and included the following four 7-point Likert scale items: "The task of using the Rental Advisor to choose a home took too much time.", "Using the Rental Advisor to choose a home required too much effort.", "The task of using the Rental Advisor to select a home was easy." (reverse coded)," The task of using the Rental Advisor to select a rental home was too complex".

Perceived decision quality (Tan et al. 2010) is a subjective indication of how a decision maker perceives his or her decision to be accurate, correct, precise, and reliable (Mennecke & Valacich 1998). It was measured using four 7-point scale items and asked participants whether homes that suited

their preferences were recommended by the Rental Advisor, whether homes that best fit their needs were provided by the Advisor, whether homes recommended did NOT match their needs (reverse) and if they would choose from the same set of alternatives provided by the Advisor in future renting occasions.

Perceived RA quality, a subjective indicator, reflects the degree to which the consumer perceives the decision aid to be capable of assisting him in reaching a decision (DeLone & McLean 1992). The measure was adapted from Tan et al. (2010) and 7-point Likert scale items, asking users whether the functions provided by the Rental Advisor were what they would need to make rental decisions, whether the advisor has helped them in making good rental viewing decisions and whether the Rental Advisor was one of the best ways to accomplish the tasks assigned.

The manipulation of the extensiveness of the RA decision strategy was checked with two 7-point (Strongly Disagree–Strongly Agree) Likert items "The Advisor's first step was to assign importance levels to every home feature" and "The Advisor discarded some homes primarily because they didn't meet the cutoff value for certain home features." The first statement is true for the WADD agent, whereas the second statement is true for the EBA agent.

3.7.3 Data

Data was collected in four sessions on subsequent days in a university research lab. 154 participants took part in the sessions. The data was analyzed for outliers and missing values. Outliers on the time that each participant took to complete the experiment was defined using the g = 2.2 labeling rule (Hoaglin & Iglewicz, 1986; Hoaglin, Iglewicz, & Tukey, 1987). Identified outliers were removed. This resulted in 134 participants that were used in the analysis. Most of our participants were relative young, with 98.5% in the age group between 18 and 24 years old. 64.9% of the participants were female. 83.6% had as highest completed education degree a high school diploma and 16.4% had a College or University Bachelor's degree. As a first step reverse score items that were negatively keyed were rescored in the direction as the other measures. Next, Cronbach's Alpha test indicates no construct scored less than 0.7, providing support for the reliability of the measures used.

Table 2 – Reliability Analysis

Variable	Number of Items	Cronbach's Alpha
User Effort	4	0.889
Decision Quality	4	0.855
RA Quality	3	0.857

A confirmatory factor analysis indicated that the three anticipated factors were extracted from our data. Appendix B provides the factor loadings for the three component factor solution, using Varimax rotation. We observed that two of the items ("perceived RA quality — The Advisor has helped me in making good rental viewing decisions" and "perceived decison quality — I would choose from the same set of alternatives provided by the Advisor in future renting occasions") loaded on two factors. These items were therefore removed in our further analysis and not included in the composite score per factor.

3.8 Results

The manipulation of RA Decision Strategy Extensiveness was successful. Users assigned to the WADD condition recognized that the advisor's first step was to assign importance weights to every home feature (Mean= 5.40), more than those using the EBA strategy (Mean = 4.68, M.D. = .71, $p < .005$). Users using the EBA strategy also recognized that the advisor discarded some homes, primarily because they didn't meet the cut-off value for certain home features (Mean= 5.20), more than those using the WADD strategy (Mean = 4.55, M.D. = .65, $p = .001$).

To test H1a, H1b and H2 we ran three oneway ANOVAs. The hypotheses stated that there are differences between the two RA decision strategies in terms of their perceived Decision Quality (H1a), RA Quality (H1b) and in terms of User Effort (H2) respectively. The main effect of the Decision Strategy Extensiveness (WADD versus EBA) had no significant direct effect on

perceived Decision Quality ($F(1, 132) = 2.68$, $p = .10$) nor on perceived RA Quality ($F(1, 132) = .25$, $p = .61$). Decision Quality for the extensive decision strategy WADD (Mean = 4.50) was lower than for the less extensive strategy EBA (Mean= 4.90) (M.D= .40). RA Quality for the extensive decision strategy WADD (Mean = 4.43) was lower than for the less extensive strategy EBA (Mean= 4.55) (M.D= .12). Thus we reject both H1a and H1b.

The effect of RA Decision Strategy Extensiveness on User Effort was significant ($F(1, 132) = 10.28$, $p < .01$). This result supports our hypothesis (H2). Participants using the WADD-based RA, perceived the agent to require more User Effort (Mean = 3.38) than those using the EBA-based RA (Mean= 2.67, M.D= .29)[5].

Next we tested H3a and H3b, regarding the effect of User Effort on Decision Quality and RA Quality by using separate linear regression models for each of the hypotheses. First, we find a significant negative effect of User Effort on Decision Quality ($R2 = .11$, $F(1, 132) = 17.42$, $p<.0001$). Higher User Effort leads to lower Decision Quality ($B = -.34$, $t(132) = -4.18$, $p < .0001$). This provides support for H3a. Second, we find a significant negative effect of User Effort on RA quality ($R2 = .04$, $F(1,134) = 5.32$, $p < .01$). Higher User Effort leads to lower RA quality ($B = -.20$, $t(132) = -2.30$, $p < .01$). This provides support for H3b.

3.8.1 Mediation

The possible mediating role of User Effort on the effect of RA Decision Strategies on Decision Quality and RA Quality was examined through the procedures delineated in Zhao, Lynch and Chen (2010). The following table compares Zhao et al.'s approach to mediation to the more often used procedure by Baron and Kenny (1986).

5 At this point we also tested the moderating effect of the platform which did not prove to be significant ($F(2, 49) = 1.31$, $p = .25$).

Table 3 – Mediation typologies comparison

Zhao et al. (2010) Typology	Baron and Kenny
Complementary mediation: Mediated effect (a×b) and direct effect (c) both exist and point at the same direction	overlaps with partial and full mediation
Competitive mediation: Mediated effect (a×b) and direct effect (c) both exist and point in opposite directions	no mediation
Indirect-only mediation: Mediated effect (a×b) exists, but no direct effect	no mediation
Direct-only non-mediation: Direct effect (c) exists, but no indirect effect	no mediation
No-effect non-mediation: Neither direct effect nor indirect effect exists	no mediation

The classic approach to mediation analysis examines the direct and indirect pathways through which an antecedent variable X transmits its effect on a consequent variable Y through one or more intermediary or mediator variables. To establish the X–Y relationship through a mediating variable M Baron and Kenny (1986, p. 1176) recommend three tests:

> A variable functions as a mediator when it meets the following conditions: (a) variations in levels of the independent variable significantly account for variations in the presumed mediator (i.e., Path a), (b) variations in the mediator significantly account for variations in the dependent variable (i.e., Path b), and (c) when Paths a and b are controlled, a previously significant relation between the independent and dependent variables is no longer significant, with the strongest demonstration of mediation occurring when Path c is zero.

Note that condition c requires a significance test for the "direct" Path c. Paths a, b, and c are tested and estimated by equations 1, 2, and 3:

$$M = i_1 + aX + e_1. \quad (1)$$

$$Y = i_2 + c'X + e_2. \quad (2)$$

$$Y = i_3 + cX + bM + e_3. \quad (3)$$

According to Baron and Kenny, a significant "effect to be mediated" in equation 2 is necessary for mediation to take place. It seems intuitive that, without an effect to be mediated, there is no point in further investigating whether the effect of X on Y is in fact mediated by M. However, this intuition is not correct. There need not be a significant zero-order effect of X on Y, r_{XY}, to establish mediation. What Baron and Kenny (1986) and most users of their tests thereafter have missed is that the zero-order effect of X on Y is in fact mathematically equivalent to the "total effect" of X on Y.

$$c = (a \times b) + c. \quad (4)$$

That is, it exactly equals the sum of the "indirect path" (path a x path b, usually hypothesized) and the "direct path"" (Zhao et al. 2010, p.199). If c and a x b are of the same sign, c´ will have the same sign. But if c and a x b are of opposite signs then c´ can be close to zero and the X–Y test may fail. Zhao et al. 's approach established that the only one requirement to establish mediation, is for the indirect effect a x b to be significant. Zhao et al. also show that the classic Sobel test for mediation is low in power compared to a bootstrap test popularized by Preacher and Hayes (2004), in some cases markedly so. Accordingly, in Zhao et al.'s mediation typology, c now represents only the total effect—not the "effect to be mediated." In that way, the X–Y test (Baron & Kenny, 1986) is never relevant to establishing mediation.

As was already shown in testing H2, there is a significant main effect of a more extensive RA Decision Strategy on User Effort. The tests of H1a and H1b, showed there are no direct main effects of a more extensive RA Decision Strategy on Decision Quality and RA Quality. Thus, indirect-only mediation may have occurred for Decision Quality and RA Quality.

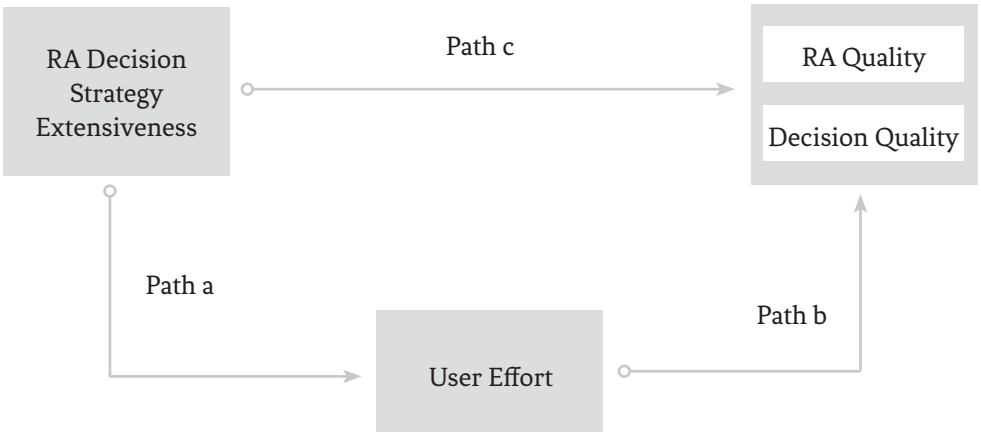


Figure 2 – Mediation notations

The results of bootstrap confidence intervals' implementation, as they are specified in Preacher and Hayes (2004, 2008) at 95% confidence interval and 5,000 bootstrap re-samples are the depicted in Table 4 and 5.

Table 4 — Decision Quality— PROCESS[6] Results[7]

	Coefficient	s.e.
Path a (Extensiveness → User Effort)	.76***	.22
Path b (User Effort → Decision Quality)	-.40***	.08
Path c (Extensiveness → Decision Quality)	-.09	.23
Indirect (axb) bootstrap	-.30*	.11
Indirect effect 5000 bootstraps C.I at 95%	LL(.1260)	UL(.5745)

6 PROCESS macro provided by Hayes, http://www.processmacro.org/index.html
7 where *P ≤ 0.05, **P ≤ 0.01, ***P ≤ 0.001

Table 5 — RA Quality— PROCESS Results

	Coefficient	s.e.
Path a (Extensiveness → User Effort)	.76***	.22
Path b (User Effort → RA Quality)	-.23*	.09
Path c (Extensiveness → RA Quality)	.05	.24
Indirect (axb) bootstrap	-.17*	.09
Indirect effect 5000 bootstraps C.I at 95%	LL(.0457)	UL(.4055)

The results of the mediation and PROCESS analysis indicate that the effect of RA decision strategy extensiveness on decision quality is mediated by user effort. For both mediation analyses, the bootstrap confidence intervals do not include zero. The PROCESS procedure by Hayes and Preacher confirms the significance of the mediating effects. We find there are only the indirect and negative effects of User Effort on Decision Quality and RA Quality. Hypotheses 4a and 4b are thus confirmed. User Effort mediates the effect of Decision Strategy Extensiveness of Decision Quality and RA Quality. However, the direction of the relationship is contrasting our expectations. This signals that although RA decision strategy extensiveness does not increase decision quality and RA quality itself, the fact that less extensive strategies save the user from putting extra effort to use the agent, does translate into the perception of higher decision quality and RA quality.

3.8.2 Additional Analysis

Following the null results on the main effect of of Decision Strategy Extensiveness yet, the presence of the mediating effect of User Effort, we performed an additional analysis, exploring further explanations for the seemingly disparate results. In section 3.8 we showed that the manipulation of Decision Strategy Extensiveness was overall successful. Nevertheless, there was considerable heterogeneity in participants' responses to the manipulation check questions. We therefore created an agregate score of these two

tests of understanding items and created two groups of "Strategy understanding" reflecting a low and high understanding segment based on a median scale split.

A Univariate ANOVA showed the extend to which Strategy understanding interacts with the impact of Decision Strategy Extensiveness on Decision Quality and RA Quality. The results indicated that for participants who do understand the working of the RA Decision Strategy, Strategy Extensiveness did have a significant effect on Decision Quality ($F(1,43)= 7.68$, $p< .01$). More specifically, Decision Quality was seen as higher for the EBA RA (Mean= 5.15) than for the WADD RA (Mean= 3.40), (M.D.= -1.75). Decision Strategy Extensiveness also had a significant effect on RA Quality ($F(1,43)= 7.00$, $p<.05$). RA Quality was higher for the EBA RA (Mean= 4.96) than for the WADD RA (Mean= 3.40), (M.D.= -1.56). However the same analysis for the low understanding segment did not reveal significant effects. Not surprisingly, we also found that the interaction of "Strategy Understanding" with Decision Strategy Extensiveness was significant. The analysis revealed a significant Understanding x Extensiveness interaction on Decision Quality ($F(1,96)= 10.18$, $p<.01$) and RA Quality ($F(1,96)= 12.41$, $p< .01$), with a stronger effect for the high understanding segment.

These results of the direct effect of Decision Strategy Extensiveness on Decision Quality and RA Quality contrast with our initial hypotheses regarding the main effect of Decision Strategy Extensiveness. However, they are aligned with the results of the mediation analysis, where we found a significant indirect negative effect through User Effort for the more extensive WADD RA. The lack of a total effect of Strategy Extensiveness on Decision and RA Quality that we observed earlier can thus very likely be attributed to the lack of Strategy Understanding for part of the sample.

3.9 Discussion

Overall, our results pinpoint to the importance of User Effort in the evaluation of recommendation agents and one's decision-making process. The absence of a direct effect on Decision Quality and RA Quality is followed by the mediating role of User Effort. In comparison to an agent which uses

the WADD strategy, a RA using the EBA strategy is perceived to lead to higher decision quality due to the fact that it saves users from effortful decision-making. Similarly, an extensive RA is not perceived as being of higher quality, but it does so, when it is perceived to not requiring high User Effort.

3.9.1 Implications for research & practice

This study sends a central message to researchers and practitioners who are interested in the study and development of RAs. Users value the degree to which a recommendation agent does not require a lot of effort on their part. They value having to put in less User Effort to the extent that they perceive an effort saving RA as being of higher quality, and leading to higher decision quality.

In contrast to past literature on RA strategies and their effect on the evaluation of RAs (e.g. Tan et al., 2010) our study does not show a direct relationship between RA Decision Strategy Extensiveness and Decision Quality, but a mediation by User Effort. Also in contrast to previous findings, we show that an RA employing an extensive decision strategy that is reflected in the user's own task, is perceived to be requiring more effort than a limited one. As such, we suggest RA researchers to consider the mediating role of User Effort while experimentally investigating the impact of different RA strategies on decision-making and RA evaluation. The results pinpoint to the importance of effort in the context of human-computer interaction. RA designers should pay utmost attention to the experience that a user has with a recommendation agent, rather than emphasizing how much higher the quality of a recommendation is. The results provide indirect support to the latest design principles that focus on User Experience (UX) rather than architectural excellence (Knijnenburg, Willemsen, & Kobsa, 2011; Kujala et al. 2011; Mahlke, 2006).

3.9.2 Limitations & Future research

A limitation of the way RA Decision Strategy Extensiveness has been included in our model is the following. Although, based on previous literature, we argued that a WADD-based RA uses a more extensive decision strate-

gy than an EBA RA, in this we study did not create a construct for extensiveness. Rather we measured if participants had correctly understood the more–versus less extensive way in which each strategy processed information. Consequently, future research may explore the construct of RA Decision Strategy Extensiveness in more detail.

What is more, our experimental framework examined only two types of recommendation agents: Content-based WADD and Content-based EBA agents. We anticipate that the research model delineated in this study applies to other RA strategies, such as collaborative filtering and hybrid RAs, and it would be worthwhile to investigate if this is indeed the case.

Limitations pertinent to the study population (highly educated students aging predominately between 18 and 22 years old) apply to this study as well. The experiment has also been conducted in a lab, controlled environment. In an actual RA use situation, were external nuisance is present; the reported results may be amplified or diminished. Future research should explore this possibility.

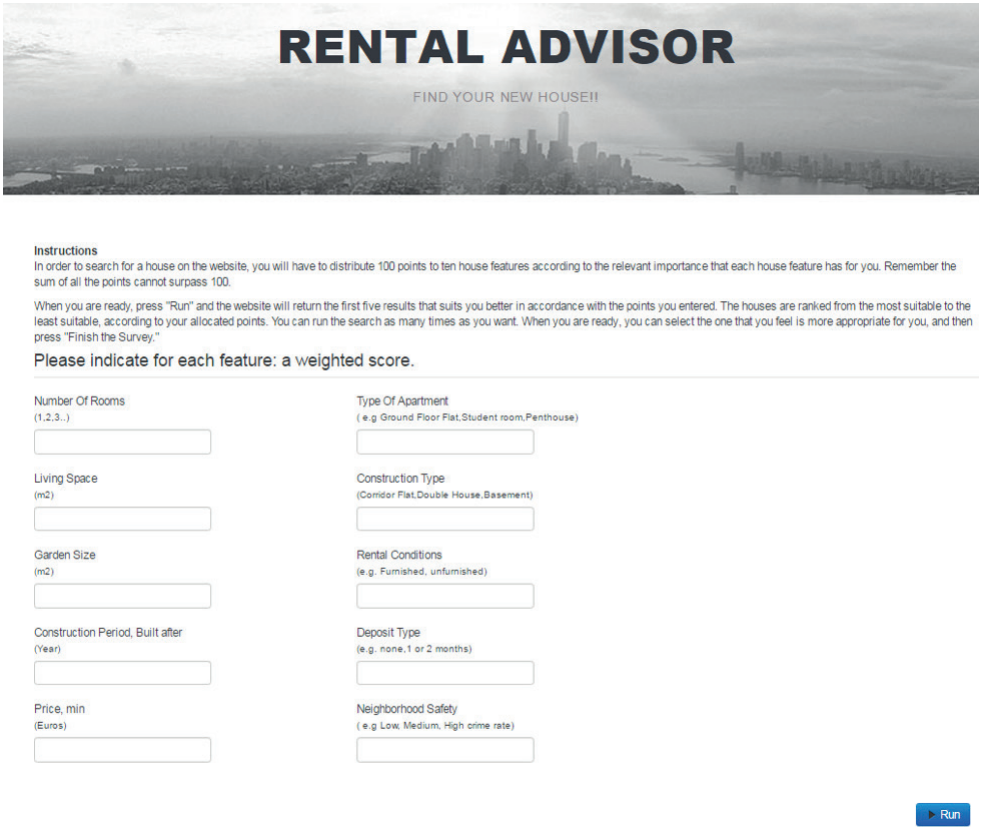
Lastly, the indiect mediation effect discovered between RA Decision Strategy Extensiveness, and User Effort, deserves further investigation. An interesting next step can be to record and compare the subjective measures of User Effort with objective measures such as time spent making the decision or number of iterations. Tan et al. (2010) have shown that decision makers are not accurate predictors of the accuracy of their RA-assisted decisions. Similar expectations can exist when estimating one's effort in using the RA. Lastly, a possible, additional mediator could be user process control.

APPENDIX A
RA Design

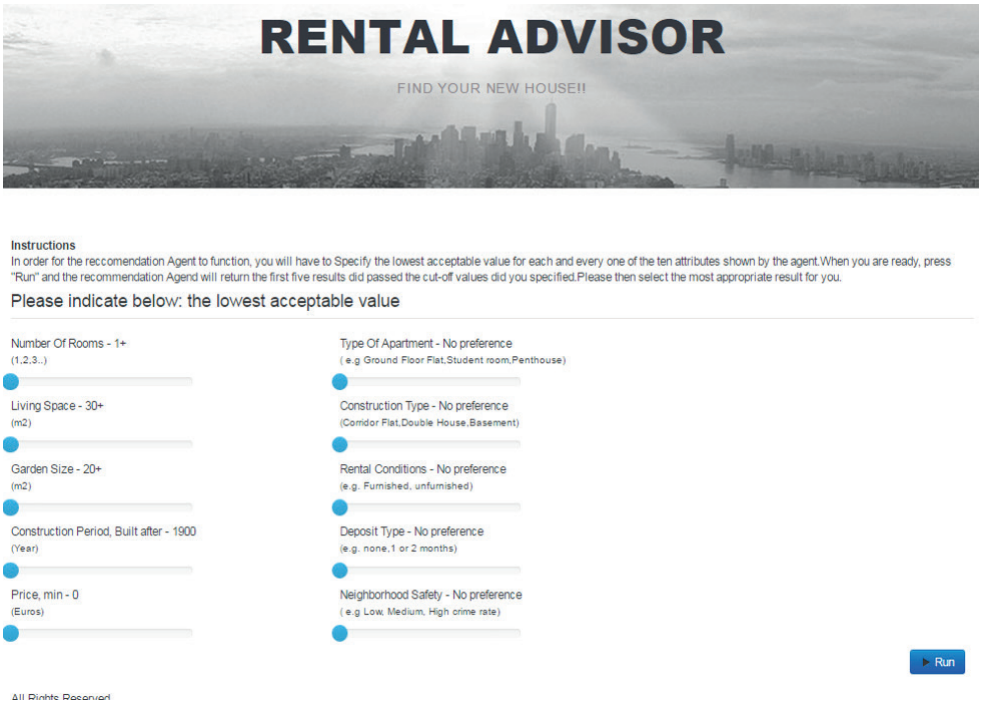
The project was built upon the Yii framework (www.yiiframework.com). The selection was made due to that is a free, open source web application development framework that promotes clean, dry design and encourages rapid development. The main advantage compared to other solutions, is that it works to streamline your application development and helps to ensure an extremely efficient, extensible, and maintainable end product. As its development is based on PHP, that was also the programming language used during the development. Our data, were also gathered on a MySQL database, one of the world's most popular database used. The whole project was saved on a server using Zpanel a free web hosting control panel, that supports Microsoft Windows and as an open source itself it also utilizes other free or open-source software like MySQL and Filezilla (http://www.zpanelcp.com/about/). For the whole development an integrated development environment (IDE), a software application that provides comprehensive facilities to computer programmers for software development (Wikipedia.org), was used and more specifically we chose to work with NetBeans as it is a free, open source and has a worldwide community of users and developers (https://netbeans.org/).

The first step was to design and test our three algorithms. The code is available upon request. When the result was the required one, we designed our database to support it with, based on the product we were going to use and its attributes that would accompany it. The agent is mainly based on two tables. Other supportive tables were also used for developing purposes. The table "Home" was the one where we stored the available homes of the agent. On the image below the structure of it can be observed.

WADD Screenshot



EBA Screenshot



RA Outcome

Results

House	Score	Number of rooms	Living space	Lot size	Construction period	Price	Type of Apartment	Construction Type	Rental conditions	Deposit	Neighborhood safety	
Wijnhaven 77 c	0	1	110	110	2013	1185	Upstairs flat	Corridor Flat	Furnished	No deposit needed	Low crime rate	Select
Wijnhaven 51 B	0	4	144	154	2009	2050	Upstairs flat	Corridor Flat	Unfurnished	2 month's rent	Low crime rate	Select
Wijnbrugstraat 319	0	3	120	124	2004	2100	Upstairs flat	Corridor Flat	Furnished	1 month's rent	Low crime rate	Select
Wijnbrugstraat 319	0	3	120	124	2004	2100	Ground Floor Flat + Upstairs flat	Corridor Flat	Furnished	1 month's rent	Low crime rate	Select
Wijnkade 49	0	2	67	67	1960	1000	Ground Floor Flat	Service Flat-apartment complex	Furnished	1 month's rent	Low crime rate	Select

APPENDIX B

Rotated Component Matrix[a]

	Component s.e.		
	Decision	Effort	RA Quality
Perceived effort: The task of using the Rental Advisor to choose a house took too much time.		0.897	
Perceived effort: Using the Rental Advisor to choose a house required too much effort.		0.898	
Perceived effort: The task of using the Rental Advisor to select a house was easy.		0.742	
Perceived effort: The task of using the Rental Advisor to select a rental house was too complex.		0.82	
Perceived RA quality: The functions provided by the Rental Advisor is what I would need to make rental decisions.			0.876
Perceived RA quality: The Advisor has helped me in making good rental viewing decisions.	0.584		0.657
Perceived RA quality: The Rental Advisor is one of the best ways to accomplish the tasks assigned.			0.828
Perceived decision quality: Houses that suit my preferences were recommended by the Rental Advisor.	0.845		
Perceived decison quality: Houses that best fit my needs were provided by the Advisor.	0.787		
Perceived decison quality: Houses recommended by the Rental Advisor did NOT match my needs.	0.825		
Perceived decison quality: I would choose from the same set of alternatives provided by the Advisor in future renting occasions.	0.632		0.489

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

[a] Rotation converged in 5 iterations. Factors with loadings <.4 are not displayed

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	5.184	47.132	47.132	5.184	47.132	47.132	3.116	28.33	28.33
2	2.409	21.899	69.03	2.409	21.899	69.03	2.929	26.627	54.957
3	0.845	7.68	76.71	0.845	7.68	76.71	2.393	21.753	76.71
4	0.53	4.816	81.526						
5	0.479	4.353	85.878						
6	0.392	3.559	89.438						
7	0.333	3.028	92.466						
8	0.253	2.304	94.769						
9	0.227	2.061	96.83						
10	0.195	1.777	98.606						
11	0.153	1.394	100						

Extraction Method: Principal Component Analysis.

4

Balance versus Dominance in RA Sets: Impact on Decision Process and Outcome Perceptions & RA Acceptance

4.1 Introduction

The rapid evolution of information technology has exponentially increased the number of products individuals have access to, anytime, anywhere. Whereas this impressive boom in information and product availability has the potential to improve consumer welfare because it lowers the costs of search, it is a fact that due to its vast amount, not all available information can be incorporated into individuals' judgments. Individuals are inherently limited in the amount of information they can assimilate and process at one time, (e.g. Miller, 1956) a limitation that often leads to information overload.

Major improvements in intelligent technologies have provided solutions to the overload problem by assisting individual decision-making. Nowadays, individuals also have access to a variety of online recommendation sources (advice) ranging from professional critics (e.g., citysearch.com) and lay-people advice (e.g., Netflix.com, amazon.com), to personalized recommendations through product Recommendation Agents (RAs) (e.g., myproductadvisor.com, skyscanner.com). The pervasiveness of mobile technologies which permit for constant reach and interaction with individuals further increases the accessibility of these resources.

In this paper we analyze RAs offered by sellers or third-parties that

enable individuals to navigate through huge product assortments, and evaluate alternatives at the click of a button by presenting them with a list of alternatives that is sorted in terms of their predicted attractiveness. In the past two decades, RA research has provided a rich understanding of the factors that influence RA acceptance and use (ranging from technology and product characteristics to individual and individual-RA interaction elements) and how RAs shape individuals' decision processes and decision outcomes. A seminal paper by Xiao and Benbasat (2007) and a recent update by the same authors (2014) provide an overview of these factors and how they have been addressed in research to date.

One important gap in our knowledge concerning RAs and how they affect individuals' behavior that was identified by Xiao and Benbasat (2007) is that little is known about the effect of the composition of RA recommendation lists on individuals' decisions. Recommendation lists presented by RAs inherently influence decision-making as they comprise a selective representation of reality (Tan & Benbasat, 1990; Vessey, 1991). Therefore, a better understanding of the impact of variations in recommendation lists on individuals' decisions has a strong potential to further improve RA effectiveness. In response, in this paper we build on the theory on choice context effects and dominance valuation (Tversky & Simonson, 1993; Huber, Payne & Puto, 1982, 2014), to investigate the impact of switching from balance to dominance between the attribute-levels of products alternatives in the set of most highly recommended alternatives in a RA list on individuals' perceptions regarding the quality of the decision process and decision outcomes, and their RA acceptance. A balanced set of top alternatives is characterized by products with similar overall attractiveness, but which score differently across different attributes, whereas in a set where dominance is present, one product clearly stands out from the rest of the set in terms of attractiveness.

In our theoretical development, we build on research in behavioral decision-making, economics, and marketing that shows that the attractiveness of a product may not only depend on the characteristics of the product itself but also on the relation of the product's attribute values with its competitor's values. This set of phenomena is called "context effects" (Tversky & Simonson, 1993), and they capture the effects of the composition of the

consideration set on decisions. Although different context effects describe different choice patterns, an underlying commonality is that an individual's evaluation of an alternative is dependent on the presence or absence of other alternatives and their characteristics (Bettman, 1986; Hogarth, 1983; Payne, 1982). When we address the possible degree of conflict between the attributes of choice alternatives, we have on the one hand choice sets consisting of alternatives which are not dominated by any other alternative (a balanced set), and on the other hand choice sets that include a dominant alternative that is more attractive on all attributes than any other alternative in the set (a dominated set). These variations in set composition reflect different choice situations that individuals face on a regular basis in day-to-day purchase decisions (Huber, Payne & Puto, 1982; 2014).

While RAs do not have control over which products are available in the market (and hence the level of dominance in a full recommended list may vary), they can often be selective in terms of which products to present to consumers as the initial most highly recommended set of alternatives. RAs can typically set the criteria they use to select this initial set. For example, an RA website may choose to balance the initial set by presenting a top recommendation set that includes alternatives that perform best on different competing criteria (e.g., price, quality, sustainability, etc.), or it may present a strictly dominating top ranking, based on one single ranking criterion such as price. For ease of exposition we refer to this initial set as the "recommended set".

It is this RA challenge of what top alternatives to present to consumers that we address in the current research. In a two-stage RA recommendation approach, knowing how balance versus dominance of the alternatives in the initially recommended set affects individuals' perceptions of their decisions and RA acceptance can help design RA output that maximizes individuals' satisfaction and use of the RAs. More specifically, based on the dependence (between the decision process, the context and the choice), this study examines how the composition of the recommended set — as expressed by the products' attribute relationships and their presentation — affects individuals' evaluation of the decision process. We further suggest how RA recommended sets can be constructed to increase both the evaluation of the

decision process and the evaluation and acceptance of the RA. More specifically, we investigate if the type of dominance relations between products presented at the output stage of the recommendation process influence how individuals' judge the quality of their own decisions and the extent to which they find the decision difficult to make. In addition, we demonstrate that the presence of dominance in the recommended set affects individual's intention to use the RA. The results of our analyses provide valuable guidelines for the construction of RAs' recommended sets.

4.2 RA Sets & Decision Difficulty

RAs obtain individual preference information input (implicitly or explicitly), they process this information to present a set of recommended product alternatives as output to the individual. Xiao & Benbasat (2007, 2014) underlined the fact that both recommended set content (what is presented) and recommended set format (how it is presented) are key antecedents of the RA's evaluation and acceptance. What is presented to the individual as output in RAs and how it is justified are questions that have received earlier scholarly attention. For example, Benbasat and Wang (2005) and Wang and Benbasat (2007) showed that providing an explanation of RA's reasoning logic strengthens individuals' beliefs regarding the RA's competence and benevolence. Diehl (2005) examined the impact of the number of recommended MP3s and greetings cards on decision processes and outcomes and found that a higher number of recommended alternatives increases the information searched, decreased the quality of the consideration set and led to poor product choices. Knijnenburg, Willemsen, Gantner, Soncu and Nevel (2012) examined RA set composition effects on choice difficulty and choice satisfaction. They found a positive effect of recommendation quality and a negative effect of choice difficulty on choice satisfaction.

Initial attention to the role of trade-off difficulty in the evaluation of RAs was given by Lee and Benbasat (2011). They manipulated trade-off difficulty, by manipulating individuals' reference points. Participants in the loss group decided how much of each attribute they had to give up, while those in the gain group decided how much of each attribute they could gain. The study

subsequently examined the effect of trade-off difficulty on the evaluation of different preference elicitation methods (PEMs) (alternative- vs. attribute-driven). Their findings showed that trade-off difficulty moderates the degree to which PEMs generate trade-off difficulty. Xu, Benbasat, and Cenfetelli (2013) focused on trade-off difficulty in providing input for RAs by incorporating an interface element which interactively demonstrates trade-offs among product attribute values. Individuals rated the advantages of the trade-off transparent RA against the traditional RA in terms of product diagnosticity and enjoyment. The results revealed that the relationship between trade-off transparency and positive beliefs regarding the RA follow an inverse-U shape, as the level of trade-off transparency displayed increased.

Taken together, the literature provides valuable insights regarding RA acceptance and the role of trade-offs. Yet, the impact of the composition of the recommended set is still a largely uncharted territory (see also Xiao & Benbasat, 2007). Research in psychology and marketing shows that the prominence of the trade-offs in a choice set affects consumers' perception of how difficult a given decision is (Ariely & Wallsten, 1995; Huber, Payne, & Puto, 1982; Montgomery, 1983; Wedell, 1991). Because recommended sets are principally choice sets from the user's perspective we anticipate a similar impact on behavior for individuals who are using RAs. In this study we address the impact of dominance versus balance in the recommended set, as dominance is one of the most extensively studied context effects in the decision-making literature (e.g. Kivetz, Netzer, & Srinivasan, 2004; Roodenkerk, Van Heerde, & Bijmolt, 2011).

4.3 Dominance Effects

When an alternative is dominated it has at least one attribute on which it performs clearly worse than any other alternative in the set and no attribute on which it performs better. For example, consider an individual comparing two cars from the same brand and model. Then, if all others attributes are also equal between the two cars, but one care is less expensive than the other, the more expensive car is said to be dominated as decision alternative by the less expensive one. The presence of dominance is a highly con-

sequential element not only for the outcome of a given decision but also for the decision-making process that an individual chooses to follow. Early evidence on the importance of dominance in individuals' decision-making suggests that its presence or absence is a key determinant to the perceived value added of the alternatives in a set (Ariely & Wallsten, 1995; Huber Payne & Puto, 1982; Montgomery, 1983; Wedell, 1991). Preference for an alternative can be altered by the dominance relationship in which it is presented.

Two types of dominance have been addressed in previous research: symmetric dominance (Wedell, 1991) and asymmetric dominance between alternatives (Huber et al., 1982). To illustrate these two types of dominance related to a balanced choice set format first consider a simple example of a balanced choice between two products with only two attributes. Imagine an individual who desires to buy a tablet computer and two models are available in the market. One tablet (A) is has a large screen but is relatively more expensive, whereas the other tablet (B) has a smaller screen but is less expensive (see Figure 1). In this simplified example, there is a balanced trade-off between the two alternatives and none of them is dominated by the other. In other words, each alternative is better than the other on at least one attribute.

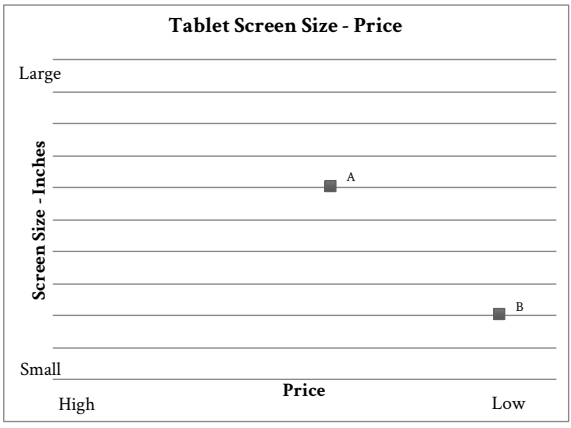


Figure 1 — Balanced choice between two tablets

This balanced choice fully contrasts to a symmetric dominance structure in which all available alternatives can be ranked in terms of attractiveness and each alternative in the ranking is better than all the alternatives that

are lower ranked (Wedell & Pettibone, 1996). To illustrate the symmetric dominance in our tablet example, a different set of two tablets is introduced (Figure 2). In this case the dominant tablet is tablet Z and comparing this tablet to the symmetrically dominated tablet Y is easy. Thus we expect that there will be a strong preference for the dominant alternative.

Only little research has been done on the effect of symmetric dominance on individuals' decision-making (Kohler, 2007). However, Tversky, Sattath and Slovic (1988) have proposed a three stage sequential model, in which the first step in a decision-making process is the assessment of the existence of dominance in the choice set (see also Evangelidis & Levav, 2013). The presence of a dominant alternative in the choice set provides the decision maker with a fast and frugal solution to the decision problem. Decision makers have in general as their primary goal the minimization of effort (Gigerenzer & Goldstein, 1996). Since a dominant alternative in a choice set stands out perceptually individuals seek for it and use it in their initial decision heuristic (Pocheptsova, Amir, & Dhar, 2009). If no dominance is observed, the decision maker checks whether any of the alternatives has a "decisive advantage" over the competing alternatives (Montgomery, 1983). Then, only in the case that no decisive advantage is discovered, a heuristic decision strategy is used, and the alternative is selected which scores higher on the most prominent attribute (c.f. Evangelidis, 2014). This sequence underlines the important role that dominance is expected to play in individuals' decision-making process. Because dominance is easily recognized by individuals when assessing a choice set we predict that its presence in an RA's recommended will greatly facilitate the individual's decision process.

The asymmetric dominance effect (Huber et al., 1982; Huber & Puto, 1983) refers to the subtler type of dominance that occurs when an additional alternative can increase the favorable perceptions of a highly similar, but superior alternative in the choice set. In our tablet example, asymmetric dominance between alternatives can be created by adding a third tablet C, in the original set of two tablets of Figure 1. This new tablet C is worse on one attribute dimension (i.e. dominated) in comparison to one of the other alternatives (tablet A), but not the other alternative (tablet B). This is illustrated in Figure 2, where tablet C is very similar to tablet A, but slightly inferior in

screen size and equal in price. The asymmetric dominance effect predicts that when alternative C is introduced in the choice set, the choice share of the more similar dominant tablet A (often called the target alternative) will increase and the choice share of tablet B will decrease. An explanation for this effect is that if alternative C (often called the decoy alternative) is absent, the decision between tablet A and B is a difficult one, because it is not clear which tablet has the best price-quality ratio. Introducing the dominated alternative C draws individuals' attention to the contrast between alternative A and C, which makes A appear more attractive and facilitates choice from the set.

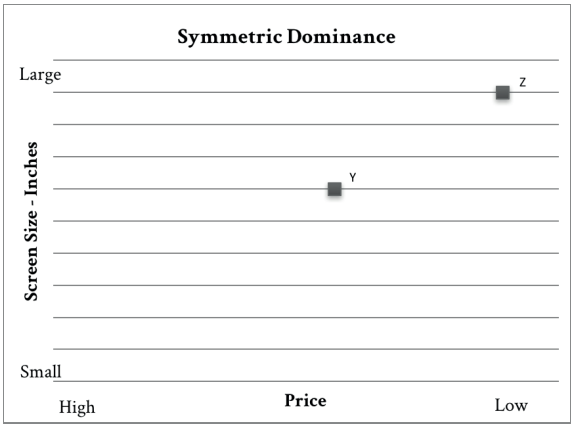


Figure 2 — Symmetric dominance in a choice between two tablets

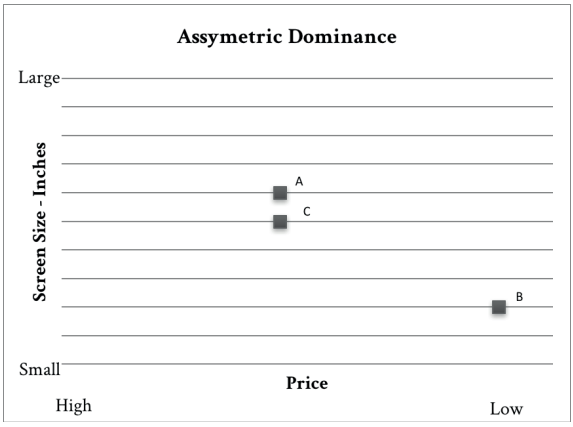


Figure 3 — Asymmetric dominance in a choice between three tablets

4.4 The Effects of Balance versus Dominance

Given that an individual uses an RA to make a product purchase decision, the output of the RA in the form of the set or products that is recommended by the RA (the "recommended set") for all practical purposes constitutes the choice set available to the individual at a given time. Therefore, we propose that similar effects to those of dominance in traditional decision environments can occur in the RA decision environment. An important distinction between traditional decision environments and RAs is that individuals do not simply make choice from a set, but also need to assess if they wish to use the RA's recommendations as a basis for their decision. Therefore, to assess the impact of dominance effects in the RA set we do not only study individuals' decision evaluations, but also their RA acceptance. To do so, we build on the framework proposed by Lilien, Rangaswamy, Van Bruggen and Starke (2004) and later utilized by Tan, Teo, and Benbasat (2010) in research on RA acceptance. This structure is graphically summarized in Figure 4.

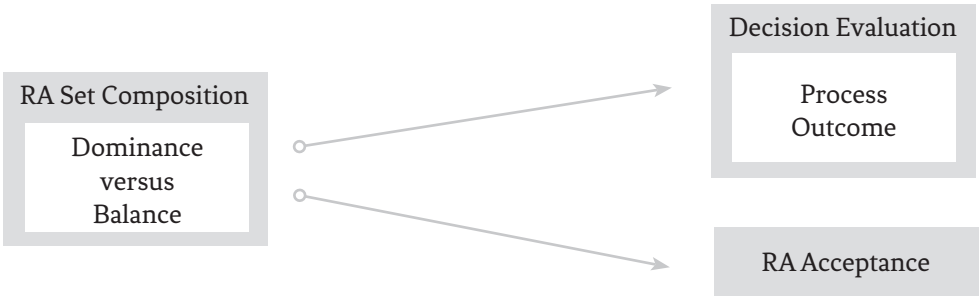


Figure 4 – Research Framework

In this framework the decision evaluation is characterized by the individual's perception of both the process of making a decision (captured by the difficulty of the decision process in our analysis) and the quality of the decision outcome (decision quality). Given the strong impact of dominance on decision-making, we expect it to influence both process and outcomes of decisions. The RA acceptance component in turn captures the degree to which the individual wishes to use the RA as tool to his or her decision (DeLone & McLean, 1992). In the next section we detail our hypotheses for these components.

4.4.1 The Impact of Dominance on Decision Process and Outcome Perceptions

Conflicting values of product attributes and trade-offs are present in many purchase choices (Bettman et al., 1998, Haubl & Murray 2003), and when they are present, the decisional conflict experienced by individuals is a major source of decision difficulty (Payne, Bettman, & Johnson, 1993). Research has shown that a choice task is considered easier in the presence of a superior alternative (Hedgcock & Rao 2009; Tversky & Shafir 1992). Klein and Yadav (1989), for instance, found that the number of dominated alternatives in a choice set influenced the time required to make a decision and its accuracy: The fewer dominated alternatives present in the set, the less accurate and the more time was used in making the decision. Furthermore, individuals are reluctant to make trade-offs among valued attributes, and as a result, this reluctance is associated with increase in decision difficulty (Dhar 1997; Kivetz, Netzer, & Srinivasan, 2004; Simonson, 1989; Tversky & Shafir 1992). This leads us to hypothesize:

Hypothesis 1a: Symmetric dominance in an RA's recommended set lowers perceived decision difficulty compared to a balanced recommended set.

Hypothesis 1b: Asymmetric dominance in an RA's recommended set lowers perceived decision difficulty compared to a balanced recommended set.

Difficult decisions have also been found to undermine individuals' confidence that the best alternative will be selected (Dhar, Nowlis, & Sherman, 1999). decision-making entails not just choosing a favored alternative but also rejecting its alternatives, and rejecting alternatives often prompts anticipated regret and decision avoidance.

On the basis of the link between choice difficulty and similarity, Kim, Novemsky and Dhar (2013) attest that introducing a small difference on an otherwise identical attribute reduced choice difficulty by increasing the perceived similarity of the available alternatives. As a result, individuals exhibit higher willingness to choose when considering a choice set where a very similar, but not identical alternative is present. Similarly, Medin, Goldstone

and Gentner (1993) showed that when individuals compare objects, features that do not vary across those objects may not be considered. This may be especially true in a choice context, because common features provide no basis for choosing (Dhar & Sherman, 1996).

Perceived decision quality is a subjective evaluation of how an individual perceives his or her decision to be accurate, correct, precise, and reliable (Mennecke & Valacich, 1998). According to the taxonomy proposed by Lilien et al. (2004), the use of RAs improves decision quality.

Decisions emerge from a process characterized from the cognitive effort devoted to problem solving and individuals tend to be more confident in a decision which is of lower difficulty (Bechwati & Xia, 2003). Since an RA set where dominance is present is likely to be perceived as less difficult to choose from we hypothesize that the quality of the outcome of the decision is also perceived to be of higher quality.

Hypothesis 1c: Symmetric dominance in an RA's recommended set increases perceived decision quality compared to a balanced recommended set.

Hypothesis 1d: Asymmetric dominance in an RA's recommended set increases perceived decision quality compared to a balanced recommended set.

4.4.2 The Impact of Dominance on RA Acceptance

In their Theory of Goal Systems, Kruglanski et al. (2002) show that the evaluations held for the attainment of a goal, can spill over to the evaluation of the means used to reach that goal. In a setting of recommendations made by information technology, the goal of the individual is to take a certain decision, whereas the "means" is the technology itself. Based on this theory, we can thus posit that depending on whether the goals held by individuals in using an RA are achieved, the evaluation of the RA itself will be influenced accordingly.

Individuals have as their expectation that these RAs will make the decision easier (Haubl & Trifts, 2000), will conserve them effort (Benbasat & Todd, 1992, 1996), and will put more effort in making the decision than they

themselves would do (Bechwati & Xia, 2003; Li & Tsekouras, 2012). Therefore, we anticipate that an RA that introduces rather than resolves decision conflict through the composition of the set recommended alternatives is evaluated negatively by individuals (Moon & Naas, 1996; Moon, 2003). Such an RA does not do the job that the individual is expecting it to do, and the activated goal of making an easy and high quality decision is not fulfilled. Reversely, when an RA resolves decision conflict by presenting a dominated choice, this will lead to a more positive evaluation of the RA. Therefore, we hypothesize that individuals will more strongly intend to use an RA when dominance occurs in the recommended set.

Hypothesis 2a: Symmetric Dominance in an RA's recommended set increases intention to use the RA compared to a balanced recommended set.

Hypothesis 2b: Asymmetric Dominance in an RA's recommended set increases intention to use the RA compared to a balanced recommended set.

4.4.3 Moderating Effect of Decision involvement

Evidence on the impact of dominance effects on product choices suggest that when individuals are not very involved with a choice, they are more likely to use heuristics (Mishra, Umesh, & Stem, 1993) and as a result, they may be tempted to violate the rationality principles that the dominance effects suggest (Diels & Muller, 2013). In other words, when individuals are not highly involved in the process, they tend to take decisions which are consistent with the choice patterns in dominance, attraction and compromise choice sets.

An individual who is highly involved in a decision, elaborates on the consumption experience is motivated to carefully compare alternatives and choose the one with the highest utility. For this to be the end result, contrast between the attribute values of the products should occur. Bone, Shimp and Sharma (1990) are one of the first to show that contrast is not taking place for individuals who are not willing to put effort in the decision. In the absence of contrast, individuals are drawn to alternatives which provide quick

and easy justifications, two characteristics which are evident in a choice set where the dominance effects take place. Based on this finding we can expect that individuals who are more involved with the task for which they use the agent will be less affected by the presence of any of the two dominance effects. Consequently, we hypothesize that the effects of dominance on decision outcomes and processes is moderated by decision involvement such that the effects are higher for individuals with low vs. high decision involvement.

Hypothesis 3a: The effect of dominance on perceived decision difficulty is stronger for individuals with low vs. high decision involvement.

Hypothesis 3b: The effect of dominance on perceived decision quality is stronger for individuals with low vs. high decision involvement.

Hypothesis 3c: The effect of dominance on intention to use the RA is stronger for individuals with low vs. high decision involvement.

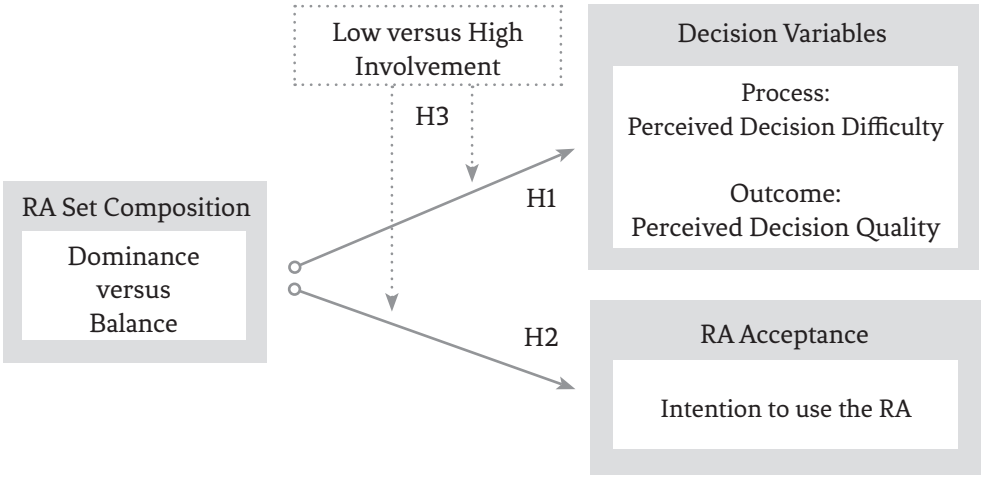


Figure 5 – Detailed Research Framework

4.5 Research Methodology

To test our hypotheses, we first designed an RA that simulated the proposed dominance effects at the output stage of the recommendation experience. This RA was then used in an experimental study followed by a survey where we could observe and document individuals' interaction and beliefs regarding the RA.

4.5.1 RA Design

In most decisions, the utility of each product in the set and the composition of the set may combine to influence individuals' choices (Nowlis & Simonson, 2000). Since the focus of this study is on the influence of dominance (a set level effect) rather than on the individual's preferences for each product separately, in the RA design for this study we first asked individuals to choose for which range of products they would like to obtain a recommendation. In other words, the RA in this research assisted decision makers after the initial screening was completed, and the individual had formed a consideration set.

Additional motivation for this choice is provided by multiple focus group discussions held to explore the needs of individuals in a mobile, in store setting. The respondent indicated that they favor the use of a mobile RA to get information and compare prices among a few alternatives that they are considering, rather than perform a full product search. Consequently, this is a RA acting as a shop comparison engine. Another practical reason that favors this approach is experimental control. By excluding the consideration of product features (e.g. color, brand etc.) we control for individual preferences which are of hedonic nature, preferences which are based on more on the emotions of the individual. Mapping preferences about cognitive aspects of the decision (e.g. price) will allow us to produce clearer effects.

We based our RA design on the principles of Multi-Attribute Utility Theory (MAUT) which provides an axiomatic foundation for choices involving multiple criteria (Dyer, Fishbun, Steuer, Wallenius, & Zionts, 1992). MAUT allows the evaluation of different product alternatives with regard to their utility for the current customer. In this context, each product is eval-

uated according to a predefined set of interest dimensions. This framework allows for a decision maker who chooses one (or a subset) of a set of alternatives evaluated on the basis of two or more criteria or attributes.

For the purposes of our experiment the RA targeted individuals looking for a nearby store to purchase a product of interest. Respondents were asked to imagine wanting to buy a camera. They were told that after some thought and product information search they had decided to buy a specific brand and model.

They were then asked to navigate to the "Store Finder", a website application that gives information about deals and availability of products in different stores, based on their preferences. On the first page of the website users were required to type in the camera brand and model. On the second page they specified preferences cut-offs[8] regarding features of the camera (price, warranty) and the store (distance to the store, seller rating) (See Appendix A). This determined the range within which products were recommended. Based on a three focus group discussions (6 participants each) the following four attributes were selected: 1. Price, 2. (Relative) Location of the store, 3. Store's reputation, and 4. Warranty provided by the store.

This elicitation process also serves to establish trust in the RA since individuals can immediately see that the recommended products are meaningful representations of their preferences.

After the individual specified the range of his or her preferences for the attributes, in the back-end of the RA a recommended set of stores was constructed. The recommended alternatives were combined in such a way that the recommended set reflected the variations in dominance that we wished to test in this research. Thus, all the alternatives in general fitted individuals' elicited preferences, but there was some variation in the set depending on the specific manipulation of dominance. The RA then presented the individual with the recommended set that represented either a balanced (control) condition or one of the two dominance conditions (see Experimental Design section for details).

8 The RA may actually follow either a compensatory decision strategy (e.g WADD) or a non-compensatory like Elimination by aspect EBA, which removes alternatives with at least one attribute value that fails to meet the minimum acceptable level. For reasons of simplicity we will follow the later approach.

It is worth noting that we control for the inherent differences in quality of the recommended set between the three conditions when testing our hypotheses by objective quality as a covariate in the analysis. The objective quality is calculated by comparing all alternatives in the recommended set and calculating a score based on whether each alternative "won" in each condition.

Consequently, in order to test our hypotheses, we designed: (1) an RA that could simulate the proposed dominance effects at the output stage of the recommendation experience and, (2) an experimental study followed by a survey where we could observe and document individuals' interaction and beliefs regarding the RA.

4.5.2 Experimental Design

To compare the RAs and to examine the impact of the presence of dominance on RA and decision variables a 3 x 2 between-subjects experimental design was employed. In order to achieve a high degree of internal validity in our results, a laboratory setting wa s selected (Singleton & Straits, 1999). The moderating effects of involvement were investigated by measuring individuals' level of involvement as they naturally occurred and were not manipulated experimentally.

The experimental design we employed manipulated not only the dominance conditions, but also the platform on which the RA was presented (online vs. mobile). Since no impact of platform was found, we combined the data across platforms in our analysis. A full factorial, between subjects 3 (RA set composition: control, symmetric dominance, asymmetric dominance) x 2 (RA platform (online vs. mobile) was employed.[9] Each participant was asked to purchase a product using the RA. Decision involvement was not manipulated in the design, but individuals' involvement was measured in the questionnaire. To increase general involvement in the decision task, participants were asked to justify their choice in the follow-up survey.

In the recommended set, respondents were presented with three hypo-

9 Two other RA-set conditions were also included in the total experiment that was run: An RA including a compromise effect and one including a similarity effect. These two other conditions are not analysed for the purposes of this research.

thetical stores that were described in terms of four attributes: 1. Store quality rating (from 3 to 5 stars), 2. Product price (ranging between a minimum of 220 euros and a maximum of 280 euros), 3. Distance to the store (ranging between 100 meters and 20 km), and 4. Product warranty (ranging between 1 and 4 years). For each attribute, respondents could pre-specify their personal relevant range within these maximum ranges.

To manipulate of the dominance effects, the rules which the RA used to select the attribute levels varied between conditions. The stores were dynamically generated based on the input of the individual and the experimental condition. The approach we used allowed individuals to specify their preferences for a number of attributes using the RA while in the back-end of the RA, recommendation alternatives were generated that according to theory, represented a dominant, asymmetrically dominant or balanced control condition.

The rules used to represent the RA sets for the balanced control condition and the two dominance conditions were as follows (for a more detailed description see Appendix B). For each individual a recommended set of three stores was dynamically generated based on the input of the individual following specific rules. he symmetric dominance condition was generated by creating one alternative that was superior to both other alternatives on all four attributes, and a second alternative that was superior on all attributes to only the third alternative, but inferior to the first alternative on all attributes (see Figure 2 for the two alternative – two attribute choice equivalent). Asymmetric dominance was achieved by first creating two balanced alternatives that were superior to the other alternative on two out of four attributes and inferior to the other alternative on the other two out of four attributes. Then, a third alternative was added that was identical to one of the two other alternatives, except for one attribute on which it was inferior (see Figure 3 for the three alternative – two attribute choice equivalent). Finally, for the balanced (control) condition, three alternatives were generated that each were superior to the other two alternatives in the set on two out of four attributes and inferior on the other two attributes (see Figure 1 for the two alternative – two attribute choice equivalent). In our analyses we control for the inherent difference in quality of the best alternative between the symmetric dominance condition and the other two conditions.

4.5.3 Procedures

The experimental session proceeded as follows. The participants were directed to take a seat at an individual cubicle room, where they could work on the task concentrated and in silence. Participation was voluntary and each participant was given €5 monetary compensation in exchange for his/her participation. Students were informed before they made their choices to pay extra attention because they would be asked to provide justifications for their choices.

The scenario asked respondents to imagine themselves wanting to buy a specific camera model (A full description of the experimental scenario is available in Appendix C). Participants were then asked to navigate to the "Store Finder", a website (or mobile application) that gives information about deals and availability of products in different stores. Previous work on RA acceptance has also used tasks in which participants were instructed to buy a gift, rather than a product/ service for themselves. However, Moreau et al (2011) found that choosing products for oneself affects the weight one puts on exerting effort vs. obtaining product quality. Gift-givers place a higher value on their own time and effort and thus report a higher willingness to pay than those choosing a product for themselves. Due to this difference and because our work is not particularly focused on gift giving, we decided to keep the decision personal

Depending on the assigned experimental conditions, participants were then asked to access Store Finder through their mobile devices or on the desktop in front of them, choose their preferred store. After completing the RA task, which had no time limit, each participant was directed to the survey part of the study were they were asked to complete a questionnaire that included various measures and a manipulation check.

4.5.4 Measures

The three dependent variables of the research model are measured with well-established multi-item measures. Measures for Decision Difficulty (Chatterjee & Heath, 1996; Dhar & Nowlis, 2004) asked participants to rate the difficulty of this electronics store decision included two 10-point items with the endpoints: "not at all difficulty/very difficult," and "not at all likely

to regret/very likely to regret".

Decision Quality (Wang & Benbasat, 2005) was measured using four 7-points scales and asked participants whether the best stores that suited their preferences were recommended by the Store Finder, whether stores which best fit their needs were provided by the Store Finder, whether stores recommended by the Store Finder did NOT match their needs (reverse scaled) and whether they would choose from the same set of alternatives provided by the Store Finder in future buying occasions.

Intention to use the RA (Benbasat & Wang, 2005) was adapted from Benbasat and Wang (2005) and their three item, 7-point measure which asked participants whether they would be willing to use the website as website as an aid to help with their decisions about where to buy a camera, whether they would be willing to let the website assist them in deciding which electronic store to choose, and whether they would be willing to use this website as a tool that suggests a number of electronic stores.

Decision involvement was taken from Mittal and Lee (1989) and was measured with one 7-point item asking participants to rate whether in this situation, deciding which store to buy the camera from was an important decision for them.

4.5.5 Data

Data were collected in two rounds. Participants were invited to come to the behavioral lab of our university having their smartphone device with them, and with access to the Internet. 273 students were randomly assigned to each of the treatment groups.

Since the survey was conducted in a university environment, the respondents are mostly undergraduate students (83.6%), whereas the remaining 16.4% have completed their undergraduate education. As far as the gender is concerned, 35.8% are men, 64.2% are women. Lastly, 89.3% of the participants were younger than 21 years old. No significant differences were found between the participants in the experimental conditions. The groups did not differ in terms of age, gender and education distribution.

Due to the experimental, scenario-based nature of the task we also assessed its perceived realism with two 7-point Likert scale items. (1) "I could

imagine myself selecting a store from which I would buy the camera." (2) I believe that the described situation could happen in real life." (Darley & Lim, 1993). The mean responses for both measures were significantly higher than 4, reflecting a good degree of perceived realism (M1= 5.53, M2= 5.75).

Outliers. The data was explored for outliers and missing values. The survey design prevented participants from leaving questions blank. The survey had a dropout rate of 9%, mainly due to internet problems during completion. Respondents who dropped out were deleted from the analyses.

Outliers were defined using the g=2.2 labeling rule (Hoaglin et al., 1986, 1987), and were controlled for during the analyses, but only removed when they were a consequence of a typing error or due to a unique event. We controlled for age (measured at a ratio level) and education (categorical level), and tested them for outliers. Although outliers were found they were not removed from the sample as they did not influence the main constructs.

Reliability. Prior to hypothesis testing, a factor analysis was conducted to test if the items in the survey adequately represented the constructs.

Construct reliability estimates (Cronbach α's) and item standardized loadings are shown in Table 1. The factor analysis and Cronbach Alpha test for internal consistency showed that one item did not adequately explain the variance in decision quality. Thus this item was eliminated. All other factor loadings were satisfactory.

In the final factor analysis three factors were retained; all of them have an Eigen value above 1.0. These three factors reflect the constructs Decision Quality, and Intention to use the RA.

Following this initial process, all scales demonstrated a high level of reliability and item loadings exceeded the recommended minimum of 0.7. Construct correlations are shown in table 3.

Table 1 —Measurement Items[10]

		Factor Loading	Mean	Standard Deviation
Decision Difficulty	*For me, choosing between the different electronics stores was:*			
	"not at all difficulty/ very difficult"	0.89	5.70	1.34
	"not at all likely to regret/ very likely to regret"	0.87	5.74	1.36
Decision Quality				
	Stores that suit my preferences were recommended by the Store Finder.	0.78	5.43	1.10
	Stores that best fit my needs were provided by the Store Finder.	0.80	5.32	1.07
	Stores recommended by the Store Finder did NOT match my needs.[R]	0.77	5.60	1.25
	I would choose from the same set of alternatives provided by the Store Finder in future buying occasions.	dropped	4.59	1.28
RA Intention				
	I am willing to use this website as an aid to help with my decisions about where to buy a camera.	0.87	5.29	1.25
	I am willing to let the website assist me in deciding which electronic store to choose.	0.83	5.17	1.29
	I am willing to use this website as a tool that suggests to me a number of electronic stores from which I can choose.	0.81	5.49	1.26

10 For the cross loadings, see Appendix D.

Table 2 — Reliability

Variable	Number of Items	Cronbach's Alpha
Decision Difficulty	2	0.754
Decision Quality	3	0.725
RA Intention	3	0.815

Table 3 — Construct Correlations

		DD	DQ	RA-I
1	Decision Difficulty [DD]	-	.20**	.05
2	Decision Quality [DQ]	.20**	-	.35**
3	RA Intention [RA-I]	.05	.35**	-

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

4.5.6 Manipulation Check

As manipulation check we investigated if the dominance effects occurred in respondents' choices in terms of the shifts in market shares between the three experimental conditions. To do so we analyzed whether the choice share of each store had shifted in the predicted direction. Figure 6 presents the choices the sample population made in each condition. The symmetric dominance effect predicts that in comparison with the control group, the increase in the dominant store's attractiveness is higher than in the asymmetric dominance condition. The asymmetric dominance effect predicts that, the preference for store A relative to store C is higher than in the control condition.

These expected shifts in choice behavior occur in our sample for the both types of dominance groups. To test if these differences are statistically significant we perform cross-tabulations and chi-square tests.

For both the symmetric ($\chi 2$= 61.20, p=.00) and asymmetric ($\chi 2$= 44.65, p=.00) dominance we reject the null hypothesis of independence of Store Choice and dominance effect presence in favor of the conclusion that the distribution of preference of a store choice varies in the predicted direction with the two dominance effects.

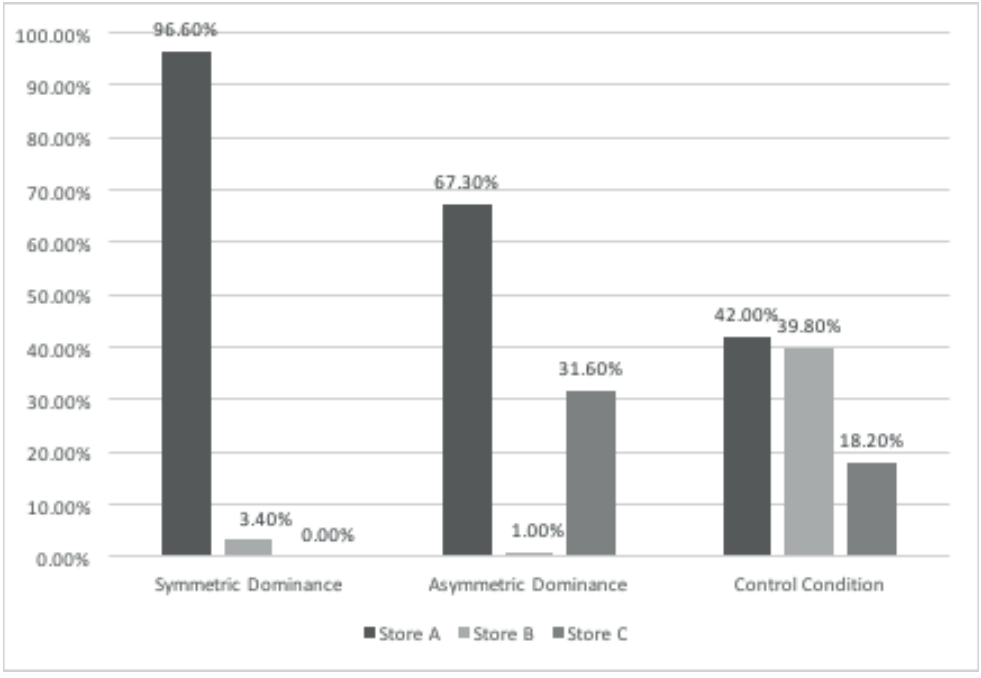


Figure 6 – Store Choice between experimental conditions

4.6 Results

4.6.1 The impact of dominance on decision difficulty & decision quality

A MANOVA of the two dominance conditions and the balanced control con-

dition was conducted in order to examine their impact on the three dependent variables. In this MANOVA we included the objective quality indicator for each condition as a covariate to control for inherent differences in quality of the recommended products between conditions. The main effect of the symmetric dominance effect in the MANOVA was significant for both Perceived Decision Difficulty (F= 9.50, p<.005), Perceived Decision Quality (F=4.63, p<.05)

Next, planned contrasts were performed to test the hypotheses. We find that participants choosing between alternatives in the presence of symmetric dominance evaluated the decision process differently than in the balanced control condition. Participants perceived the store choice decision to be less difficult (M.D= .54, p<.005) and of higher quality (M.D= .31, p<.01). Thus, we find strong support for H1a and H1c.

When we turn to the between–subjects' effects for asymmetric dominance the multivariate analysis of variance confirms the following hypotheses. The introduction of asymmetric dominance has no significant effect on any of the decision process variables. The perceptions of Decision Difficulty (F=.76, p= .38), and Decision Quality (F= .05, p= .81) do not differ from a recommended set where a dominance effect is not present. Thus, H1b and H1d are rejected.

4.6.2 The impact of dominance on intention to use the RA

The main effect of the symmetric dominance effect in the MANOVA was significant for one's intention to use the RA (F= 7.83, p< .01). Planned comparisons show that in the presence of symmetric dominance, Intention to Use the RA is higher than in the control group (M.D.= 0.48, p< 0.01). Consequently, H2a is supported for symmetric dominance.

For the asymmetric dominance recommended set, we find that there is a significant difference between one's intention to use the RA in comparison to the control condition in the expected direction, but only in one-tailed t-test (F=3.01, p< .05[11]). Participants demonstrated higher intention to use the RA where asymmetric dominance was present than in the control condition (M.D= .30,). Thus H2b is marginally supported.

11 One-tailed t-test.

4.6.3 The moderating effect of decision involvement

Hypotheses 3a, 3b and 3c focus on the moderating effect of Decision Involvement. The sample demonstrated a decision involvement mean of 5.04 with SD= 1.47 and Variance= 2.18. In order to test our hypotheses, we created a dichotomous variable where participants with a score less than or equal to 3 were classified as having low involvement (N= 38), and individuals indicating at the 7-point scale a score higher or equal to 4, were classified as being highly involved (N=137) in the decision to buy the camera. Since our results indicated that the main effect of dominance is present only for the symmetric dominance condition, we look at the role of involvement only for the asymmetric dominance condition.

To test the hypotheses pairwise comparisons (LSD) were conducted between those participants in the low vs. high decision involvement groups. The results are presented in Table 4.

Table 4 — Multiple Comparisons Results (LSD) – Decision Involvement as a Moderator

	Control Group	Dominance Group	Mean Difference	Significance
Decision Difficulty				
Low Involvement	Mean: 6.03 SD: .24	Mean: 6.08 SD: .20	.045	.88
High Involvement	Mean: 5.62 SD: .15	Mean: 5.83 SD: .10	.21	.23
Decision Quality				
Low Involvement	Mean: 4.88, SD: .25	Mean: 5.58, SD: .20	.70	.003
High Involvement	Mean: 5.48, SD: .10	Mean: 5.53, SD: .07	.04	.72
Intention to Use				
Low Involvement	Mean: 4.26, SD: .27	Mean: 5.40, SD: .20	1.14	.001
High Involvement	Mean: 5.31, SD: .11	Mean: 5.53, SD: .07	.045	.71

When a dominance effect is introduced in a recommended set, involvement is a significant moderator of the impact on Perceived Decision Quality ($F= 4.35$, $p<.01$) and Intention to use the RA ($F= 8.96$, $p< .05$). Table 4 shows that — as hypothesized — for two of the three variables, the impact of the dominance effect is stronger for individuals who exhibit lower decision involvement. The analysis reveals that dominance effects produce no difference in the perceptions of those who are highly involved in the decision. This provides support for H3b and H3c, but not for H3a, and implies that decision involvement is limiting condition for the hypothesized effects in H1 and H2, with more involved individuals being significantly less sensitive to the impact of dominance in RA recommended sets.

4.7 External validation — Field data

Since the results of this study were obtained in a hypothetical decision-making setting, we looked for a way to validate if dominance in recommended sets also affects individuals' decisions in real-world market settings. A Dutch online financial product recommendation site was willing to share data on a natural field experiment that occurred on their site and closely resembled our research context.

In particular, on the website visitors looking for a health insurance product were presented with a personalized recommended top three of best fitting products based on a price-quality criterion ranking. The products in this recommended set were dominating in that they were sorted from their highest to lowest price-quality score for any products that matched the individuals own pre-set criteria and the vast majority of individuals selected a product from the recommended set.

However, as an additional information service to their users, in some largely randomly occurring instances the website in addition also presented the lowest priced health insurance product that met an individual's pre-set criteria in the recommended set as fourth alternatives. This product was added to the price-quality based top three. The addition of the lowest priced product only occurred in cases where it was not part of the recommended top three based on price-quality ranking. Thus, for a subset of all choice

observations individuals were also exposed to a fourth non-dominated alternative that was superior in price, but inferior in terms of price-quality ranking.

Importantly for our research, whether or not this fourth lowest priced product was presented was determined exogenously to the individual's specifications and was only dependent on how the market at that time happened to be composed of alternatives. This structure provided for natural random variation in terms of whether individuals were presented with a dominated set (top three price-quality ranking only) or a non-dominated set (top three price-quality ranking and lowest price product). Thus we could analyze the impact of the composition of the recommended set on whether or not individuals chose to follow the recommendation or continue their search and choose an alternative outside of the recommended set. While we acknowledge that this measure is not a direct indicator of individuals' willingness to use the RA, we think it is still of great relevance for our research, as it reflects individuals' use of the RA's recommendation, which is likely to be positively correlated with their satisfaction with this recommendation and ultimately with their willingness to use the RA.

Users of the website entered their personal characteristics and desired insurance specifications – in particular additional coverage above the legal minimum. Based on this information and depending on the products in the market, they were then presented with a price-quality ranking based top three of recommended health insurance alternatives or a top three plus the lowest priced product. Individuals could choose to click through to inspect a full sorted list of health insurance products.

For most products, individuals were able to close a contract with the insurance firm directly via the recommendation website. Alternatively, they were asked to go the recommended insurer's website to close the contract. In the latter case we were not able to observe whether or not a contract was in fact closed with the insurance company. Therefore, for the purpose of this study, we only analyzed those visits in which consumers closed a contract directly though the recommendation website. This allowed us to track the impact of the recommended set on individuals' actual market choices.

We obtained data from November–December 2011. In the months of

November–December almost all health-insurance purchases are closed in the Netherlands because there is a legal insurance acceptance window until January 1st. A health insurance product was purchased by a total of 35,113 visitors in 2011. This represented 1.6% of the total visits to the site. For each visit, the data we obtained captured the top three alternatives plus the lowest priced alternative if it was also presented along with the top three, some individual characteristics, and the alternative that was purchased — in particular if this was inside or outside of the recommended set (with or without or the lowest priced alternative).

Table 5 — Multiple Comparisons Results (LSD) – Decision Involvement as a Moderator

	Choices in dominated sets (top three only)		Choices in non-dominated sets (top three plus a fourth option of the lowest price)	
Recommendation list position	Number times selected	Percentage	Number times selected	Percentage
Choice within recommended top 3	20,274	87.6 %	10,337	86.4 %
Choice outside of recommended top 3	2,874	12.4 %	1,628	13.6 %
Total	23,148	100 %	11,965	100.0 %

Table 5 provides an overview of the results from the field study. We find that overall 87.2 % of the visitors who purchased health insurance selected an alternative from within the top three (with or without lowest price alternative), which illustrates the strong positive impact of the recommendation ranking on individuals' decision-making. To validate our hypothesis (H2a) that with dominance consumers are more likely use an RA recommendation, we tested for the significance of the difference in individuals buying a product from the recommended set versus not buying from the recommended set depending on the two field conditions. As predicted, consumers

that were presented with a dominated set of alternatives were significantly more likely to purchase a product from the recommended set based on a Chi-square test ($\chi^2 = 10.03$; $p < 0.01$; 1 d.f.). This provides further (real-world) support for the hypothesized beneficial effect of dominance on RA acceptance.

4.8 Discussion

In this research we investigated consequences of the dominance structure of RA output on individuals' evaluation of the RA-based decision process, decision outcome, and their intention to use the RA. Although the influence of the output of RAs on RA evaluations and RA acceptance has received limited scholarly attention, our results confirm its central role in the user experience. The output of the RA in this research was manipulated based on phenomena well documented in the decision-making literature. The findings provide general support for the proposed role of dominance in affecting decision processes (decision difficulty, decision quality) and intention to use the RA. What is more, the study provides evidence that individuals' decision involvement, acts as moderators of the effect of dominance effects on decision variables and RA acceptance.

While the symmetric dominance effect had significant and positive consequences for the individual's experience with the RA and their intention to use the RA, the results show that the asymmetric dominance effect did affect individuals' evaluations and intentions towards the RA, but to a lesser extent. The role of dominance in recommended sets is further and empirically supported by the analysis of field data. Given this evidence, we can confidently conclude that the presence of dominance in RA sets influence the evaluation of the technology as well as the perception of user experience. Our results are in line with findings by Willemsen et al. (2016) who in two online experiments show that a more diverse (and less 'accurate') top 5 of recommended movies is more satisfactory than a highly accurate top 5. The effect is attributed to users' valuing diversification in that it reduces choice difficulty and increases recommendation attractiveness (Willemsen et al. 2016).

4.8.1 Limitations & Future Research

The organization of information display plays a major role in what individuals choose (Russo, 1977). According to the "concreteness" principle (Slovic, 1972) individuals tend to use only the information that is explicitly displayed and will use them in the form they are displayed. Support for this contention is provided by Bettman and Kakkar (1977) who found that individuals indeed acquired information in a manner consistent with the display format (by attribute or by brand), and Jarvenpaa (1989) extended these results to the case of graphical displays. Based on these findings Bettman, Luce and Payne (1998) propose that the relationships among choice alternatives will be more difficult to assess if the choice set is displayed in such a way that these relationships are less transparent. Examining the interaction between the compromise effect and alternatives' display format, Chang and Liu (2008) found that the position of the middle option influences its relative attractiveness; study participants were more likely to choose the compromise alternative when it was presented in the middle of a product list. As a result, it is probable that the representation of dominance and its effects on RA acceptance may depend on the position of the alternatives on the screen. Future investigation may vary the position of the dominance alternatives in order to examine the robustness of our results.

What is more, a prerequisite for dominance effects occurrence is the engagement in comparative evaluation of attribute values between alternatives. Dominance effects are typically represented in the literature with two to three alternatives described by two attributes. For the purposes of realism, our task involved three alternatives described by four different attributes. This added complexity of our choice set may have prevented participants from engaging in comparative evaluation for all attributes and alternatives. Future research could attempt to represent these effects with varying number or attributes and alternatives and study their impact on RA acceptance. It is, after all, mostly relevant to uncover whether dominance effects take place in multi-attribute situations, as in the real world products and choice sets have multiple dimensions.

What also needs to be noted is that this study did not study the objective quality of the recommended sets as a main variable of interest. The accu-

racy of a given decision is of main interest for both behavioral scientists and designers and a promising future research direction. Initial evidence is provided by Bollen et al. (2010). They performed an experiment using a movie RA movie recommender, comparing a small Top-5 list, a large Top-20 list, and a large lower quality 20-item list, composed of the Top-5 plus 15 lower-ranked movies. Users experienced significantly more choice difficulty when presented with the high quality Top-20 item list, compared to the other two lists. It is observed that adding inferior items to the recommendation list may increase choice satisfaction due to the lesser difficulty users face when making the movie choice.

Furthermore, the control and artificial environment of the lab limits the generalization of our results. Whereas the controlled environment of the lab offers certain benefits, like experimental control, minimization of external noise and to a certain extent, causality. On the other hand, the experimental setting is characterized by low realism, as in reality individuals would use the agent in a noisy environment, on their mobile while walking, for example or while multitasking.

Secondly, this study was largely based on a fictional buying situation. For this purpose, we asked participants to rate the realism of the task (Darley & Lim, 1993) which demonstrated adequate levels (Mean= 5.59). This provides some reassurance that the fictional task was seen as realistic by participants.

Thirdly, the recommended sets presented by the RA itself were setup in such so that the representation of dominance effects was systematically manipulated between conditions. In order to ensure the manipulation of the presence of the dominance effects, the alternatives presented to the individuals were fictional. It should be noted that the existence of truly symmetric dominance in recommended sets in real-world marketplaces is less likely to occur, for example in markets characterized by fierce competition where products may be designed to be optimal in different dimensions. Therefore, although this study provides evidence on the impact of dominance effects on RA acceptance, the practical implementation of generating dominated recommended sets in real markets may not be as straightforward.

Thus, the deployment of a field experimental design and a real decision-making environment will significantly add to the validity and robustness to

our findings.

In this paper, the effects of dominance on decision processes and the acceptance of RAs is solely investigated for the purchase of a camera. It is possible that for other products the discovered effects may vary due to differences in decision involvement or product complexity. Also the effect of the brand name Sony could have influenced the level of their behavioral intentions.

The participants were also selected out of a pool of highly educated individuals. This over-representation could have potentially biased the conclusions drawn from this research, as highly educated individuals may engage in more attribute-based comparisons. As a result, homogeneity of educational level may increase the reliability of the results.

4.8.2 Contributions to Theory & Practice

Despite its limitations, this study makes a number of contributions to theory and practice. The results draw the attention of both practitioners and researchers to the importance of the relationships between the (top) recommended items in a RA's list. Firstly, we are uniquely providing empirical evidence on the occurrence of dominance in a RA environment. Secondly, our experimental design allows us to explore the effects of dominance on the individual's decision processes. More importantly, providing a link between the composition of the RA list, the decision process and the evaluation of the technology itself, we put forward that RA designers should be cautious about the presentation of alternatives of any recommended set. Especially in a mobile application environment, providing a (long) list of alternatives that is unsorted or shorted on a specific attribute (e.g. price) may put an excessive burden on the individual. By introducing a list of recommendations where a context effect takes place, the agent can reduce that burden and improve the evaluation of the RA and the decision experience as a whole, which will ultimately lead to higher utilization of such a system. Providing an understanding of the impact of the contextual decision phenomena may lead to the design of more intelligent recommendation technologies.

The presence of significant dominance effects calls into question many current practices of recommendations presentation which have largely ig-

nored the presence of other products and their relative position in the list provided by the agent.

This study is also extending previous RA research by proposing a novel way of compiling the recommended set that is presented to the individuals. To the best of our knowledge, such a design has not been considered in RA or even human–computer interaction research.

The role of situational characteristics, such as individuals' involvement in the decision at hand, delineates the conditions under which dominance relationships matter in a RA context.

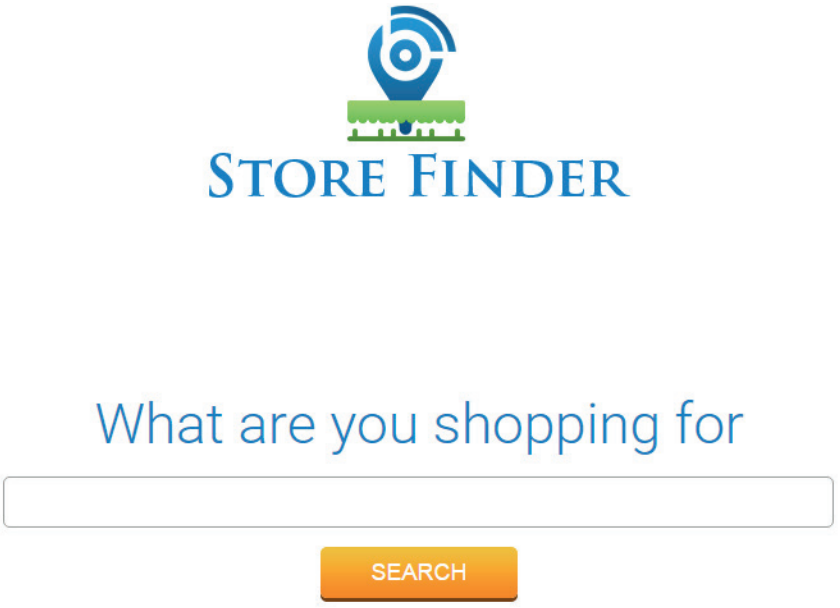
The findings of this study are generalizable to other decision domains, apart from that of individuals' product selection. If context effects impact decision processes and outcomes the way we propose, it is possible that these effects occur in other technology supported decisions, like healthcare decision-making. This is a highly uncertain and consequential environment were the composition of the recommended alternatives may relief or burden decision makers.

Designers of RAs and in some sense, of any system that presents a list of results/ products to individuals should take into account that the relationship of the attribute levels of the top alternatives have a significant impact on technology acceptance and the shopping experience.

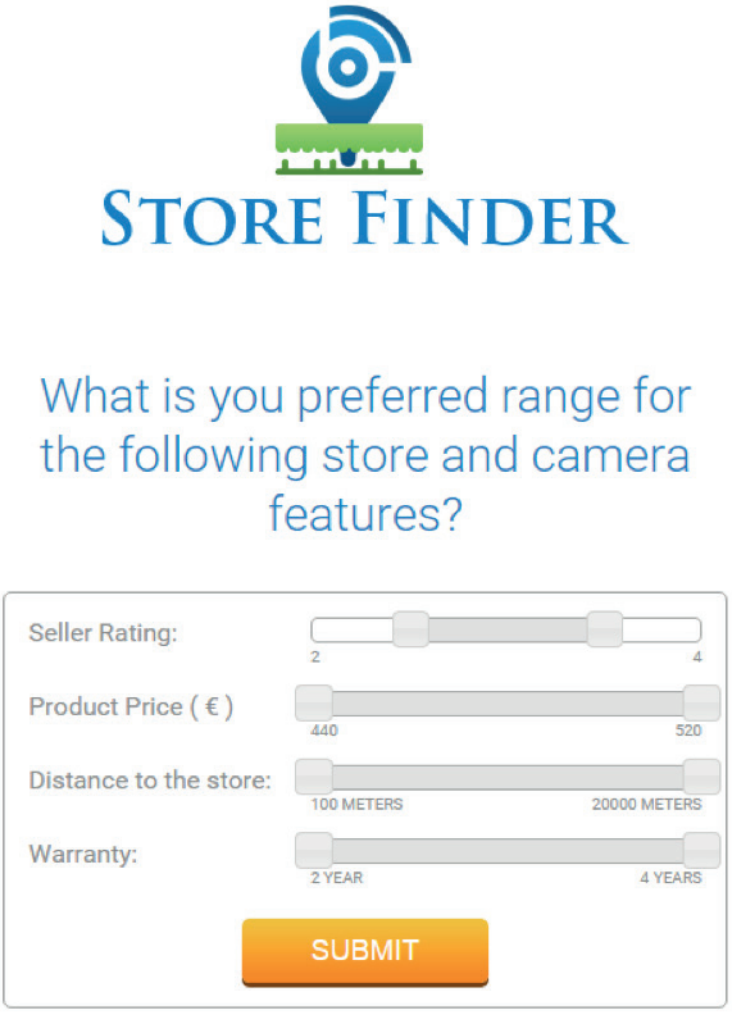
A number of recommendation websites show a "top 3" or "top 5" of most attractive alternatives while giving the option to click through to see all ranked alternatives. This work demonstrates that the presentation of a balanced set of alternatives that score well on different dimensions are only seemingly providing a better RA set to the user. Compared to presenting a set in which the best alternative clearly stands out against other alternatives, balance representation may harm conversion and consumer satisfaction. In this way we draw attention to the composition of recommended sets that improve both individuals' decision experience and the evaluation and acceptance of the RA.

APPENDIX A

Website Homepage



Preferences elicitation page



Example of Recommendations Page (symmetric dominance)

We found the following stores that match your preferences
Please choose your preferred store.

STORE NAME	STORE RATING (CUSTOMER REVIEW)	DISTANCE TO THE STORE	PRICE	WARRANTY
STORE A	★★★★☆ / 4 OUT OF 5	100	520	3

STORE NAME	STORE RATING (CUSTOMER REVIEW)	DISTANCE TO THE STORE	PRICE	WARRANTY
STORE B	★★★★☆ / 4 OUT OF 5	100	520	2

STORE NAME	STORE RATING (CUSTOMER REVIEW)	DISTANCE TO THE STORE	PRICE	WARRANTY
STORE C	★★☆☆☆ / 2 OUT OF 5	20000	440	4

APPENDIX B

Manipulation of the Decision Context

In order to represent each of the dominance effects, we manipulate the rules which the RA uses in order to calculate the attributes of each feature for each store. As mentioned before, the stores themselves are fictitious, are dynamically generated based on the input of the individual based on specific rules. The rules follow the boundary conditions indicated by the participant and also followed for each experimental condition. Behind each attribute level a "+" or "–" symbol indicates if it is a relatively attractive or unattractive feature. These symbols were not visible for respondents, but facilitate understanding of the balance between alternatives.

The Symmetric Dominance Effect

Symmetric dominance is achieved if one alternative is superior to the other alternatives on all attributes. First, we need to put forward a dominant store A. This store obtains a positive score on all attributes.

STORE A

Seller rating: Equal to the highest possible of the specified preference. (+)
Price: Equal to the lowest possible preferred price. (+)
Distance to the store: Equal to the closest indicated distance (+)
Warranty: Equal to the highest preferred warranty (+)

Then a second and third alternative B and C are added that makes A the dominant alternative on all attributes compared to B and C. B takes on a middle position that dominates C (a middle score of +/- vs. -), while A dominates both B and C.

STORE B

Seller rating: middle of possible specified preference (+/-)
Price: middle of possible price specified (+/-)
Distance: middle of indicated distance specified (+/-)
Warranty: middle of preferred warranty specified+1 (+/-)

STORE C

Seller rating: lowest possible specified preference (-)
Price: highest possible price specified (-)
Distance: furthest indicated distance specified (-)
Warranty: lowest preferred warranty specified+1 (-)

The Asymmetric Dominance Effect

Asymmetric dominance was achieved by first creating two balanced alternatives that were superior to the other alternative on two out of four attributes and inferior to the other alternative on the other two out of four attributes. Then, a third alternative was added that was identical to one of the two other alternatives, except for one attribute on which it was inferior.

First two stores (A and C) are created that are balanced in terms strongly and poorly scoring attributes.

STORE A

Seller rating: Equal to the highest possible of the specified preference (+)
Price: Equal to the highest possible preferred price (-)
Distance to the store: Equal to the closest indicated distance (+)
Warranty: Equal to the lowest preferred warranty+1 (-)

STORE C

Seller rating: Equal to the lowest possible of the specified preference (-)
Price: Equal to the lowest possible preferred price (+)
Distance to the store: Equal to the furthest indicated distance (-)
Warranty: Equal to the highest preferred warranty (+)

Then the third (asymmetrically dominated) store is added. This store is identical to store A, except for one attribute on which it scores worse (--).

STORE B
Seller rating: equal to store A (+)
Price: equal to store A (-)
Distance: equal to store A (+)
Warranty: store A warranty-1 (--)

The Balanced Control Condition

For the balanced (control) condition, again three alternatives were generated. These alternatives were all were superior to the other two alternatives in the set on two out of four attributes and inferior on the other two attributes. To do so the same two balanced stores are generated as in the asymmetric dominance condition (stores A and C). However, store B was not dominated in this condition. Instead it also was a balanced alternative with two strong and two poor attributes. This resulted in the following three stores types:

STORE A
Seller rating: Equal to the highest possible of the specified preference (+)
Price: Equal to the highest possible preferred price (-)
Distance to the store: Equal to the closest indicated distance (+)
Warranty: Equal to the lowest preferred warranty+1 (-)

STORE C
Seller rating: Equal to the lowest possible of the specified preference (-)
Price: Equal to the lowest possible preferred price (+)
Distance to the store: Equal to the furthest indicated distance (-)
Warranty: Equal to the highest preferred warranty (+)

STORE B
Seller rating: equal to store C (-)
Price: equal to store C (+)

Distance: equal to store A (+)
Warranty: equal to store A (-)

To illustrate how these rules may work for a specific individual we provide an example.

Individual specifies:
- A seller rating from 3 to 5 stars.
- Price should be between 220E and 280E.
- Distance to the store should be between 100 meters and 20 km.
- Individual specifies that warranty should be between 1 and 4 years

Symmetric Dominance

	Store A	Store B	Store C
Seller Rating (customer review)	5/5 stars	4/5 stars	3/5 stars
Price	€220	€250	€280
Distance to the store	100m	10km	20km
Warranty	4 years	3 years	2 years

Asymmetric Dominance

	Store A	Store B	Store C
Seller Rating (customer review)	5/5 stars	5/5 stars	3/5 stars
Price	€280	€280	€220
Distance to the store	100m	100m	20km
Warranty	2 years	1 years	4 years

Balanced Condition (control)

	Store A	Store B	Store C
Seller Rating (customer review)	5/5 stars	3/5 stars	3/5 stars
Price	€280	€220	€220
Distance to the store	100m	100m	20km
Warranty	2 years	2 years	4 years

APPENDIX C
Survey Instructions

Please take your time and read the following hypothetical scenario about yourself carefully. We are going to ask you some questions about it. Remember that your answers must demonstrate that you have completed the assigned reading.

Imagine yourself in the following situation:

Imagine that you want to buy a camera. After some thought and product information search you decide you want to buy the **Sony a6000**.

Since you have decided on which camera you want to buy, you navigate to the "**Store Finder**", a website application that gives you information about deals and availability of products in different stores, based on your preferences.

Website Use Instructions

You now need to browse Store Finder in order to search from which store you want to buy the camera. On the first page of the website you need to type in the camera brand and model. On the second page you will specify your preferences regarding features of the camera (price, warranty) and the store (distance to the store, seller rating).

The store Finder will then find the top 3 stores that match your specified preferences.

As a last step you will be asked to choose which store you want to buy the camera from. Choose the store which according to you provides the highest overall value/ benefit. – You will be later asked to provide reasons for your choice- .

Please don't close this window as you need to come back to finish the survey.

Click the link below!

<<<<GO TO THE WEBSITE>>>>

APPENDIX D

Rotated Component Matrix

	Component		
	1	2	3
Perceived Decision Quality - Stores that suit my preferences were recommended by the Store Finder	.241	.780	-.143
Perceived Decision Quality - Stores that best fit my needs were provided by the Store Finder.	.195	.796	-.174
Perceived Decision Quality - Stores recommended by the Store Finder did NOT match my needs.	.024	.769	-.057
Difficulty - not at all difficult: very difficult	-.007	-.109	.896
Difficulty - not at all likely to regret: very likely to regret	-.052	-.179	.872
Intention - I am willing to use this website as an aid to help with my decisions about where to buy a camera.	.872	.173	-.077
Intention - I am willing to let the website assist me in deciding which electronic store to choose.	.838	.183	.046
Intention - I am willing to use this website as a tool that suggests to me a number of electronic stores from which I can choose.	.810	.076	-.051

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Tests of Between-Subjects Effects — Symmetric Dominance vs. Control

Source	Dependant Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Intention to Use the RA	11.236[a]	1	11.236	9.057	.003
	Perceived Decision Quality	4.018[b]	1	4.018	4.809	.030
	Perceived Decision Difficulty	12.078[c]	1	12.078	9.702	.002
Intercept	Intention to Use the RA	4998.116	1	4998.116	4028.547	.000
	Perceived Decision Quality	5330.139	1	5330.139	6378.626	.000
	Perceived Decision Difficulty	6247.059	1	6247.059	5018.457	.000
condition_num	Intention to Use the RA	11.236	1	11.236	9.057	.003
	Perceived Decision Quality	4.018	1	4.018	4.809	.030
	Perceived Decision Difficulty	12.078	1	12.078	9.702	.002
Error	Intention to Use the RA	214.637	173	1.241		
	Perceived Decision Quality	144.563	173	.836		
	Perceived Decision Difficulty	215.353	173	1.245		
Total	Intention to Use the RA	5221.444	175			
	Perceived Decision Quality	5477.222	175			
	Perceived Decision Difficulty	6471.556	175			
Corrected Total	Intention to Use the RA	225.873	174			
	Perceived Decision Quality	148.582	174			
	Perceived Decision Difficulty	227.431	174			

a. R Squared = .050 (Adjusted R Squared = .044)
b. R Squared = .027 (Adjusted R Squared = .021)
c. R Squared = .053 (Adjusted R Squared = .048)

Tests of Between-Subjects Effects — Asymmetric Dominance vs. Control

Source	Dependant Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Intention to Use the RA	4.180[a]	1	4.180	3.085	.081
	Perceived Decision Quality	.120[b]	1	.120	.122	.727
	Perceived Decision Difficulty	1.009[c]	1	1.009	.696	.405
Intercept	Intention to Use the RA	5094.359	1	5094.359	3760.302	.000
	Perceived Decision Quality	5393.862	1	5393.862	5464.137	.000
	Perceived Decision Difficulty	5896.082	1	5896.082	4069.687	.000
condition_num	Intention to Use the RA	4.180	1	4.180	3.085	.081
	Perceived Decision Quality	.120	1	.120	.122	.727
	Perceived Decision Difficulty	1.009	1	1.009	.696	.405
Error	Intention to Use the RA	249.278	184	1.355		
	Perceived Decision Quality	181.634	184	.987		
	Perceived Decision Difficulty	266.576	184	1.449		
Total	Intention to Use the RA	5378.333	186			
	Perceived Decision Quality	5594.000	186			
	Perceived Decision Difficulty	6172.444	186			
Corrected Total	Intention to Use the RA	253.458	185			
	Perceived Decision Quality	181.754	185			
	Perceived Decision Difficulty	267.584	185			

a. R Squared = .016 (Adjusted R Squared = .011)
b. R Squared = .001 (Adjusted R Squared = -.005)
c. R Squared = .004 (Adjusted R Squared = -.002)

5
Conclusion

A number of aspects of RA research related to consumer decision-making have been studied in this doctoral dissertation. First, we investigated the role of anticipated emotions in motivating the use of RAs. Our main goal was to uncover the impact of anticipated regret on the decision to use a decision aid. Our results indicate that anticipated regret can motivate individuals to use assistive technology. The effect is stronger for decisions of high complexity. Second, we explored how User Effort interacts with an RA's decision strategy to influence the evaluation of these systems. A less extensive decision strategy is perceived to be of higher quality, because it saves users' effortful processing. With the third and final research paper, we performed two studies on how the output that users see on their screen may or may not drive their system and decision evaluation. Our findings indicate that the RA set composition does influence the perception of the RA both in a lab and field setting.

The findings are supported by complementary data from the field. In the following section, we summarize the findings of the three research papers. The focus is on main contributions and avenues of future research that call for further exploration.

5.1 Summary of key findings

Online decision support systems, aimed at improving the efficiency and effectiveness of consumer decision-making have been around for a couple of decades. Yet, their use is not widespread and thus, the benefits they can offer to consumers remain unrealized. Hence, the research in this thesis attempted to discover factors that can contribute to an increase in the adoption of recommendation agents. While research on RA acceptance has experienced

considerable growth, and is at the stage of maturity, there are still many open questions and several of these have been investigated in this manuscript.

In the first research paper, we investigated the role that anticipated regret can play in persuading consumers to use online decision aids. The idea originated from the realization of the important role that anticipated emotions play in other decision-making domains. And therein lies the novelty of the paper. The emotion of regret was particularly suitable for our investigation, as it is often cited as a reason for decision avoidance. As an RA is a decision support technology that can help consumers reduce decision error, regret anticipation with respect to making a poor decision without the use of the technology may be a useful vehicle for adoption increase.

To investigate this question, we conducted two lab experiments. In the first experiment, we asked some of the participants to think about the regret they would feel if they made a bad decision in choosing a flight plan to Australia. We then asked them to report their intention to use an RA to assist them with the decision. The second experiment builds upon the literature in message framing and persuasion, and investigates whether RA acceptance can also be increased by regret-laden, persuasive messages. For both experiments we also varied the complexity of the task at hand, since this is a factor that also weighs heavily on the decision to accept decision assistance. Our findings suggest that anticipated regret has the ability to promote decision aid acceptance. The strength of the effect may be dependent on contextual (complexity) characteristics. A limitation of our approach is that we collected data through a scenario-based experiment. We asked participants to imagine using an RA, rather than actually presenting them with a real RA, which they could use during the experiment.

The second paper shows the central role that User Effort plays in the evaluation of the decision process (Decision Quality) and the evaluation of the RA (RA Quality). Whereas an RA using an extensive decision strategy (WADD) is not overall perceived differently than a limited RA (EBA) in terms of system (RA) and decision quality, differences come to light when taking into account the effort that users need to exert when using these two agents. A less extensive RA is perceived to lead to higher decision quality

only when the RA is saving users from effortful decision-making. Similarly, an extensive RA is not perceived as being of higher quality in general, but is only perceived to be of higher quality when it is also perceived not to require high User Effort. These findings are the result of one lab experimental study where 154 university students used either an actual WADD or EBA house Recommendation Agent and reported their rating regarding RA and Decision Quality, as well as User Effort, directly afterwards.

In the case of the last research paper, we show that the presence of dominance in the recommendation list of products presented to the user affects his/her evaluation of the RA, as well as his/her evaluation of the experience of the decision process. Our objective was to contribute to the literature on RA output with insights from decision theory and context effects. Findings in the literature on context effects — preference changes that depend on the availability of other options — may not hold in an online, RA environment. We hypothesized that the presence of symmetric dominance (one clearly superior product) or asymmetric dominance (absence of a clearly dominant product) in the list that an RA user sees when searching to buy a digital camera, results in the perception of: (a) higher decision quality, (b) lower decision difficulty, (c) higher intention to use the RA. The findings suggest that while the symmetric dominance effect had significant and positive consequences for the individual's experience with the RA and their intention to use the RA, the asymmetric dominance effect did affect individuals' evaluations and intentions concerning the RA, but to a lesser extent. We also found that people who are less involved in the decision are more affected by dominance effects. The experimental findings are further validated by real-world choice data from a Dutch online financial product recommendation website. An analysis of 35,113 actual product choices showed that consumers who were presented with a dominated set of alternatives were more likely to purchase a product from the recommended set. The outcome of this research can be used to design RAs in such a way that user experience as well as acceptance of the RA is maximized. A main limitation of this paper lies in its implications; the existence of truly symmetric dominance in recommended sets in real-world marketplaces is less likely to occur and, as a result, the practical implementation of generating dominated recommended sets in real markets

may not be universally applicable. An issue for further research includes a study that examines the objective quality of each decision and whether it is improved by dominance in RA sets (c.f Haubl & Trifts, 2000).

5.2 Implications for Research

The essays included in this dissertation offer a number of significant theoretical implications in regards to RA evaluation and RA acceptance. Primarily, this dissertation offers a first account of the role of anticipated emotions in technology and RA acceptance. While past research has focused on the role of cognitive elements of decision-making in explaining RA use, this research provides a first account of the important role of the cognitive emotion of anticipated regret. Websites that employ RAs or activities promoting the use of RAs can effectively increase their acceptance by priming anticipated regret. Focusing on technology itself, RA use and RA output, this research confirms that the presentation of alternatives at the output stage, as well as the decision strategy implemented by the RA itself, can enhance one's evaluation of an RA. In 2007, Xiao & Benbasat postulated that "RA use will influence users' perceived usefulness of, perceived ease of use of, trust in, and satisfaction with an RA" (p. 161). "However, this does not provide much insight into our understanding of the effects of RA use on users' evaluations. In order to answer research question (2.1) — How does RA use influence users' evaluations of RAs? — it is important to take into account RA characteristics and other important moderating factors." (p. 161). This dissertation responds to this call by examining the effect of strategy extensiveness on decision process and RA acceptance variables. The same authors further note that no study has investigated the effect of the preference elicitation method on users' perceptions of how easy it is to use the RAs, which is another research gap we address.

At a minimum, our findings underscore that these elements, ignored by past research, do need to be considered when designing decision support systems. Understanding the mechanisms through which consumers make technology decisions is of great importance for marketing managers when they develop new technology products, services and marketing com-

munication campaigns. Only through studying consumer behavior will we understand how we should adapt innovations to match consumers' needs. Integrating our findings with the body of prior research investigating how to improve the acceptance of RAs offers a number of practical recommendations on how higher evaluation and acceptance can be achieved in tandem.

5.3 Implications for Practice

This dissertation presents three actionable ways through which managers and designers can increase RA acceptance and evaluation. Chapter 2 shows the effects of presenting users with decision-related, anticipated regret-laden messages. Chapter 3 shows that RA evaluation also depends on how extensive RA strategies are. As such, RA designers should keep in mind that once users believe that they put too much effort into using the RA, the evaluation of the system is affected in a negative way, independently of whether the system processes information in a more extensive way (WADD) or a more limited way (EBA). A system that is perceived to be cumbersome in its use decreases the individual's intention to use the RA, as well as the perceived quality of the decision taken. As a result, the design of these systems should not sacrifice the user's experience for technical superiority. Chapter 4 directs designers towards an informed choice on how they should present RA output (products) to the user in order to improve evaluation and increase acceptance. Marketers can increase their product sales by altering the recommendation set to a set where dominance is present. A recommendation set where dominance is present has positive psychological effects on consumers' perceived decision quality and RA acceptance. Users experience less difficulty in choosing a product and intend to use the RA again.

5.4 Limitations & Future Research

The findings reported in this dissertation should be interpreted in the context of their limitations. While the thesis provides valuable insights into factors that promote RA acceptance and use, further research is required to obtain a deeper understanding of these effects. Factors that might mod-

erate the effects reported here include the number of available alternatives and the amount of risk associated with a purchase. Additionally, consumers' trust towards an RA would create a clearer picture of the state of the field.

All experiments were conducted either in the lab (Chapter 3 and 4) or using the MTurk online panel (Chapter 2). While this fact strengthens the internal validity of the research and allows for control of factors such as noise and time taken to complete the tasks, it weakens the external validity of the results. However, a recurring limitation of the studies was the nature of the sample used. To conduct our experiments, we either used samples drawn from the Mturk online panel, or ad hoc samples of university students. This approach creates the potential for self-selection bias as these populations have certain relatively stable characteristics (e.g. education level, age). It is possible that this skewed nature of the sample affected the mean scores of some of the measured variables.

Future research efforts could proceed in a number of directions. First, we underline the need for a field examination of the relationships tested in this dissertation. It is possible that the results of all three essays will differ in a field, real-world setting. Secondly, this research followed a quantitative design in its entirety. Future research can aim at verifying the results following a qualitative research design such as in-depth interviews with consumers and experts, or case studies. Third, this research focused on content-filtering RAs. This reduces the generalizability of results to other types of RAs available in the market. Future effort can be directed towards content-filtering RAs, which are quite popular (e.g. product reviews) yet not thoroughly investigated at an academic level. Fourth, it is also possible that our results do not hold beyond western-oriented cultures. Future research efforts should consider replicating the studies described herein in other cultural contexts, and explore the role that culture plays in affecting the determinants of RA acceptance. Fifth, future research could investigate how the proposed relationships hold in contexts where customers interact with online IT artefacts in public domains. Past research in marketing seems to suggest that due to increased social presence, the emotions experienced intensify (Dahl et al., 2001). An additional path for future investigation is the examination of actual choice and usage of RAs. Our studies infer acceptance

and actual use by studying intention to use. Finally, a last more generally unexplored area is the factors that play a role in the repeated use of RAs. Future research may steer away from the intention to use an RA and focus on what brings users back to its use.

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Summary in English

The purpose of this dissertation is to investigate how designers and marketers can promote the use of technologies aiding online consumers' decisions. We examine the problem from two different viewpoints that highlight different strategies by which one can influence consumer behavior towards recommendation systems.

In Chapter 2, we investigate whether anticipated regret can be used to overcome individuals' reluctance to use online recommendation systems that help them achieve better choice outcomes. In two experiments, we show that triggering anticipated regret about the outcome of a decision can increase user acceptance of online recommendation systems. The results highlight the power of appealing to anticipated regret as a generic means to persuade consumers to use recommendation systems to further improve their (complex) decision outcomes.

In Chapter 3, we theorize on the neglected role of User Effort in relation to the evaluation of the recommendation system technology and the experience with the decision itself. We built an actual recommendation agent and asked participants to use two different versions of the aid in a lab environment. The results indicate that greater effort savings experienced by users while being aided by technology, translate into a higher evaluation of the recommendation system itself. The study sheds light on the prior inconclusive empirical evidence on the relationship between User Effort and Decision Quality.

In Chapter 4, we examine whether a clearly superior, dominant alternative that is presented at the top of a list of recommended products steers individuals into making decisions more easily. Basing our expectations on theory concerning choice context effects and dominance evaluation, we provide a novel perspective on constructing what consumers' see on their screens when purchasing products online. The suggested system design approach improves decision process and outcome evaluations as well as recommendation system acceptance. The findings are corroborated by real-world choice data from a popular insurance products website.

Overall, this dissertation contributes to the academic literature in a number of ways. Firstly, it offers a first account of the role of anticipated emotions in technology and RA acceptance. Focusing on technology itself, RA use and RA output, it also confirms that the presentation of alternatives at the output stage, as well as the decision strategy implemented by the recommendation system itself, can enhance one's evaluation of an RA. At a minimum, our findings underscore that these elements need to be considered when designing decision support systems. Understanding the mechanisms through which consumers make technology choices is of great importance for marketing managers when they develop new technology products, services and marketing communication campaigns. Finally, the dissertation presents three actionable ways through which managers and designers can increase RA acceptance and evaluation.

Summary in Dutch

Het doel van deze dissertatie is te onderzoeken hoe ontwerpers en marketeers het gebruik van technologieën die de beslissingen van online consumenten helpen, kunnen bevorderen. We onderzoeken het probleem vanuit twee verschillende perspectieven die ieder verschillende strategieën belichten door welke men consumentengedrag met betrekking tot aanbevelingssystemen kan bevorderen.

In Hoofdstuk 2 onderzoeken we of geanticipeerde spijt (anticipated regret) gebruikt kan worden om de tegenzin van individuen met betrekking tot het gebruik van online aanbevelingssystemen die hen helpen tot betere keuzes te komen, te overwinnen. De resultaten markeren de kracht van het beroep op geanticipeerde spijt (anticipated regret) als een algemeen middel om consumenten te overtuigen tot het gebruik van een aanbevelingssysteem om hun (complexe) beslissingsuitkomsten te verbeteren.

In Hoofdstuk 3 theoretiseren we de verwaarloosde rol van gebruikersinspanning (user effort) in relatie tot de evaluatie van de aanbevelingssysteemtechnologie en de ervaring met de beslissing zelf. We hebben een recommendation agent gebouwd en deelnemers gevraagd om twee verschillende versies van het hulpmiddel te gebruiken in een labomgeving. De resultaten geven aan dat grotere inspanningsbesparingen ervaren door gebruikers terwijl ze geholpen worden door technologie, zich vertalen in een hogere evaluatie van het aanbevelingssysteem zelf. De studie werpt licht op het tot nu toe onduidelijke empirisch onderbouwing voor de relatie tussen gebruikersinspanning (user effort) en beslissingskwaliteit (decision quality).

In Hoofdstuk 4 onderzoeken we of een duidelijk superieur, dominant alternatief dat gepresenteerd is aan de top van een lijst van aanbevolen producten, individuen ertoe aanzet op eenvoudiger manier beslissingen te nemen. We bieden een nieuw perspectief op het construeren van wat consumenten zien op hun schermen als ze producten online kopen en baseren onze verwachtingen daarbij op theorie betreffende keuzecontext-effecten en dominance evaluation. De voorgestelde systeemontwerpaanpak verbetert beslissingsprocessen en resultaatevaluaties evenals acceptatie van het

aanbevelingssysteem. De resultaten worden ondersteund door daadwerkelijke keuzedata van een populaire website voor verzekeringsproducten.

In zijn geheel draagt deze dissertatie op een aantal manieren bij aan de academische literatuur. Ten eerste geeft ze een eerste verklaring voor de rol van geanticipeerde emoties in technologie en RA acceptatie. Door zich te richten op technologie zelf, RA gebruik en RA output, bevestigt ze dat de weergave van alternatieven bij de outputfase, als ook de beslissingsstrategie geïmplementeerd door het beslissingssysteem zelf, iemands evaluatie van een RA kan verbeteren. Onze resultaten benadrukken dat deze elementen in acht genomen dienen te worden wanneer men beslissingsondersteuningsystemen bouwt. Het begrijpen van de mechanismes waarmee consumenten technologiekeuzes maken is van groot belang voor marketing managers wanneer zij nieuwe technologieproducten, services en marketingcommunicatie campagnes ontwikkelen. Ten slotte presenteert deze dissertatie drie praktische manieren waardoor managers en ontwerpers RA-acceptatie en -evaluatie kunnen verhogen.

About the Author

Agapi Thaleia Fytraki was born in 1984 in Athens, Greece. She has studied Computer Information Systems at The American College of Greece, and obtained an MSc in Economics & Informatics from the Erasmus School of Economics (ESE) where she specialized on the adoption of technology innovations. In September 2011, Agapi started her Ph.D. under the supervision of professor Benedict Dellaert at the department of Business Economics at Erasmus School of Economics, Erasmus University. In 2014, she spent five months as a visiting scholar at Sauder School of Business, University of British Columbia.

Her research interests lay at the intersection of behavioral economics, decision making and information systems. She is particularly interested in the role of emotions, heuristics and regulatory processes in consumers' interaction with information technology. Application areas of interest include financial services, healthcare and e-commerce.

Her work has appeared in the proceedings of the International Conference on Information Systems (ICIS). Apart from her research activities, Agapi has been involved in teaching Marketing & Consumer Behavior courses and has supervised MSc and BSc theses.

She is currently a lecturer at the Economics and Business department of the Erasmus University College (EUC) and a part-time lecturer in Marketing for the Erasmus School of Economics.

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