Nuanced Effects of Decision Effort on Decision Confidence

in Matters of Quality versus Matters of Taste

by

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ABSTRACT

Consumers are largely considered cognitive misers because of their general aversion toward exerting mental effort in decision making. Prior research suggests that engaging in effortful decision tasks tends to undermine consumers' decision confidence by increasing metacognitive difficulty. In the current research, we examine the circumstances under which the relationship among mental effort exertion, metacognitive difficulty, and decision confidence can be more nuanced. The key hypothesis is that whether exerting more mental effort in the decision process increases or decreases decision confidence is a function of consumers' *effort sensitivity* in a particular domain and of the inferences that consumers draw from the decision effort they exert. We theorize that consumers' effort sensitivity is higher in domains considered "matters of quality" than in domains considered "matters of taste" such that exerting more mental effort has a stronger positive impact on how difficult a decision is perceived to be in quality domains than in taste domains. This systematic difference in effort sensitivity between quality and taste domains differentially impacts two distinct aspects of decision confidence – *preference clarity* and *preference correctness*. Evidence from seven studies supports this theorizing, demonstrating that exerting more mental effort in quality domains *reduces* confidence by undermining preference correctness, whereas exerting more mental effort in taste domains *increases* confidence by enhancing preference clarity. In addition, disentangling instrumental and incidental experienced decision effort reveals that the former is the key driver of the predicted effects on decision confidence. Moreover, eye tracking evidence provides deeper insight into the information processing strategies (e.g., attribute-based vs. alternative-based processing) that consumers use when making decisions in quality and taste domains. Beyond advancing our conceptual understanding of the experience and consequences of decision effort, these findings

have important practical implications for when firms and other choice architects should seek to promote versus discourage effort exertion in consumer decision making.

Keywords: Decision Effort, Decision Confidence, Preference Clarity, Preference Correctness, Metacognitive Difficulty, Visual Attention

Note: This dissertation is written by Nahid Ibrahim. Any reference to “we” is in anticipation of a joint submission to the target journal.

PREFACE

This thesis is an original work by Nahid Ibrahim. The research projects, of which this is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Dynamics of Experienced Difficulty (Effects on Consumption Experience and Evaluation of the Chosen Alternative),” No. Pro00069022, December 11, 2017, and Project Name “Experienced Difficulty Dynamics (Understanding the Dynamics of Experienced Difficulty via Eye-Tracking),” No. Pro00098345, February 28, 2020. I was responsible for the experimental design, the data collection and analysis, and the manuscript composition. My advisor, Prof. Gerald Häubl, supervised the experimental design and the data collection.

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INTRODUCTION

Effort, be it physical or mental, is an integral part of everyday consumer decision making, and it plays a critical role in consumers' assessment of the choices they make. Evidence suggests that consumers are largely cognitive misers as they feel a general aversion toward exerting mental effort in decision making (e.g., Kahneman 1973, 2011; Kool et al. 2010; Liu and Goodhue 2012; Shah and Oppenheimer 2008; Stanovich 2018; Tversky and Kahneman 1974). Due to the limitation of cognitive resources (Hughes et al. 2015) and consideration of opportunity costs (Kurzban et al. 2013), consumers are inclined toward expending less effort in cognitive tasks. As a result, cognitive processes that consume less cognitive resources often become the default cognitive mechanism in decision making (Stanovich 2018). Consistent with this view, it has been shown that when consumers engage in mentally effortful decision tasks, doing so tends to undermine their decision confidence by increasing metacognitive difficulty (e.g., Dhar 1997; Iyengar and Lepper 2000; Tversky and Shafir 1992; see Anderson 2003 for a review). In the current research, we examine the circumstances under which the relationship among mental effort exertion, metacognitive difficulty, and decision confidence can be more dynamic.

We introduce and test a theoretical model of the nuanced effects of the amount of mental effort that consumers experience while shopping for a product on their decision confidence. The key hypothesis is that whether exerting more mental effort in the decision process increases or decreases decision confidence is a function of consumers' effort sensitivity in a particular domain and of the inferences that consumers draw from the decision effort they exert.

We theorize that consumers' effort sensitivity – i.e., the strength of the relationship between effort exertion and metacognitive difficulty – differs systematically between domains

that are "matters of quality" (where alternatives *can* be rank-ordered based on features reflecting objective quality) and domains that are "matters of taste" (where alternatives *cannot* be rank-ordered based on their objective quality) (Spiller and Belogolova 2017). We predict that consumers' effort sensitivity is higher in domains considered "matters of quality" than in domains considered "matters of taste" such that a given amount of exerted decision effort has a stronger (positive) impact on how difficult a decision is perceived to be in quality domains than in taste domains. This systematic difference in effort sensitivity between quality and taste domains differentially impacts two distinct aspects of decision confidence – *preference clarity* (i.e., the extent to which consumers' choices reflect their true inclination) and *preference correctness* (i.e., the extent to which consumers' choices can be validated or justified by normative preferences). Exerting greater effort in quality domains undermines preference correctness, in turn diminishing decision confidence. By contrast, exerting greater effort in taste domains boosts preference clarity, in turn increasing decision confidence.

We present evidence from seven studies that were designed to shed light on the psychological forces that govern the nuanced effects of decision effort on decision confidence and to examine the potential moderators of this relationship.

THEORETICAL FRAMEWORK

Decision Effort

Effort is the subjective intensification of mental or physical activity in pursuit of a specific goal (Eisenberger 1992) and is quintessential to everyday consumer decision making. According to many models in economics, cognitive psychology, and neuroscience, effort has a distinct phenomenology such that it feels difficult and aversive, even when consumers predict

experiencing greater utility from engaging in effortful tasks (Comerford and Ubel 2013; Dreisbach and Fischer 2015; Kurzban 2016; Saunders et al. 2016). Consistent with this notion, there is a body of evidence that suggests that greater effort tends to undermine decision confidence by increasing metacognitive difficulty (Dhar 1997; Iyengar and Lepper 2000; Tversky and Shafir 1992; see Anderson 2003 for a review). Therefore, whenever possible, consumers are motivated to minimize effort (Hull 1943).

However, it is not well-understood why certain decisions feel more effortful than the others, which factors affect consumers' willingness to expend effort, and why there is a general aversion toward effort exertion (Westbrook and Braver 2015). Moreover, there is a lack of conceptual clarity regarding the essence of phenomenal effort and how it is perceived and interpreted across various decision contexts. To address this gap, we start with a discussion of what decision effort is, with a special emphasis on how it compares with other seemingly analogous constructs.

At a broader level, we define decision effort as the degree of active engagement with a decision task. Although this is not an exhaustive list, the amount of mental effort exerted is often multiply determined by the number of alternatives being considered (e.g., Iyengar and Lepper 2000; Reibstein, Youngblood, and Fromkin 1975), the number of attribute dimensions describing products (e.g., Chernev 2003a; Greifeneder, Scheibehenne, and Kleber 2010; Hoch, Bradlow, and Wansink 1999), the magnitude of tradeoffs among presented alternatives (e.g., Chernev 2005; Luce 1998; Luce, Bettman, and Payne, 1997; Luce, Payne, and Bettman, 1999, 2000; Gourville and Soman 2005; Griffin and Broniarczyk 2010), the structural and perceptual complexity of the choice set (e.g., Diehl, Van Herpen, and Lamberton 2015; Pocheptsova, Labroo, and Dhar 2010), as well as the perceived importance of the decision task (e.g., Schrift,

Netzer, and Kivetz 2011; Sela and Berger 2012). Effort exertion is also influenced by individuals' trait disposition toward engaging in cognitively demanding tasks (e.g., need for cognition, Lin and Wu 2006), as well as their lay beliefs about favorable effort-outcome link (e.g., work ethic heuristic, Schrift, Kivetz, and Netzer 2016).

Although effort and difficulty are often used synonymously, we posit that they are not the same thing. Difficulty can be construed as the degree to which a task seems demanding and thus a key determinant of how much effort is required to achieve the desired outcome in that task. We refer to this prospective assessment as *task difficulty*, which speaks to the anticipated or demanded decision effort. Difficulty can also be construed as the subjective assessment of how demanding the decision task is as one actively engages with the task. We refer to this concurrent and/or retrospective assessment as *metacognitive difficulty*, which speaks to the ongoing and/or experienced decision effort. Prior research has shed light on the dynamics of anticipated decision effort and expended decision effort when there is a discrepancy between how important a decision task is perceived to be and how difficult the task actually feels (Schrift, Netzer, and Kivetz 2011; Sela and Berger 2012). In this research, we shed light on the dynamics between expended decision effort and metacognitive difficulty and how it informs decision confidence.

Effort Sensitivity

Despite the predominant view in consumer research that effort is aversive and often triggers negative affective reactions in consumers, prior work has demonstrated that effort can also add value, both to the products of effort and to effort itself (e.g., Cacioppo and Petty 1982; Cutright and Samper 2014; Eisenberger 1992; Norton, Mochon, and Ariely 2012; Olivola and Shafir 2013; Schrift, Kivetz, and Netzer 2016). In this research, we aim to reconcile these prior mixed findings by conceptualizing effort exertion as a value-based decision process (Shenhav et

al. 2017; Westbrook and Braver 2015; Kool et al. 2017). We theorize that consumers tend to be more versus less sensitive toward exerting effort depending on their likelihood of achieving a desired decision goal (Atkinson 1957; Tolman 1955). When effort exertion signals low goal attainability, consumers tend to be more effort sensitive such that they experience disutility from expending further effort. By contrast, when effort exertion signals high goal attainability, consumers tend to be less effort sensitive such that they experience utility from expending further effort. These nuanced encodings of expended decision effort is manifested in consumers' metacognitive difficulty that is the extent to which they perceive or retrospectively evaluate a decision to be difficult versus easy. When effort exertion signals low goal attainability, it has a stronger (positive) impact on consumers' metacognitive difficulty than when it signals high goal attainability. We conceptualize the strength of this relationship between expended decision effort and metacognitive difficulty as consumers' *effort sensitivity*. Although it is plausible that consumers' trait disposition toward engaging in cognitively demanding activities (e.g., need for cognition, Cacioppo and Petty 1982; maximizing-satisficing tendencies, Schwartz et al. 2002) determines their effort sensitivity in general, in this research we focus our attention on contextualized effort sensitivity and its impact on decision confidence.

Decision Confidence

Prior work has defined decision confidence as the degree to which consumers are certain of the optimality or appropriateness of their decisions (Parker et al. 2016; Thomas and Menon 2007; Zakay 1985). This cognitive evaluation of decision optimality is primarily informed by the magnitude of conflict among alternatives (Zakay 1985), the balance of arguments for and against the chosen option (Griffin and Tversky 1992), as well as the amount of information available prior to the decision (Tsai, Klayman, and Hastie 2008). Firms place significant emphasis on

identifying touchpoints in consumers' decision journey where they can provide decision assistance and convey essential information that may boost decision confidence (Spenner and Freeman 2012). Although there is a body of research that rigorously examined the antecedents and downstream consequences of decision confidence across various contexts, the construct itself is not well-understood. This calls for a deeper examination of its latent structure to advance our understanding of the key determinants of consumers' subjective assessment of the optimality or appropriateness of their decisions.

In this endeavor, we draw a parallel between the literature on attitude and persuasion and the literature on choice and decision making. Prior research has shown that attitude certainty can be conceptualized and empirically separated in terms of attitude clarity (the subjective sense that one knows what one's attitude is) and attitude correctness (the subjective sense that one's attitude is correct or valid) (Petrocelli, Tormala, and Rucker 2007). In a similar vein, we identify two distinct aspects of decision confidence – *preference clarity* (i.e., the subjective sense that one's choices reflect their true inclination) and *preference correctness* (i.e., the subjective sense that one's choices can be validated or justified by normative preferences). Importantly, we pinpoint conditions under which these two aspects are differentially manifested in decision confidence as a function of consumers' effort sensitivity.

Matters of Quality versus Matters of Taste

Prior research has documented that consumers' beliefs about product differentiation vary considerably in terms of whether differences among products are largely "matters of quality" or they are largely "matters of taste" (Spiller and Belogolova 2017). This distinction between matters of quality and matters of taste coincides with consumers' beliefs about objectivity and subjectivity (Zeithaml 1988), as well as vertical and horizontal differentiations of products

(Anderson 2008; Chen 2009; Tirole 1988). In quality domains, consumers believe that alternatives can be rank-ordered based on features reflecting objective quality, and they make their choices based on how much they are willing to pay for quality. By contrast, in taste domains, consumers believe that alternatives cannot be rank-ordered based on objective quality, and they make their choices based on their own idiosyncratic preferences for product features. This differentiation exists along a *perceived subjectivity* continuum from *matters of quality* to *matters of taste*, where some domains are considered largely matters of quality (e.g., medical equipment), some are considered largely matters of taste (e.g., colors and shapes), and others fall somewhere in between (e.g., automobiles).

These beliefs have been shown to evolve over time (Carpendale and Chandler 1996; Kuhn, Cheney, and Weinstock 2000) and have substantial implications for information search behavior, interpretation of information, perceived usefulness of the information, advice seeking, preference matching, and preference for conformity (e.g., Berger and Heath 2007; Dai, Chan, and Mogilner 2020; Goethals and Nelson 1973; Gorenflo and Crano 1989; Olson, Ellis and Zanna 1983; Solomon, Pruitt, and Insko 1984; Spears, Ellemers, and Doosje 2009; Liu, McFerran, and Haws 2020). What is of special interest here is that perceived subjectivity of a decision domain has a differential impact on the extent to which consumers engage in a self-focused versus other-focused reasoning process (Spiller and Belogolova 2017; also see, Dai, Chan, and Mogilner 2020; Liu, McFerran, and Haws 2020). In quality domains, consumers believe that alternatives can be rank-ordered objectively and whether their own choices converge with those of other consumers is diagnostic of the optimality of their choices. By contrast, in taste domains, the match between the product and consumers' idiosyncratic preference is integral to the reasoning process and whether one's choices converge with those of others is less

important. We speculate that these distinct reasoning processes alter how experienced decision effort is encoded in quality and taste domains, in turn affecting consumers' decision confidence. Although consumers' beliefs about matters of quality and matters of taste seem to vary across product domains (Olson et al. 1983; Spears et al. 2009), we speculate that these beliefs can also vary within a common product domain as a function of the product features.

Predictions and Conceptual Model

We hypothesize that consumers' effort sensitivity is higher in domains considered "matters of quality" than in domains considered "matters of taste." That is, we propose that a given amount of exerted decision effort has a stronger (positive) impact on how difficult a decision is perceived to be in quality domains than in taste domains **(H1)**. This systematic difference in effort sensitivity between quality and taste domains differentially impacts two distinct aspects of decision confidence – *preference clarity* (i.e., the extent to which consumers' choices reflect their true inclination) and *preference correctness* (i.e., the extent to which consumers' choices can be validated or justified by normative preferences).

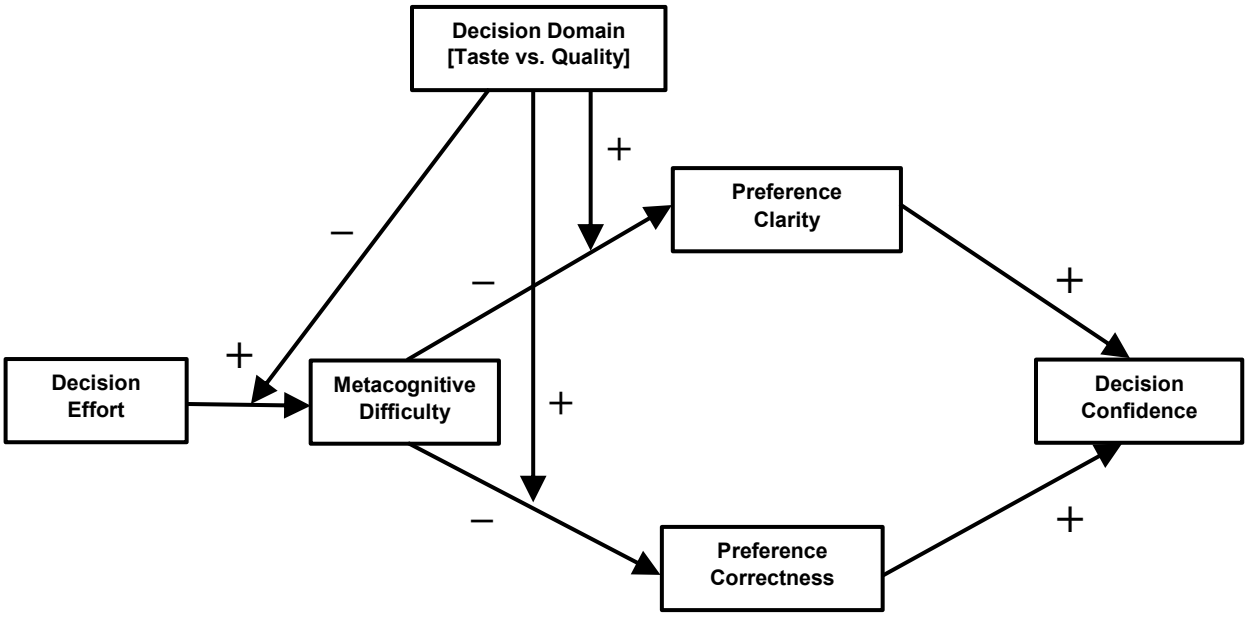
In *quality* domains, consumers are more attuned to finding an alternative that can be justified or validated to be the "right" choice. Prior work on attitude certainty has shown that individuals often engage in an extrinsic comparison process to establish the validity or accuracy of their inclinations (e.g., Fazio 1979; Festinger 1954). For example, if individuals' own inclinations converge with those of their immediate social group, they consider their inclinations to be more valid or accurate (e.g., Festinger 1954; Gerard and Orive 1987; Orive 1988; Visser and Mirabile 2004). We posit that in quality domains, consumers tend to engage in a similar reasoning process that focuses on their likelihood of choosing a justifiable or valid alternative (e.g., "I chose what other people would have chosen under the same circumstances"). In this

case, consumers associate cognitive ease or lack of mental effort with identifying a clearly dominant alternative and thus making a more valid choice. Therefore, when consumers experience greater effort in decision making, it induces a sense of divergence from normative preferences and signals to them that their likelihood of making the "right" choice is low. We predict that consumers tend to be more effort sensitive in quality domains such that exerting greater (vs. less) effort undermines their inferences about preference correctness, in turn diminishing decision confidence **(H2a)**.

By contrast, in *taste* domains, consumers are more attuned to finding an alternative that closely matches their own idiosyncratic preferences. In this case, consumers tend to engage in a reasoning process that focuses on the extent to which their true inclinations are clear in their minds (e.g., "What I chose really reflects my true preference"). This intrinsic reasoning process is phenomenologically distinct from the more extrinsic one of validating or justifying one's chosen alternative by normative preferences. Therefore, when consumers experience greater effort in decision making, it induces a sense of convergence about their own inclinations and signals to them that their likelihood of selecting an alternative that matches their true preference is high. We predict that consumers tend to be less effort sensitive in taste domains such that exerting greater (vs. less) effort promotes their inferences about preference clarity, in turn increasing decision confidence **(H2b)**.

Figure 1 depicts the proposed conceptual model. It summarizes the hypothesized nuanced effects of decision effort on decision confidence in taste versus quality domains, with metacognitive difficulty as a moderated serial mediator, and preference clarity and preference correctness as moderated parallel mediators.

Figure 1:
Conceptual Model



Moderating Role of Instrumental versus Incidental Decision Effort

Prior research has shown that a decision can feel more or less effortful due to factors that are either instrumental or incidental to the decision task (Payne, Bettman, and Johnson 1993). We define *instrumental* decision effort as the effort that is inherent to the decision itself – for instance, the mental effort experienced in evaluating or considering product information. It tends to increase as the magnitude of tradeoffs among available alternatives increases (Luce 1998; Luce, Bettman, and Payne 1997; Luce, Payne, and Bettman 1999, 2000) and is generally a positive function of the assortment size (Iyengar and Lepper 2000; Reibstein, Youngblood, and Fromkin 1975) and the number of attributes describing available options (Chernev 2003a; Greifeneder, Scheibehenne, and Kleber 2010; Hoch, Bradlow, and Wansink 1999), further amplified by the non-alignability (Gourville and Soman 2005; Griffin and Broniarczyk 2010)

and the complementarity of attributes dimensions (Chernev 2005). By contrast, we define *incidental* decision effort as the effort that is a byproduct of the decision task – for instance, the effort experienced in merely acquiring product information (e.g., in navigating to it, waiting for it to become available, or processing it prior to interpretation). This tends to increase as the ease with which product information can be obtained decreases, such as when internet lags while browsing for products or when product information is presented in visually degraded fonts. While incidental effort may still increase anticipated effort and task difficulty (Song and Schwarz 2008; Pocheptsova, Labroo, and Dhar 2010), unlike instrumental effort, it may not speak to consumers' metacognitive difficulty in choosing an alternative, in turn affecting decision confidence. For example, choosing from a smaller assortment that is presented in a disfluent font is expected to increase effort in obtaining and processing information compared to the same assortment presented in a fluent font, but the effort expended in identifying one's preferred alternative may not vary significantly between these assortments, in turn affecting consumers' metacognitive difficulty. Therefore, we theorize that instrumental decision effort as opposed to incidental decision effort is the key driver of the predicted effects on decision confidence **(H3)**.

Potential Alternative Explanations

There are several possible alternative explanations for the proposed effects – that is what governs the relationship between exerted decision effort and decision confidence, and we actively address them in this research.

First, it is both intuitive and supported by extensive evidence that consumers exert more effort in decisions that they consider to be important (Chaiken and Maheshwaran 1994; Petty and Wegener 1998). In fact, consumers often artificially complicate important decisions that feel too

easy based on the effort-compatibility principle (Schrift, Netzer, and Kivetz 2011). It is plausible that consumers, in general, consider quality domains to be more important than taste domains and therefore are willing to exert more effort in quality domains than in taste domains. Moreover, consumers often rely on memorized evaluation of alternatives without actively deliberating about the presented information (i.e., affect-referral heuristic, Wright 1975; also see, Lingle and Ostrom 1979; Lynch, Marmorstein, and Weigold 1988; Pham 1998). This effect may be more pronounced in taste domains than in quality domains due to greater reliance on intrinsic (vs. extrinsic) reasoning processes (Spiller and Belogolova 2017; also see, Dai, Chan, and Mogilner 2020; Liu, McFerran, and Haws 2020), in turn attenuating the mental effort exerted in the decision process. However, it is not obvious whether the actual experience of greater effort in quality domains versus taste domains boosts or undermines consumers' decision confidence.

Second, apart from their perceived subjectivity, product domains also differ in other dimensions, such as the extent to which they are considered hedonic versus utilitarian, experiential versus material, vice versus virtue, etc., which may impact how consumers encode their exerted decision effort. For instance, prior research suggests that the benefits of utilitarian products are considered more concrete and quantifiable than those of hedonic products, and thus utilitarian products are easier to justify than hedonic products (Bazerman, Tenbrunsel, and Wade-Benzoni 1998; Kivetz 1999; Kivetz and Keinan 2006; Kivetz and Simonson 2002; Hsee 1995; Sela, Berger, and Liu 2009; Shafir, Simonson, and Tversky 1993). Therefore, exerted decision effort may be encoded more favorably in utilitarian domains than in hedonic domains and thus lead to greater decision confidence. However, it is an open question whether the distinction between utilitarian versus hedonic products strongly coincides with the distinction between matters of quality versus matters of taste.

Third, chronic individual differences in effort valuation may also lead to a differential impact of decision effort on confidence. For example, people with strong protestant work ethic belief (i.e., effort leads to positive outcomes) tend to exert more effort in decision making by seeking more information and spending more time before finalizing their choices (Schrift, Kivetz, and Netzer 2016). Similarly, people with high (vs. low) need for cognition (Cacioppo, Petty, and Kao 1984) have a strong internal motivation to engage in cognitive elaboration and thus develop stronger preferences for their chosen alternatives when choosing from a larger assortment than when choosing from a smaller assortment (e.g., Lin and Wu 2006). In this research, we actively account for these individual differences.

Finally, prior work suggests that consumers who are more knowledgeable about a product domain have more refined cognitive structures that help them differentiate among various alternatives more efficiently than those who are less knowledgeable (i.e., experts vs. novices; Alba and Hutchinson 1987; Morrin, Broniarczyk, Inman, and Broussard 2008). Moreover, experts are more likely to have well-articulated preferences for product features than novices (i.e., Chernev 2003b), which may influence the downstream consequences of effort exertion. In this research, we actively control for consumers' perceived expertise in the product domains.

OVERVIEW OF EMPIRICAL EVIDENCE

We present evidence from seven studies that were designed to test our theoretical model of the effect of exerted decision effort on decision confidence. Study 1 demonstrates a systematic relationship between perceived subjectivity of a decision domain and consumers' willingness to expend effort in that domain across 16 product categories, by showing that higher (lower) perceived subjectivity of a decision domain predicts a decrease (an increase) in consumers'

willingness to exert effort in the decision process. Studies 2 through 7 examine the hypothesized effects of exerted decision effort on decision confidence in quality versus taste domains using tightly controlled product-choice paradigms. Study 2 develops reliable measures of preference clarity and preference correctness as the predictors of decision confidence, and demonstrates the interdependence of these constructs in quality domains and independence of these constructs in taste domains. Study 3 provides a first test of the predicted interaction effect of exerted decision effort and decision domain on decision confidence and sheds light on its underlying psychological mechanisms. It shows that exerting more mental effort decreases confidence in quality domains by undermining preference correctness, whereas it increases confidence in taste domains by enhancing preference clarity. Importantly, this study demonstrates further downstream effects of mental effort exertion on decision confidence, such as consumers' likelihood of purchasing their selected products and their preference for additional information about the products. Study 4 establishes the robustness of these findings by tightly controlling for the hedonic versus utilitarian nature of the decision domain. Critically, this study shows that the nuanced effects of exerting more mental effort on decision confidence cannot be explained by the variations in perceived importance of the decision task and chronic individual differences in effort valuation. Studies 5 and 6 distinguish between instrumental experienced decision effort (the effort that is inherent to the decision process) and incidental experienced decision effort (the effort that is a byproduct of the decision task), and demonstrate that the former is the key driver of the predicted effects on decision confidence. Finally, study 7 conceptually replicates our key findings in a within-subjects experimental design and sheds light on the information processing strategies that consumers adopt as they navigate through the decision process in quality and taste domains (i.e., attribute-based vs. alternative-based processing) using eye tracking.

STUDY 1

The key objective of study 1 was to examine the relationship between perceived subjectivity of a decision domain and consumers' inclination toward effort exertion in that decision domain. This study also accounted for consumers' subjective knowledge of the decision domain and examined its interaction with the perceived subjectivity of the decision domain.

Method

Procedure. Two hundred and forty-five Amazon Mechanical Turk workers (M_{age} = 36.45 yrs., SD = 11.06; 55.5% female) completed this study in exchange for a payment of $1.40. Participants' task was to respond to series of questions about various product domains. At the outset of the study, they read a passage that explained the difference between domains that are considered largely "matters of quality" and those that are considered largely "matters of taste" (see appendix E for details). Then they responded to two follow-up questions that confirmed whether they understood the distinction between quality and taste domains. Next, participants were presented with 16 product domains (i.e., beers, clothing stores, credit cards, digital cameras, fast food chains, gas stations, hotels, laptops, moisturizer, package delivery services, search engines, sedans, shoes, smartphones, sodas, televisions; adopted from Spiller and Belogolova 2017), one at a time, in a randomized order. For each domain, they completed a battery of questions measuring their perceived subjectivity of the decision domain, willingness to actively exert effort in the decision process, and subjective knowledge of the decision domain. The study concluded with some basic demographic questions (i.e., age, gender, language used most commonly in daily life, etc.).

Measures. Our key dependent variable was the maximum amount of mental effort participants were willing to exert in each domain. For each domain, participants were asked to

imagine that they were considering making a purchase in that domain and indicate the maximum amount of time they would actively spend in the decision process (i.e., hours and minutes; log-transformed). Participants also indicated to what extent they considered the differences among available alternatives in a product domain to be matters of quality versus matters of taste on a 10-point scale (1 = "matters of quality", 10 = "matters of taste")[1] and how much they think they know about the product domain on an 11-point scale (0 = "very little", 10 = "a lot") (see appendix E for details).

Results

Perceived Subjectivity of the Decision Domain. A repeated measures ANOVA with Greenhouse-Geisser correction revealed that perceived subjectivity differed significantly across 16 product domains ($F(11.25, 2744.73) = 200.26$, $p < .001$, $\eta_p^2 = .451$). Product domains such as digital camera, laptop, and television were considered largely matters of quality ($M_{camera} = 2.96$, SD = 2.03; $M_{laptop} = 3.13$, SD = 2.08; $M_{television} = 3.27$, SD = 2.26), whereas domains such as soda, beer, and fast food chain were considered largely matters of taste ($M_{soda} = 9.11$, SD = 1.34; $M_{beer} = 8.60$, SD = 1.85; $M_{fastfood} = 8.17$, SD = 1.90) (see appendix A for details).

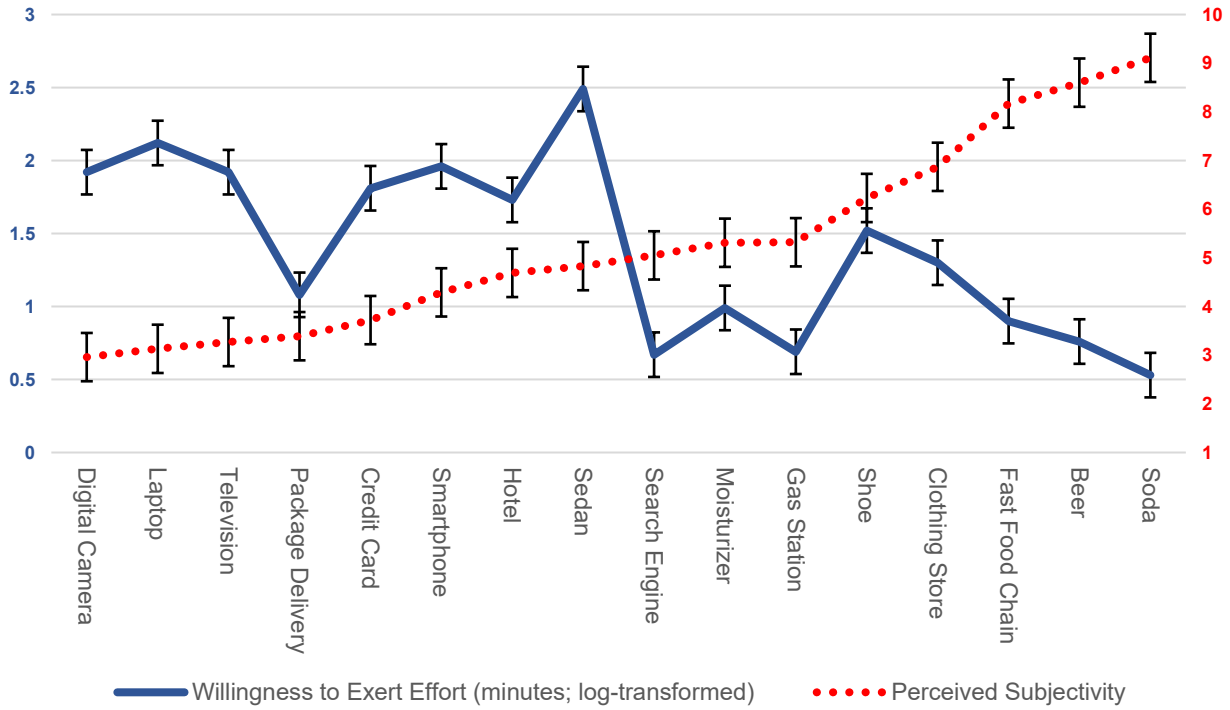
Subjective Knowledge of the Decision Domains. A repeated measures ANOVA with Greenhouse-Geisser correction revealed that participants' subjective knowledge of the 16 product domains varied significantly ($F(10.05, 2452.26) = 41.56$, $p < .001$, $\eta_p^2 = .146$). Participants indicated that they knew more about domains such as fast food chain, soda, and

[1] We used a 10-point scale instead of an 11-point scale to discourage participants from fence-sitting. To test the specific set of hypotheses guided by our conceptual framework, it was important that participants take a position on whether they consider the decision domains to be matters of quality or matters of taste and to what extent they believe so. However, we do acknowledge that there are decision domains that fall somewhere in between the perceived subjectivity continuum (see the discussion above). For these decision domains, incidental factors (e.g., consumption occasion, resource constraints, etc.) may shift whether consumers construe them as matters of quality or matters of taste, and thus influence how they interpret the effort exerted in the decision process. Future research should examine these nuanced context effects.

laptop ($M_{fastfood}$ = 7.39, SD = 2.11; M_{soda} = 7.33, SD = 2.36; M_{laptop} = 7.31, SD = 2.16), whereas they knew less about domains such as beer, sedan, and moisturizer (M_{beer} = 4.98, SD = 3.14; M_{sedan} = 5.22, SD = 2.46; $M_{moisturizer}$ = 5.34, SD = 2.71) (see appendix A for details).

Willingness to Exert Effort. A repeated measures ANOVA with Greenhouse-Geisser correction revealed that participants' willingness to exert mental effort in the decision process significantly varied across 16 product domains ($F(6.53, 1592.24) = 519.16$, $p < .001$, $\eta_p^2 = .680$). On average, participants were willing to spend more time choosing in product domains such as sedan, laptop, and smartphone (M_{sedan} = 862.71 minutes, SD = 1348.12; M_{laptop} = 299.84 minutes, SD = 672.32; $M_{smartphone}$ = 264.71 minutes, SD = 934.08), and less time choosing in domains such as gas station, fast food chain, and beer ($M_{gasstation}$ = 10.15 minutes, SD = 22.01; $M_{fastfood}$ = 13.48 minutes, SD = 19.98; M_{beer} = 14.94 minutes, SD = 47.64) (see appendix A for details). A repeated measures mixed model analysis with willingness to exert effort (i.e., time in minutes; log-transformed) as the dependent variable and perceived subjectivity of the decision domain as the independent variable revealed that a higher (lower) perceived subjectivity of a decision domain predicted a decrease (increase) in time participants are willing to actively spend in the decision process (β = –.094, SE = .003, t = –28.28, $p < .001$; 95% CI [–.101,–.088]; see figure 2). This effect was significant after controlling for participants' subjective knowledge of the decision domain and its interaction with perceived subjectivity of the decision domain (β = –.086; t = –9.50, $p < .001$; 95% CI [–.104,–.068]; see appendix B for details).

Figure 2:
Consumers' Willingness to Exert Effort (minutes; log-transformed) across 16 Product Domains as a Function of the Perceived Subjectivity of the Product Domains (Study 1)



Discussion

The findings of study 1 suggest that there are systematic differences across product domains regarding the extent to which they are considered matters of quality versus matters of taste. Importantly, this variance along the perceived subjectivity continuum is a significant predictor of consumers' willingness to exert effort across product domains, even after controlling for consumers' subjective knowledge of these product domains. These findings are consistent with our theorizing but not fully conclusive since these product domains differ considerably in their economic significance (e.g., Chaiken and Maheshwaran 1994; Petty and Wegener 1998). For instance, consumers may be willing to expend more mental effort in choosing a sedan

because it is a more expensive, more consequential, and less frequent purchase, whereas they may be willing to expend less mental effort in choosing a soda because it is a less expensive, less consequential, and more frequent purchase. Along the same line, consumers may rely on their memorized evaluation of alternatives (i.e., affect-referral heuristic, Wright 1975; also see, Lingle and Ostrom 1979; Lynch, Marmorstein, and Weigold 1988; Pham 1998) or have a well-articulated preference structure (Chernev 2003b; Mogilner, Rudnik and Iyengar, 2008) for sodas than for sedans, which may undermine their anticipated decision effort in the former domain. While anticipated decision effort may influence how much mental effort consumers actually expend while choosing in quality versus taste domains, it is not clear how actual effort exertion informs decision confidence under these circumstances. In subsequent studies, we aim to answer this question by manipulating the amount of mental effort exerted in the decision process by varying aspects of choice architecture such as the number of alternatives to be inspected, number of product features, as well as format and timing of information presentation.

STUDY 2

The objective of study 2 was to develop reliable measures of preference clarity and preference correctness and examine whether these constructs predict decision confidence. In this endeavor, we adapted the attitude clarity and attitude correctness scale advanced by Petrocelli and colleagues (2007) to fit product-choice paradigms.

Method

Procedure. We recruited four hundred and ninety-four Amazon Mechanical Turk workers (M_{age} = 36.77 yrs., SD = 11.53; 47.8% female) in exchange for a payment of $1.25.[2] Participants' task was to choose their preferred alternative either from an assortment of electric toothbrushes or from an assortment of coffee tables (see appendix D for sample screenshots). They were randomly assigned to one of four conditions in a 2 (decision effort: low vs. high) x (decision domain: quality vs. taste) between-subjects design. In the low effort condition, participants were presented with 4 alternatives[3] (in a 1 x 4 matrix), and in the high effort condition, they were presented with 20 alternatives (in a 5 x 4 matrix). The order in which the alternatives were presented was unique and random for each participant. Participants were asked to uncover these alternatives one by one by clicking on them. After looking at all the alternatives, participants indicated their choice and then responded to a series of questions. First, participants indicated their decision confidence on an 11-point scale (0 = "not confident at all", 10 = "very confident"). Followed by this measure, participants completed seven preference-clarity and preference-correctness items on 11-point scales (see table 1). Each participant was presented with these seven items in a unique, randomized order. Participants also responded to items measuring their metacognitive difficulty (0 = "not difficult at all" to 10 = "very difficult") and perceived subjectivity of the decision domain (1 = "matters of quality" to 10 = "matters of taste"; see appendix E for details). The time participants spent in choosing their preferred alternative was recorded unobtrusively.

[2] Initially, five hundred and three participants were recruited for this study. Nine of these were excluded from analysis due to evident response inconsistencies to attention check questions. Using the full sample yields the same substantive conclusions as those reported here.

[3] These 4 alternatives were a random subset of 20 alternatives in the larger assortment.

Table 1:
Items Measuring Preference Clarity and Preference Correctness
(Adapted from Petrocelli et al. 2007)

Items [4]	*M*	SD
Preference Clarity		
1. I truly know what type of [product] I prefer.	8.28	2.19
2. The [product] I chose really reflects my true preference.	8.51	1.85
3. My true preference for the [product] I chose is clear in mind.	8.49	1.83
4. The [product] I chose is the alternative I really prefer.	8.11	2.38
Preference Correctness		
1. The [product] I chose was the right alternative to be chosen.	8.35	1.65
2. Other people would have chosen the same [product] as I did from the presented choice set.	5.85	2.27
3. The [product] I chose reflects the correct way to evaluate available alternatives.	7.44	2.23

Results

Perceived Subjectivity of the Decision Domain. A two-way ANOVA with perceived subjectivity as the dependent variable revealed a significant main effect of decision domain, such that participants considered the choice among electric toothbrushes more of a matter of quality and the choice among coffee tables more of a matter of taste ($M_{quality}$ = 3.15, SD = 2.29 vs. M_{taste} = 7.60, SD = 2.19; $F(1, 490) = 485.60$, $p < .001$, $\eta_p^2 = .498$). Neither the main effect of decision effort ($F(1, 490) < .01$, $p > .900$) nor its interaction with decision domain ($F(1, 490) = .18$, $p = .672$) was significant, indicating that our manipulation of perceived subjectivity was successful.

[4] Participants were asked to indicate to what extent they agreed or disagreed with each statement about the alternative they selected. All responses were collected on 11-point scales (0 = "strongly disagree", 10 = "strongly agree").

Decision Time. A two-way ANOVA with decision time (seconds; log-transformed) as the dependent variable revealed a significant main effect of decision effort ($F(1, 490) = 1868.70$, $p < .001$, $\eta_p^2 = .793$). Consistent with our manipulation of decision effort, participants spent more time in choosing from an assortment of 20 alternatives than choosing from an assortment of 4 alternatives ($M_{\text{low-effort}} = 50.09$ seconds, SD = 53.20 vs. $M_{\text{high-effort}} = 187.29$ seconds, SD = 76.74). There was also a significant main effect of decision domain ($F(1, 490) = 14.26$, $p < .001$, $\eta_p^2 = .028$), such that participants spent more time in choosing their preferred electric toothbrush than choosing their preferred coffee table ($M_{\text{quality}} = 127.22$ seconds, SD = 102.50 vs. $M_{\text{taste}} = 108.03$ seconds, SD = 85.81). The interaction between decision effort and decision domain was not significant ($F(1, 490) = .10$, $p = .757$).

Exploratory Factor Analysis. The seven preference-clarity and preference-correctness items were examined via an exploratory factor analysis to assess the factor structure. We used a principal component analysis with oblique rotation, which allowed these items to be correlated. The Kaiser-Meyer-Olkin measure of sampling adequacy was .84, above the commonly recommended value of .60, and Bartlett's test of sphericity was significant (χ^2 (21) = 1305.64, $p < .001$), indicating that the set of items were suitable for a factor analysis. The analysis yielded a two-factor solution (eigenvalues > 1) that explained 65.192% of the total variance. Factor 1 explained 50.421% of the total variance and factor 2 explained 14.771% of the total variance. All four preference-clarity items loaded on factor 1 and had a high internal consistency (Cronbach's $\alpha = .80$) (see table 2). However, only two of the three preference-correctness items (i.e., items 2 and 3) loaded on factor 2, while the other (i.e., item 1) loaded on factor 1. Besides, these items had a low internal consistency (Cronbach's $\alpha = .59$).

Table 2:
Results Summary of Exploratory Factor Analysis

Items	*Loadings Total Sample*		*Loading Quality Domain*		*Loadings Taste Domain*	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
Preference Clarity						
• **Item 1**	**.779**	.086	**.781**	-	**.801**	.068
• **Item 2**	**.866**	-.043	**.810**	-	**.843**	-.019
• **Item 3**	**.827**	.112	**.851**	-	**.858**	.094
• **Item 4**	**.709**	-.193	**.715**	-	**.556**	-.392
Preference Correctness						
• **Item 1**	**.700**	.265	**.856**	-	**.698**	.179
• **Item 2**	-.106	**.881**	**.441**	-	-.019	**.823**
• **Item 3**	.292	**.617**	**.679**	-	.370	**.628**
Eigenvalue	3.529	1.034	3.890	-	3.176	1.175
% of Variance	50.421	14.771	55.568	-	45.375	16.784
Cumulative Variance %	**65.192**		**55.568**		**62.158**	

To probe further into the factor structure, we split the total sample by domains and conducted two separate principal component analyses with oblique rotation. In the quality domain, the analysis yielded a one-factor solution that explained 55.568% of the total variance (KMO adequacy = .87; χ^2 (21) = 785.26, $p < .001$). All seven items loaded on factor 1 and had a high internal consistency (Cronbach's $\alpha = .85$). By contrast, in the taste domain, the analysis yielded a two-factor solution that explained 62.158% of the total variance (KMO adequacy = .78; χ^2 (21) = 558.67, $p < .001$). Factor 1 explained 45.375% and factor 2 explained 16.784% of the variance. All four preference-clarity items loaded on factor 1 and had a moderately high internal consistency (Cronbach's $\alpha = .72$). However, only two of the three preference-correctness items (i.e., items 2 and 3) loaded on factor 2, while the other (i.e., item 1) loaded on factor 1. Besides, these items had a low internal consistency (Cronbach's $\alpha = .52$).

These findings are consistent with our theoretical account, suggesting that preference clarity and preference correctness are interdependent in quality domains and correspond to decision effort in a similar fashion. Conversely, preference clarity and preference correctness are independent of each other in taste domains and correspond to decision effort in distinct ways. The correlational structure of the original preference-clarity and preference-correctness items with decision confidence and metacognitive difficulty in quality and taste domains corroborates this theorizing (see appendix C for details). In the quality domain, all seven items positively correlated with decision confidence ($.418 \leq r\text{s} \leq .680$, $p\text{s} < .001$) and negatively correlated with metacognitive difficulty ($-.465 \leq r\text{s} \leq -.248$, $p\text{s} < .001$). By contrast, in the taste domain, preference-clarity items, including item 1 in the preference-correctness scale, positively correlated with decision confidence ($.270 \leq r\text{s} \leq .791$, $p\text{s} < .001$) and negatively correlated with metacognitive difficulty ($-.461 \leq r\text{s} \leq -.266$, $p\text{s} < .001$). However, in this case, the preference-correctness items (i.e., items 2 and 3) had low correlations with decision confidence ($.155 \leq r\text{s} \leq .359$, $p\text{s} < .05$), and they were uncorrelated with metacognitive difficulty ($-.118 \leq r\text{s} \leq -.031$, $p\text{s} \geq .068$). Note that in both domains, decision confidence and metacognitive difficulty was negatively correlated (quality domain: $r = -.465$, $p < .001$; taste domain: $r = -.461$, $p < .001$).

Based on these findings, we selected one item from the original preference-clarity scale (item 2: *"The [product] I chose really reflects my true preference"*) and one item from the original preference-correctness scale (item 2: *"Other people would have chosen the same [product] as I did from the presented choice set"*) that had the lowest correlation with each other both in quality domain ($r = .182$, $p = .004$) and in taste domain ($r = .041$, $p = .525$). We speculated that this would optimize the likelihood of detecting their distinct contributions to decision confidence in quality versus taste domains.

To examine the manner in which the selected preference-clarity and preference-correctness measures influenced decision confidence, we submitted decision confidence to a simultaneous regression analysis with preference clarity and preference correctness as the predictors. The analysis revealed that both preference clarity ($\beta = .504$, $p < .001$) and preference correctness ($\beta = .174$, $p < .001$) were significant predictors of decision confidence (see table 3a), and they remained so even after controlling for metacognitive difficulty (see table 3b). These relationships held in both quality and taste domains.

Discussion

Findings from the exploratory factor analyses support our theorizing that both preference clarity and preference correctness are significant predictors of decision confidence. Critically, our analyses suggests that preference clarity and preference correctness inform decision confidence in distinctive ways in quality versus taste domains. Consistent with our theorizing, a one-factor solution provided better fit in the quality domain, suggesting that preference clarity and preference correctness are interdependent and correspond to decision effort similarly. By contrast, a two-factor solution provided better fit in the taste domain, suggesting that preference clarity and preference correctness are independent and correspond to decision effort distinctively. Based on these findings, we selected one item from each set of the original items measuring preference clarity and preference correctness to differentiate their contribution to decision confidence in our subsequent studies.

Table 3a:
Results Summary of Linear Regression Analysis with Preference Clarity and Preference Correctness as the Predictors of Decision Confidence

Level of Analysis	*Predictors*	*β*	*t*	*p*	*F*	*df*	*p*	Adj. R^2
Total Sample (N=494)	Overall Model				179.32	2, 491	<.001	.420
	Preference Clarity	.612	16.826	<.001				
	Preference Correctness	.199	6.710	<.001				
Quality Domain (N=253)	Overall Model				86.580	2, 250	<.001	.404
	Preference Clarity	.527	9.966	<.001				
	Preference Correctness	.308	6.634	<.001				
Taste Domain (N=241)	Overall Model				105.145	2, 238	<.001	.465
	Preference Clarity	.680	14.127	<.001				
	Preference Correctness	.090	2.689	.008				

Note. The dependent variable for all regressions was decision confidence.

Table 3b:
Results Summary of Linear Regression Analysis with Preference Clarity and Preference Correctness as the Predictors of Decision Confidence Controlling for Metacognitive Difficulty

Level of Analysis	*Predictors*	*β*	*t*	*p*	*F*	*df*	*p*	Adj. R^2
Total Sample (N=494)	Overall Model				149.995	3, 490	<.001	.476
	Preference Clarity	.504	16.826	<.001				
	Preference Correctness	.174	6.710	<.001				
	Metacognitive Difficulty	–.169	–7.294	<.001				
Quality Domain (N=253)	Overall Model				69.865	3, 249	<.001	.450
	Preference Clarity	.444	8.261	<.001				
	Preference Correctness	.260	5.578	<.001				
	Metacognitive Difficulty	–.164	–4.683	<.001				
Taste Domain (N=241)	Overall Model				82.023	3, 237	<.001	.503
	Preference Clarity	.588	11.564	<.001				
	Preference Correctness	.087	2.725	.007				
	Metacognitive Difficulty	–.130	–4.412	<.001				

Note. The dependent variable for all regressions was decision confidence.

STUDY 3

The objective of study 3 was to examine the effect of active effort exertion in the decision process in quality versus taste domains. We tested our key prediction that consumers tend to be more effort sensitive in quality domains than in taste domains such that exerting more mental effort decreases confidence in quality domains, but it increases confidence in taste domains. We also examined two further downstream effects of exerting more mental effort on decision confidence – i.e., product purchase likelihood and preference for additional information about the products.

Method

Procedure. Five hundred and one participants recruited via Amazon's Mechanical Turk (M_{age} = 40.61 yrs., SD = 12.43; 51.7% female) completed this study in exchange for a payment of $0.85. Participants' task was to choose their preferred alternative either from an assortment of wireless headphones or from an assortment of coffee tables. They were presented with either 4 alternatives[5] (in a 1 x 4 matrix) or 20 alternatives (in a 5 x 4 matrix) to choose from (see appendix D for sample screenshots). The order in which the alternatives were presented was unique and random for each participant. Participants were asked to view these alternatives one by one, by uncovering them at 4-second intervals. Unless otherwise noted, the rest of the procedure was the same as those in study 2.

Design and Stimuli. Participants were randomly assigned to one of four conditions in a 2 (decision effort: low vs. high) x 2 (decision domain: quality vs. taste) between-subjects product choice paradigm. Decision effort was manipulated by varying the assortment size (i.e., considering 4 vs. 20 alternatives) and the magnitude of tradeoffs among the presented

[5] These 4 alternatives were a random subset of 20 alternatives in the larger assortment.

alternatives (i.e., alternatives varying along 2 vs. 4 feature dimensions). In the low effort condition, alternatives predominantly varied along two feature dimensions: wireless headphones varied in sound quality and price, whereas coffee tables varied in shapes and storage space.[6] By contrast, in the high effort condition, alternatives varied along four feature dimensions: wireless headphones varied in sound quality, noise-cancelling capability, battery life, and price, whereas coffee tables varied in shape, color, size, and storage space.

Measures. Participants indicated their decision confidence on an 11-point scale (0 = "not confident at all" to 10 = "extremely confident"). Followed by that they reported their preference clarity and preference correctness, in a randomized order (0 = "strongly disagree" to 10 = "strongly agree") by responding to the items developed in study 2. Then participants indicated their metacognitive difficulty (0 = "not difficult at all" to 10 = "extremely difficult"), and their likelihood of purchasing their chosen alternative should it become available at a store (0 = "not at all likely" to 10 = "very likely"). After that, participants were asked to read an excerpt (adapted from Olson et al. 1983) about how consumers form judgment about different products when making purchase decisions. They were informed that consumers can rely on two types of information that can bring new perspectives to their initial judgment about products – 1) what other people have purchased for themselves and 2) additional information about the product being considered. Then participants indicated, given an opportunity to choose between these two types of information, which type of information they would choose when making purchase decisions in the corresponding domain (1 = "information about what others chose", 0 = "additional information about their selected alternative"). They also reported their interest in obtaining each type of information on 11-point scales (0 = "not interested at all" to 10 = "very

[6] The 4 alternatives presented in the low effort condition were a subset of 20 alternatives presented in the high effort condition.

interested"). We also measured perceived importance of the decision task (0 = "not important at all" to 10 = "very important") and perceived enjoyment of the decision task (0 = "did not enjoy at all" to 10 = "enjoyed very much") as control variables. Perceived subjectivity of the decision domain and decision time was measured in the same way as in study 2.

Results

Perceived Subjectivity of the Decision Domain. As predicted, a two-way ANOVA with the perceived subjectivity as the dependent variable revealed a significant main effect of decision domain, such that participants considered the choice among wireless headphones more of a matter of quality and the choice among coffee tables more of a matter of taste ($M_{quality}$ = 2.95, SD = 2.29 vs. M_{taste} = 8.34, SD = 2.33; $F(1, 497) = 703.20$, $p < .001$, $\eta_p^2 = .586$). There was also a significant interaction effect of decision effort and decision domain ($F(1,497) = 9.95$, $p = .002$, $\eta_p^2 = .020$), such that the difference in perceived subjectivity between the choices of wireless headphones and those of coffee tables was more pronounced in the low effort condition ($M_{quality}$ = 2.34, SD = 1.95 vs. M_{taste} = 8.39, SD = 2.21; $t(497) = 20.80$, $p < .001$) than in the high effort condition ($M_{quality}$ = 3.54, SD = 2.45 vs. M_{taste} = 8.30, SD = 2.45; $t(497) = 16.67$, $p < .001$).

Decision Time. A two-way ANOVA with decision time (seconds; log-transformed) as the dependent variable revealed a significant main effect of decision effort ($F(1,497) = 2417.28$, $p < .001$, $\eta_p^2 = .829$), a significant main effect of decision domain ($F(1,497) = 19.63$, $p < .001$, $\eta_p^2 = .038$), as well as a significant interaction effect of these two factors ($F(1,497) = 4.87$, $p < .001$, $\eta_p^2 = .028$). Overall, participants spent significantly more time choosing their preferred alternative in the high effort condition than in the low effort condition ($M_{low\text{-}effort}$ = 37.04 seconds, SD = 18.79 vs. $M_{high\text{-}effort}$ = 151.22 seconds, SD = 51.88). Planned contrasts revealed that in the low effort condition, decision time did not vary significantly between quality and taste domains

($M_{quality}$ = 38.20 seconds, SD = 18.86 vs. M_{taste} = 35.82 seconds, SD = 18.72, $t(497) = .49$, $p = .622$). However, in the high effort condition, participants spent significantly more time choosing in the quality domain than in the taste domain ($M_{quality}$ = 166.23 seconds, SD = 56.61 vs. M_{taste} = 134.86 seconds, SD = 40.45, $t(497) = 6.63$, $p < .001$).

Decision Confidence. A two-way ANOVA with decision confidence as the dependent variable revealed the predicted interaction effect of decision effort and decision domain ($F(1,497) = 14.86$, $p < .001$, $\eta_p^2 = .029$) (see figure 3a). The main effect of decision effort ($F(1,497) = 14.27$, $p < .001$, $\eta_p^2 = .028$) and the main effect of decision domain were also significant ($F(1,497) = 13.25$, $p < .001$, $\eta_p^2 = .026$). Planned contrasts revealed that in the low effort condition, decision confidence did not vary significantly between quality and taste domains ($M_{quality}$ = 8.88, SD = 1.75 vs. M_{taste} = 8.85, SD = 1.59; $t(497) = .15$, $p = .880$). By contrast, in the high effort condition, participants were significantly more confident about their decision in the taste domain than in the quality domain ($M_{quality}$ = 7.71, SD = 2.10 vs. M_{taste} = 8.86, SD = 1.31; $t(497) = 5.35$, $p < .001$).

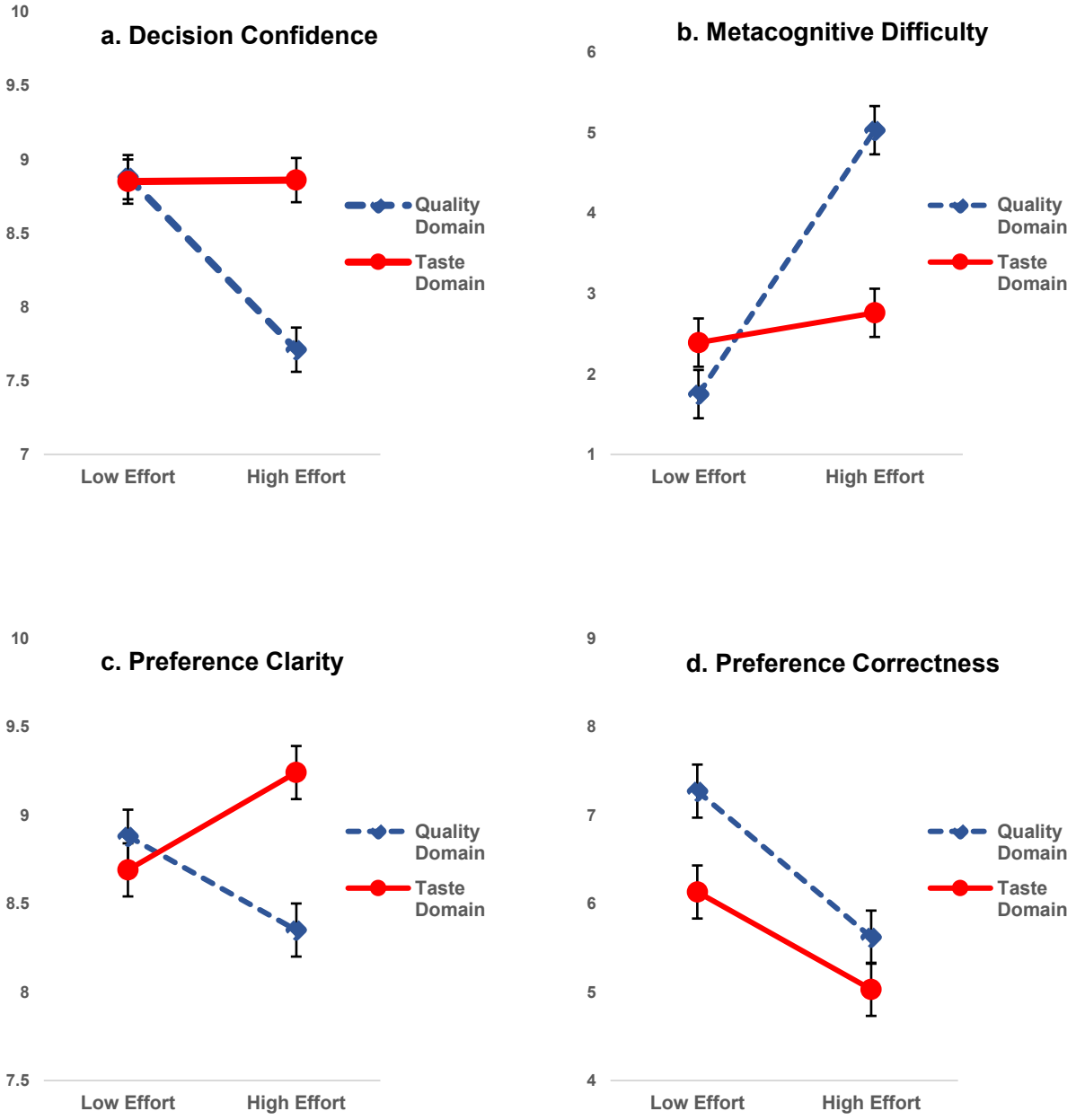
Metacognitive Difficulty. A two-way ANOVA with metacognitive difficulty as the dependent variable revealed a significant main effect of decision effort ($F(1, 497) = 56.55$, $p < .001$, $\eta_p^2 = .102$), a significant main effect of decision domain ($F(1, 497) = 11.16$, $p = .001$, $\eta_p^2 = .022$), as well as the predicted interaction effect of these two factors ($F(1, 497) = 36.08$, $p < .001$, $\eta_p^2 = .068$) (see figure 3b). Planned contrasts revealed that in the low effort condition, metacognitive difficulty was marginally higher in the taste domain than in the quality domain ($M_{quality}$ = 1.75, SD = 2.35 vs. M_{taste} = 2.39, SD = 2.60; $t(497) = 1.87$, $p = .062$). By contrast, in the high effort condition, metacognitive difficulty was significantly higher in the quality domain than in the taste domain ($M_{quality}$ = 5.03, SD = 3.03 vs. M_{taste} = 2.76, SD = 2.81; $t(497) = 6.67$, $p <$

.001). These findings supports our theorizing that consumers are more effort sensitive in quality domains than in taste domains.

Preference Clarity. A two-way ANOVA with preference clarity as the dependent variable revealed the predicted interaction effect of decision effort and decision domain ($F(1, 497) = 12.65$, $p < .001$, $\eta_p^2 = .025$), as well as a significant main effect of decision domain ($F(1, 497) = 5.21$, $p = .023$, $\eta_p^2 = .010$) (see figure 3c). Planned contrasts revealed that in the low effort condition, preference clarity did not vary significantly between quality and taste domains ($M_{quality} = 8.88$, SD = 1.50 vs. $M_{taste} = 8.69$, SD = 2.15; $t(497) = .89$, $p = .373$). By contrast, in the high effort condition, preference clarity was significantly higher in the taste domain than in the quality domain ($M_{quality} = 8.35$, SD = 1.92 vs. $M_{taste} = 9.24$, SD = .95; $t(497) = 4.17$, $p < .001$).

Preference Correctness. A two-way ANOVA with preference correctness as the dependent variable revealed a significant main effect of decision effort, such that preference correctness was significantly lower in the high effort condition than in the low effort condition ($M_{low\text{-}effort} = 6.72$, SD = 2.14 vs. $M_{high\text{-}effort} = 5.34$, SD = 2.44; $F(1, 497) = 46.15$, $p < .001$, $\eta_p^2 = .085$) (see figure 3d). Moreover, there was also a significant main effect of decision domain, such that preference correctness was significantly higher in the quality domain than in the taste domain ($M_{quality} = 6.42$, SD = 2.37 vs. $M_{taste} = 5.57$, SD = 2.36; $F(1, 497) = 18.24$, $p < .001$, $\eta_p^2 = .035$). The interaction between these two factors was not significant ($F(1, 497) = 1.91$, $p = .168$, $\eta_p^2 = .004$).

Figure 3:
Effects of Decision Effort in Quality versus Taste Domains on (a) Decision Confidence, (b) Metacognitive Difficulty, (c) Preference Clarity, and (d) Preference Correctness (Study 3)

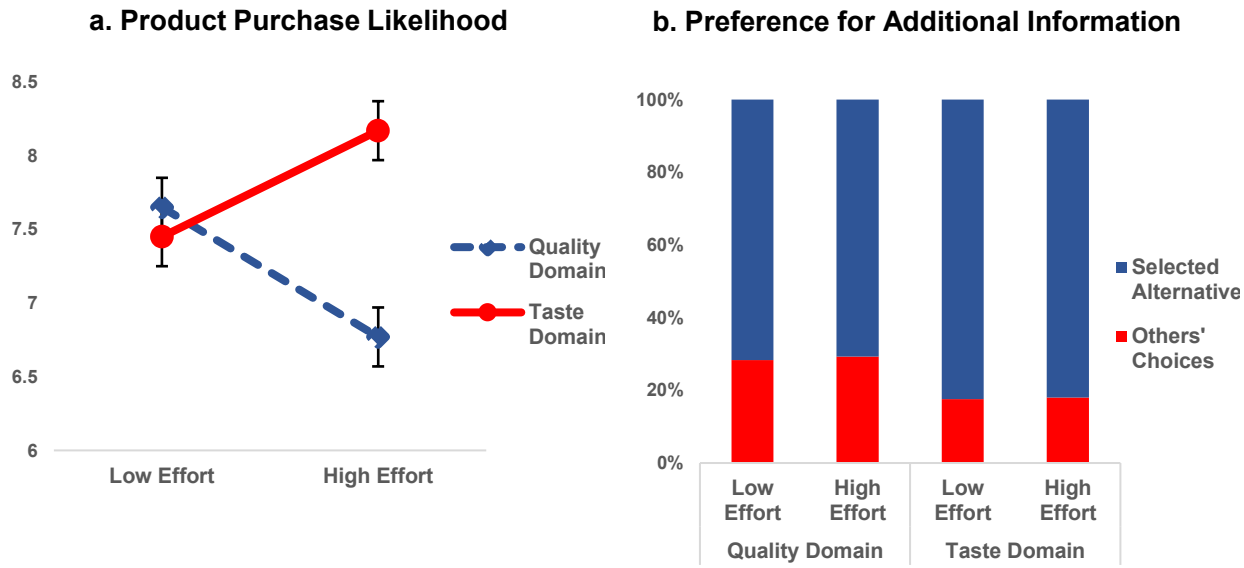


Product Purchase Likelihood. A two-way ANOVA with product purchase likelihood as the dependent variable revealed the predicted interaction effect of decision effort and decision domain ($F(1, 497) = 14.19$, $p < .001$, $\eta_p^2 = .028$), as well as a significant main effect of decision domain ($F(1, 497) = 7.81$, $p = .005$, $\eta_p^2 = .015$) (see figure 4a). Planned contrasts revealed that in the low effort condition, product purchase likelihood did not vary significantly between quality and taste domains ($M_{quality} = 7.65$, SD = 2.26 vs. $M_{taste} = 7.45$, SD = 2.46; $t(497) = .68$, $p = .496$). By contrast, in the high effort condition, product purchase likelihood was significantly higher in the taste domain than in the quality domain ($M_{quality} = 6.77$, SD = 2.58 vs. $M_{taste} = 8.17$, SD = 2.26; $t(497) = 4.68$, $p < .001$).

Preference for Additional Information. A chi-square analysis revealed that participants' preference for the two types of additional information (i.e., information about others' choices vs. additional information about their selected alternative) differed significantly across conditions (χ^2 (3, N = 501) = 8.45, $p = .038$) (see figure 4b). Planned contrasts revealed that participants' preference for information about others' choices (vs. additional information about their selected alternative) did not vary significantly between low effort and high effort conditions ($M_{low\text{-}effort}$ = 23.2% vs. $M_{high\text{-}effort}$ = 23.9%; χ^2 (1, N = 501) = .04, $p = .916$). However, consistent with our theorizing, participants' preference for information about others' choices (vs. additional information about their selected alternative) was significantly higher in the quality domain than in the taste domain ($M_{quality}$ = 28.8% vs. M_{taste} = 17.8%; χ^2 (1, N = 501) = 8.41, $p = .004$).[7]

[7] Participants' interest in each type of additional information about the products (continuous measures) were consistent with their choices, therefore are not discussed further.

Figure 4:
Effects of Decision Effort in Quality versus Taste Domains on (a) Product Purchase Likelihood and (b) Preference for Additional Information about the Selected Alternative (Study 3)



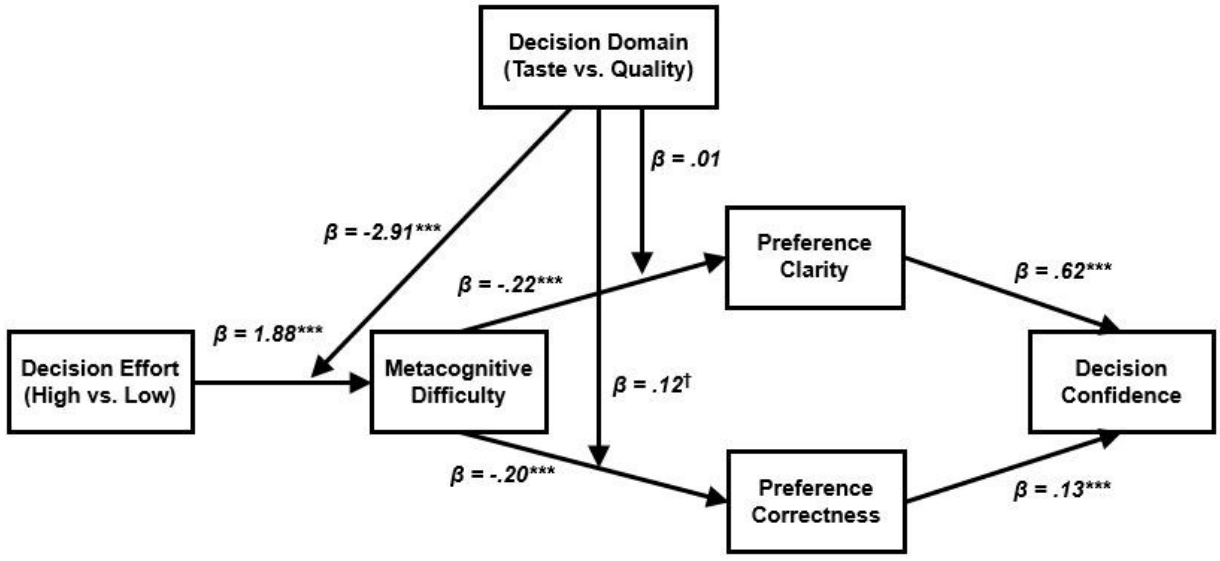
Perceived Enjoyment of the Decision Task. A two-way ANOVA with perceived enjoyment of the decision task as the dependent variable revealed a significant main effect of decision domain ($F(1, 497) = 17.97$, $p < .001$, $\eta_p^2 = .035$), such that participants enjoyed the task of choosing their preferred alternative more in the taste domain than in the quality domain ($M_{quality} = 6.68$, SD = 2.51 vs. $M_{taste} = 7.61$, SD = 2.37). There was also a marginally significant main effect of decision effort ($F(1, 497) = 3.02$, $p = .083$, $\eta_p^2 = .006$), such that participants enjoyed the choice task less in the high effort condition than in the low effort condition ($M_{low\text{-}effort} = 7.32$, SD = 2.33 vs. $M_{high\text{-}effort} = 6.93$, SD = 2.62). The interaction between these factors was not significant ($F(1, 497) = .20$, $p = .652$). Importantly, a two-way ANCOVA with decision confidence as the dependent variable and perceived enjoyment of the decision task as a covariate yielded the same substantive results, therefore are not discussed further.

Perceived Importance of the Decision Task. A two-way ANOVA with perceived importance of the decision task as the dependent variable revealed that neither the main effect of decision effort ($F(1, 497) = .10$, $p = .753$) nor the main effect of decision domain ($F(1, 497) = .71$, $p = .400$) was significant. The interaction between these factors was also not significant ($F(1, 497) = .42$, $p = .518$), therefore are not discussed further.

Test of Moderation Mediation. We estimated a bias-corrected moderated mediation model (Hayes 2013; 10,000 bootstrap samples) to test the hypothesized nuanced effects of decision effort on decision confidence in quality versus taste domains, with metacognitive difficulty as a moderated serial mediator, and preference clarity and preference correctness as moderated parallel mediators (see figure 5). The results indicate that, as predicted, decision effort affected decision confidence by shifting the balance between the two indirect pathways (i.e., the negative indirect effect of decision effort via metacognitive difficulty and preference clarity, and the negative indirect effect of decision effort via metacognitive difficulty and preference correctness) in quality versus taste domains. In the quality domain, the effect of decision effort on confidence was mediated via increased metacognitive difficulty, in turn reducing both preference clarity (a x b_1 x $c_1 = –.4635$, SE = .1212, 95% CI = [–.7361, –.2623]) and preference correctness (a x b_2 x $c_2 = –.1112$, SE = .0415, 95% CI = [–.2065, –.0466]). By contrast, in the taste domain, neither of these negative indirect effects of decision effort on decision confidence was statistically significant (preference clarity: a x b_1 x $c_1 = –.0492$, SE = .0470, 95% CI = [–.1399, .0486]; preference correctness: a x b_2 x $c_2 = –.0066$, SE = .0084, 95% CI = [–.0280, .0047]). These findings support our hypothesis that consumers are more effort sensitive in quality domains than they are in taste domains such that exerting more mental effort has a

stronger, negative impact on both preference clarity and preference correctness in quality (vs. taste) domains, which in turn reduces consumers' decision confidence.

Figure 5:
Moderated Mediation Model (Study 3)



*** p < .001, ** p < .01, * p < .05, † p < .10

Discussion

The findings of study 3 lend support to our proposed conceptual framework of how exerting more mental effort in the decision process affects decision confidence in quality versus taste domains. These results demonstrate that exerting more mental effort reduces confidence in quality domains, whereas it increases confidence in taste domains. These nuanced effects can be explained by the systematic divergence in consumers' effort sensitivity in quality versus taste domains and of the inferences that consumers draw from their exerted decision effort, thus providing initial support for H1, H2a, and H2b. Furthermore, we demonstrate that this dynamic relationship between exerted decision effort in quality versus taste domains and decision

confidence has important downstream effects on product purchase likelihood and the nature of additional information consumers prefer to inform their decisions. Critically, these dynamic effects cannot be explained by the variances in either perceived importance of the decision task or perceived enjoyment of the decision task.

STUDY 4

The objective of study 4 was to examine the nuanced effects of decision effort on decision confidence within a common product domain by manipulating the set of alternatives so as to make the choice among them either a matter of quality or a matter of taste. This allowed us to impose tighter control on the hedonic versus utilitarian nature of the decision domain, as well as the perceived importance of the decision task, and pinpoint the psychological forces governing the effects of exerting more mental effort on decision confidence.

Method

Procedure. Four hundred and ninety-one Amazon Mechanical Turk workers (M_{age} = 37.47 yrs., SD = 11.52; 50.9% female) completed this study in exchange for a payment of $1.25.[8] Participants' task was to choose their preferred alternative from an assortment of electric toothbrushes. They were presented with either 4 alternatives[9] (in a 1 x 4 matrix) or 24 alternatives (in a 6 x 4 matrix) to choose from (see appendix D for sample screenshots). The order in which the alternatives were presented was unique and random for each participant. Participants were asked to uncover these alternatives one by one by clicking on them. After

[8] Initially, four hundred and ninety-nine participants were recruited for this study. Eight of these were excluded from analysis due to obvious response inconsistencies to attention check questions. Using the full sample yields the same substantive conclusions as those reported here.

[9] As in studies 2 and 3, these 4 alternatives were a random subset of 24 alternatives in the larger assortment.

looking at all the alternatives, participants indicated their choice. Unless otherwise noted, the rest of the procedure was the same as that for studies 2 and 3.

Design and Stimuli. Participants were randomly assigned to one of four conditions in a 2 (decision effort: low vs. high) x 2 (decision domain: quality vs. taste) between-subjects product-choice paradigm. Decision effort was manipulated in the same way as in studies 2 and 3 by varying the assortment size (i.e., 4 vs. 24 alternatives) and the magnitude of tradeoffs among presented alternatives. Half of the participants chose from a *vertically differentiated* assortment of electric toothbrushes, where alternatives varied in terms of their cleaning performance and price but not in terms of their aesthetic and ergonomic properties (a matter of quality). The other half of the participants chose from a *horizontally differentiated* assortment of electric toothbrushes, where alternatives varied in terms of their aesthetic and ergonomic properties but not in terms of their cleaning performance and price (a matter of taste).

Measures. The same measures as those in studies 2 and 3 were obtained. In addition to that, participants indicated their satisfaction with the decision process using a six-item composite measure (Cronbach's $\alpha = .89$; Zhang and Fitzsimons 1999). We measured participants' trait disposition toward engaging in cognitively demanding tasks using an 18-item composite measure of need for cognition (Cronbach's $\alpha = .95$; Cacioppo, Petty, and Kao 1984; see appendix E for details).

Results

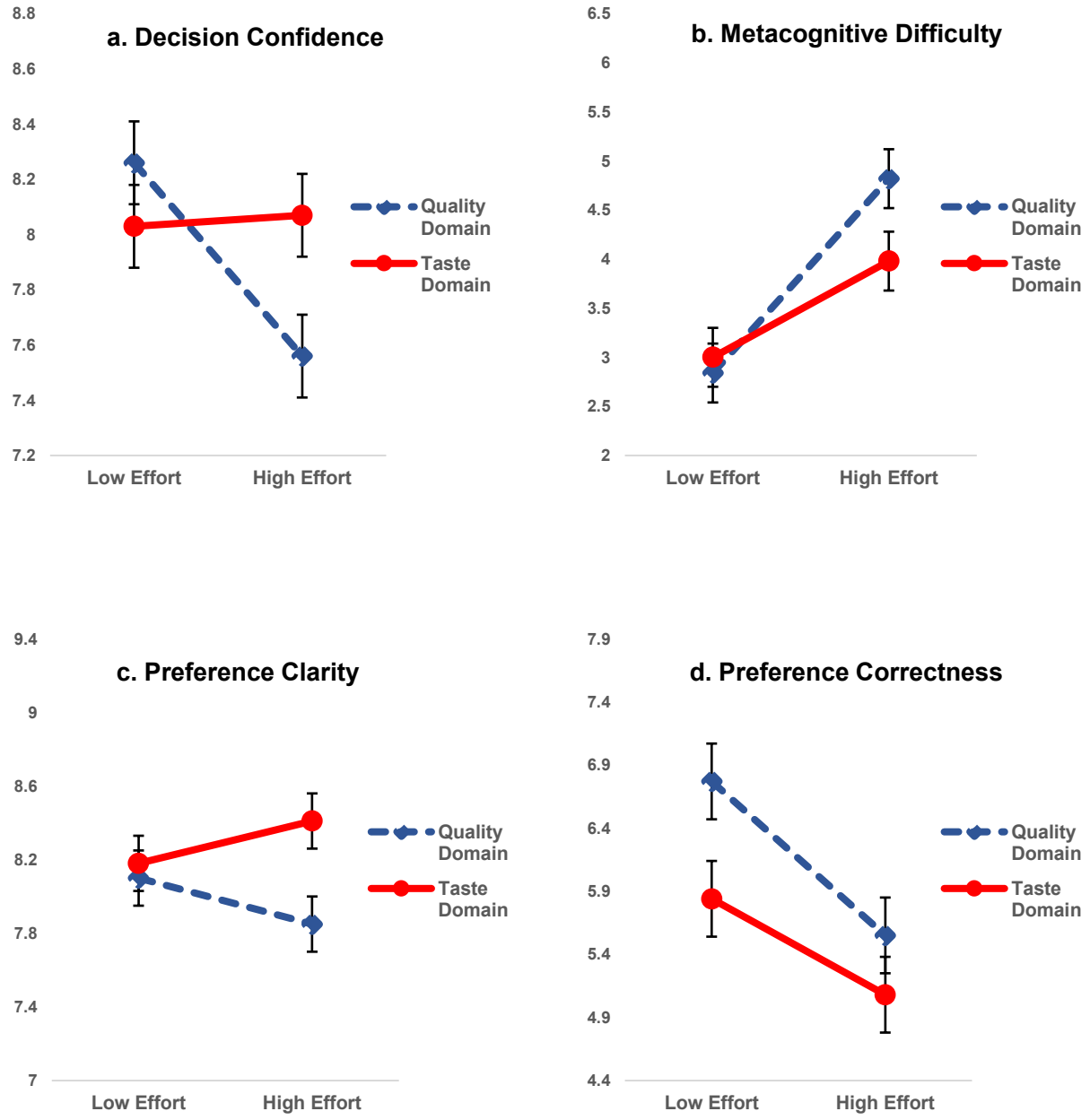
Perceived Subjectivity of the Decision Domain. A two-way ANOVA with perceived subjectivity as the dependent variable revealed a significant main effect of decision domain, such that participants considered the choice among vertically differentiated electric toothbrushes more of a matter of quality and the choice among horizontally differentiated electric toothbrushes

more of a matter of taste ($M_{quality}$ = 2.95, SD = 2.21 vs. M_{taste} = 7.47, SD = 2.90; $F(1, 487)$ = 376.57, $p < .001$, $\eta_p^2 = .436$). Neither the main effect of decision effort ($F(1, 487) = 1.20$, p = .274) nor the interaction effect of decision effort and decision domain ($F(1, 487) = .32$, $p = .571$) was significant, indicating that our manipulation of perceived subjectivity was successful.

Decision Time. A two-way ANOVA with decision time (seconds; log-transformed) as the dependent variable revealed a significant main effect of decision effort ($F(1, 487) = 1622.84$, $p <$ .001, $\eta_p^2 = .769$), such that participants spent more time in choosing from an assortment of 24 alternatives than choosing from an assortment of 4 alternatives ($M_{low\text{-}effort}$ = 59.52 seconds, SD = 47.72 vs. $M_{high\text{-}effort}$ = 236.17 seconds, SD = 113.71). Neither decision domain ($F(1, 487) = 1.53$, $p = .216$) nor its interaction with decision effort ($F(1, 487) = .28$, $p = .594$) had a significant effect on decision time.

Decision Confidence. A two-way ANOVA with decision confidence as the dependent variable revealed the predicted interaction effect of decision effort and decision domain ($F(1, 487) = 4.45$, $p = .035$, $\eta_p^2 = .009$), as well as a marginally significant main effect of decision effort ($F(1, 487) = 3.53$, $p = .061$, $\eta_p^2 = .007$). Planned contrasts revealed that when choosing from an assortment of 4 alternatives participants' decision confidence did not vary significantly between quality and taste domains ($M_{low\text{-}effort\text{-}quality}$ = 8.26, SD = 1.70 vs. $M_{low\text{-}effort\text{-}taste}$ = 8.03, SD = 1.85; $t(487) = .94$, $p = .347$). However, when choosing from an assortment of 24 alternatives participants were significantly more confident in the taste domain than they were in the quality domain ($M_{high\text{-}effort\text{-}quality}$ = 7.56, SD = 2.28 vs. $M_{high\text{-}effort\text{-}taste}$ = 8.07, SD = 1.82; $t(487) = 2.02$, p = .044) (see figure 6a). The main effect of decision domain was not significant ($F(1, 487) = .64$, p = .423).

Figure 6:
Effects of Decision Effort in Quality versus Taste Domains on (a) Decision Confidence, (b) Metacognitive Difficulty, (c) Preference Clarity, and (d) Preference Correctness (Study 4)



Metacognitive Difficulty. A two-way ANOVA with metacognitive difficulty as the dependent variable revealed a significant main effect of decision effort ($F(1, 487) = 27.90$, $p < .001$, $\eta_p^2 = .054$), as well as a marginally significant interaction effect of decision effort and decision domain ($F(1, 487) = 3.66$, $p = .056$, $\eta_p^2 = .007$). Overall, participants perceived their decision to be more difficult when choosing from an assortment of 24 alternatives than when choosing from an assortment of 4 alternatives ($M_{\text{low-effort}} = 2.92$, SD = 2.85 vs. $M_{\text{high-effort}} = 4.40$, SD = 3.28). Planned contrasts revealed that metacognitive difficulty while choosing from an assortment of 4 alternatives did not vary significantly between quality and taste domains ($M_{\text{low-effort-quality}} = 2.84$, SD = 2.88 vs. $M_{\text{low-effort-taste}} = 3.00$, SD = 2.82; $t(487) = .42$, $p = .674$). However, metacognitive difficulty while choosing from an assortment of 24 alternatives was significantly higher in the quality domain than in the taste domain ($M_{\text{high-effort-quality}} = 4.82$, SD = 3.36 vs. $M_{\text{high-effort-taste}} = 3.93$, SD = 3.12; $t(487) = 2.25$, $p = .025$) (see figure 6b). The main effect of decision domain on metacognitive difficulty was not significant ($F(1, 487) = 1.76$, $p = .185$). Taken together, these findings are consistent with our theorizing that consumers are more effort sensitive in quality domains than in taste domains.

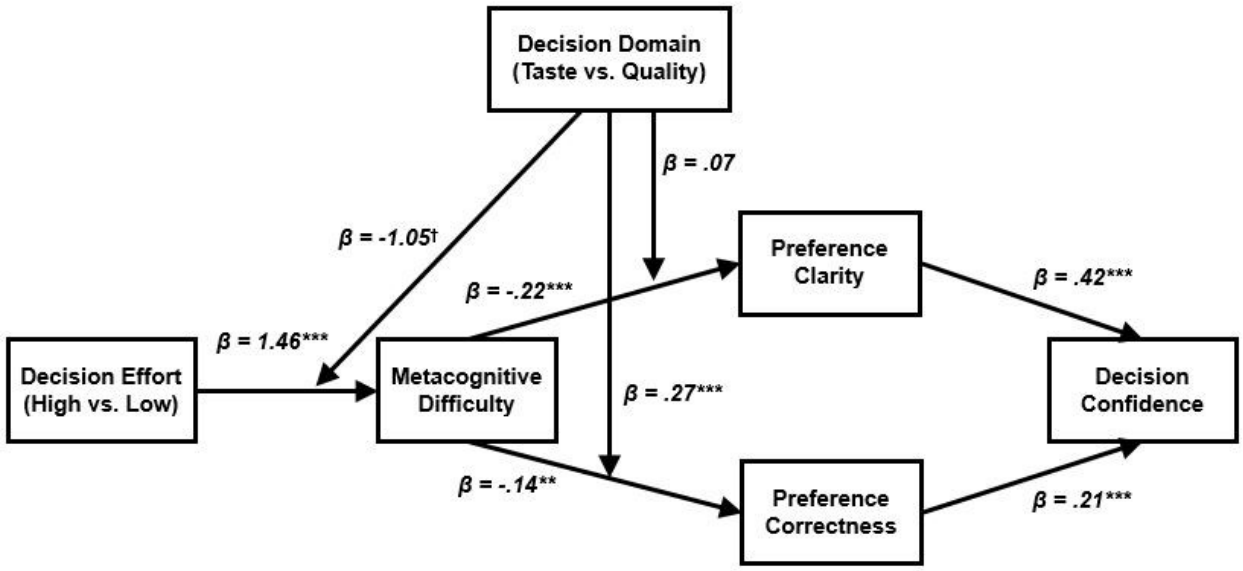
Preference Clarity. A two-way ANOVA with preference clarity as the dependent variable revealed a marginally significant main effect of decision domain ($F(1, 487) = 2.82$, $p = .094$, $\eta_p^2 = .006$), such that participants had a stronger belief that their chosen alternative reflected their true inclination when choosing from a horizontally differentiated assortment than when choosing from a vertically differentiated assortment ($M_{\text{quality}} = 7.97$, SD = 2.33 vs. $M_{\text{taste}} = 8.28$, SD = 1.85) (see figure 6c). Neither decision effort ($F(1, 487) < .01$, $p = .958$) nor its interaction with decision domain ($F(1, 487) = 1.59$, $p = .208$) had a significant effect on preference clarity.

Preference Correctness. A two-way ANOVA with preference correctness as the dependent variable revealed a significant main effect of decision effort ($F(1, 487) = 24.10$, $p < .001$, $\eta_p^2 = .047$), such that participants considered their chosen alternative to be less normatively valid when choosing from an assortment of 24 alternatives than when choosing from an assortment of 4 alternatives ($M_{\text{low-effort}} = 6.30$, SD = 2.15 vs. $M_{\text{high-effort}} = 5.31$, SD = 2.44). There was also a significant main effect of decision domain on preference correctness ($F(1, 487) = 12.20$, $p = .001$, $\eta_p^2 = .024$), such that participants considered their chosen alternative to be more normatively valid when choosing from a vertically differentiated assortment than when choosing from a horizontally differentiated assortment ($M_{\text{quality}} = 6.16$, SD = 2.45 vs. $M_{\text{taste}} = 5.47$, SD = 2.18) (see figure 6d). Here, the interaction between decision effort and decision domain was not significant ($F(1, 487) = 1.16$, $p = .283$).

Test of Moderated Mediation. We estimated a bias-corrected moderated mediation model (Hayes 2013; 10,000 bootstrap samples) to test the hypothesized nuanced effects of decision effort on decision confidence in quality versus taste domains, with metacognitive difficulty as a moderated serial mediator, and preference clarity and preference correctness as moderated parallel mediators (see figure 7). The results indicate that, as predicted, decision effort affected decision confidence by shifting the balance between the two indirect pathways in quality versus taste domains. In the quality domain, the effect of decision effort on confidence was mediated via increased metacognitive difficulty, in turn reducing both preference clarity (a x b_1 x $c_1 = –.1496$, SE = .0610, 95% CI = [–.2857, –.0501]) and preference correctness (a x b_2 x $c_2 = –.0868$, SE = .0347, 95% CI = [–.1669, –.0322]). By contrast, in the taste domain, the effect of decision effort on decision confidence was mediated via increased metacognitive difficulty, in turn reducing preference clarity (a x b_1 x $c_1 = –.0429$, SE = .0230, 95% CI = [–.0944, –.0060]), but

not preference correctness (a x b_2 x c_2 = –.0118, SE = .0109, 95% CI = [–.0085, .0354]). These findings support our hypothesis that consumers are more effort sensitive in quality domains than in taste domains, and therefore, exerting greater effort has a stronger, negative impact on decision confidence by reducing both preference clarity and preference correctness.

Figure 7:
Moderated Mediation Model (Study 4)



*** p < .001, ** p < .01, * p < .05, † p < .10

Satisfaction with the Decision Process. A two-way ANOVA with the composite decision process satisfaction index as the dependent variable revealed a marginally significant main effect of decision domain ($F(1, 487) = 3.03$, $p = .082$, $\eta_p^2 = .006$), such that participants were more satisfied with their experience of choosing their preferred alternative from a vertically differentiated assortment than from a horizontally differentiated assortment ($M_{quality} = 7.76$, SD = 1.87 vs. $M_{taste} = 7.44$, SD = 2.18). Neither decision effort ($F(1, 487) = .04$, $p = .838$) nor its

interaction with decision domain ($F(1, 487) = .66$, $p = .417$) had a significant effect on satisfaction with the decision process.

Perceived Importance of the Decision Task. A two-way ANOVA with perceived importance of the decision task as the dependent variable revealed a marginally significant main effect of decision domain ($F(1, 487) = 2.90$, $p = .089$, $\eta_p^2 = .006$), such that choosing an electric toothbrush from a vertically differentiated assortment was considered more important than choosing the same from a horizontally differentiated assortment ($M_{quality} = 7.03$, SD = 2.49 vs. $M_{taste} = 6.62$, SD = 2.77). Neither decision effort ($F(1, 487) = .29$, $p = .588$) nor its interaction with decision domain ($F(1, 487) = .01$, $p = .946$) had a significant effect on perceived importance of the decision task. Importantly, a two-way ANCOVA with decision confidence as the dependent variable and perceived importance of the decision task as a covariate yielded the same substantive results.

Need for Cognition. A two-way ANCOVA with decision confidence as the dependent variable and the composite index of need for cognition as a covariate yielded the same substantive conclusions as reported above, suggesting that our proposed theoretical model is robust to chronic individual differences in effort valuation.

Discussion

The findings of study 4 corroborates our proposed conceptual model of the effect of decision effort on decision confidence in quality versus taste domains. Again, our findings show that exerting more mental effort reduces confidence in quality domains, whereas it increases confidence in taste domains. These nuanced effects can be explained by the systematic difference in consumers' effort sensitivity in quality versus taste domains and of the inferences that consumers draw from their exerted decision effort, lending further support for H1, H2a, and H2b.

Importantly, our results reveal that consumers' beliefs about matters of quality and matters of taste can also vary within a common product domain as a function of the product features, and the dynamic effects of exerting more mental effort on decision confidence in these domains are robust to consumers' perceived importance of the decision task, as well as their trait disposition toward engaging in cognitively demanding tasks.

STUDY 5

The key objective of study 5 was to distinguish between the effects of instrumental and incidental experienced decision effort on decision confidence. We tested our hypothesis that instrumental decision effort (i.e., the effort experienced in considering and reasoning about the products) as opposed to incidental decision effort (i.e., the effort experienced in merely obtaining product information) is the key driver of the predicted effects on consumers' decision confidence. We also examined the robustness of our proposed framework by seeking to conceptually replicate the findings of studies 2 and 3 with different product domains (i.e., portable power banks and ceramic coffee mugs), and demonstrate further downstream effects of mental effort exertion on consumers' evaluation of their chosen alternative and recommendation likelihood.

Method

Procedure. Six hundred and three Amazon Mechanical Turk workers (M_{age} = 37.16 yrs., SD = 11.44; 51.9% female) completed this study in exchange for a payment of $1.10. Participants' task was to choose their preferred alternative either from an assortment of portable power banks or from an assortment of ceramic coffee mugs. They were presented with either 5

alternatives[10] (in a 5 x 1 matrix) or 20 alternatives (in a 5 x 4 matrix) to choose from in each domain (see appendix D for sample screenshots). The order in which the alternatives were presented was unique and random for each participant. Participants were asked to uncover these alternatives one by one by clicking on them. After looking at all the alternatives, participants were asked to indicate their choice. Unless otherwise noted, the rest of the procedure was the same as that for study 3.

Design and Stimuli. Participants were randomly assigned to one of six conditions in a 3 (decision effort: low-instrumental/low-incidental vs. low-instrumental/high-incidental vs. high-instrumental/low-incidental) x 2 (decision domain: quality vs. taste) between-subjects product-choice paradigm. Low versus high instrumental effort was manipulated in the same way as in prior studies by varying the assortment size (i.e., 5 vs. 20 alternatives). Low versus high incidental effort was manipulated by varying the interval at which each alternative became available for inspection (i.e., 2 seconds vs. 8 seconds). Therefore, in both low-instrumental/low-incidental and low-instrumental/high-incidental effort conditions, participants chose from a set of 5 alternatives, however, they waited longer for product information to become available in the latter condition than in the former condition (i.e., 10 seconds vs. 40 seconds). Conversely, in both low-instrumental/high-incidental and high-instrumental/low-incidental effort conditions participants waited 40 seconds for product information to become available, however, in the latter condition they considered more alternatives than in the former condition (i.e., 5 vs. 20 alternatives). This design allowed us to disentangle the impact of instrumental and incidental decision effort on decision confidence.

[10] As in studies 2–4, these 5 alternatives were a random subset of 20 alternatives in the larger assortment.

In the quality domain, participants were asked to choose a portable power bank for themselves. These power banks looked and weighed the same, but they varied in charging capacity (measured in milliampere hour – mAh) and price. The higher the charging capacity of a power bank, the higher was its price. In the taste domain, participants were asked to choose a ceramic coffee mug for themselves. These mugs had the same size and price, but they varied in look, that is each coffee mug was designed with a unique color.

Measures. The same measures as in prior studies were obtained. In addition to these measures, we asked participants to evaluate their chosen alternative using a four-item composite measure on 11-point scales (0 = "bad/unattractive/undesirable/unpleasant", 10 = "good/attractive/desirable/pleasant"; Cronbach's $\alpha = .91$) and their likelihood of recommending their chosen alternative to others on an 11-point scale (0 = "not at all", 10 = "very likely"). We also measured chronic individual differences in maximizing-satisficing tendency using a six-item scale (Cronbach's $\alpha = .56$; Nenkov et al. 2008; Schwartz et al. 2002) for exploratory purposes (see appendix E for details).

Results

Perceived Subjectivity of the Decision Domain. A two-way ANOVA with perceived subjectivity as the dependent variable revealed a significant main effect of decision domain, such that participants considered the choice among power banks largely a matter of quality and the choice among coffee mugs largely a matter of taste ($M_{quality} = 3.13$, SD = 2.52 vs. $M_{taste} = 8.52$, SD = 2.50; $F(1, 597) = 691.50$, $p < .001$, $\eta_p^2 = .537$). Neither the main effect of decision effort ($F(2, 597) = .44$, $p = .646$) nor the interaction effect of decision effort and decision domain ($F(2, 597) = .40$, $p = .673$) was significant, indicating that our manipulation of perceived subjectivity was successful.

Decision Time. A two-way ANOVA with decision time (seconds; log-transformed) as the dependent variable revealed a significant main effect of decision effort ($F(2, 597) = 278.09$, $p < .001$, $\eta_p^2 = .482$), a significant main effect of decision domain ($F(1, 597) = 106.06$, $p < .001$, $\eta_p^2 = .151$), as well as a significant interaction effect of these two factors ($F(2, 597) = 6.34$, $p = .041$, $\eta_p^2 = .021$). Overall, participants spent more time in choosing a power bank than choosing a coffee mug ($M_{quality} = 88.33$ seconds, SD = 68.70 vs. $M_{taste} = 62.60$ seconds, SD = 50.95). Planned contrasts revealed that, participants took significantly more time in choosing their preferred alternative in the high-instrumental/low-incidental effort condition ($M_{high\text{-}ins/low\text{-}inc} = 109.47$ seconds, SD = 77.89) than both in the low-instrumental/high-incidental effort condition (vs. $M_{low\text{-}ins/high\text{-}inc} = 74.77$ seconds, SD = 40.91; $t(597) = 6.18$, $p < .001$) and in the low-instrumental/low-incidental effort condition (vs. $M_{low\text{-}ins/low\text{-}inc} = 44.48$ seconds, SD = 42.33; $t(597) = 10.09$, $p < .001$). The difference in decision time between the latter two conditions was also significant ($t(597) = 4.06$, $p < .001$).

Decision Confidence. A two-way ANOVA with decision confidence as the dependent variable revealed a significant main effect of decision domain ($F(2, 597) = 72.62$, $p < .001$, $\eta_p^2 = .108$) and a marginally significant interaction effect of decision effort and decision domain in the predicted direction ($F(2, 597) = 2.66$, $p = .071$, $\eta_p^2 = .009$). Overall, participants felt less confident when choosing a power bank than when choosing a coffee mug ($M_{quality} = 7.96$, SD = 1.89 vs. $M_{taste} = 9.08$, SD = 1.24). Planned contrasts revealed that when choosing a power bank participants were significantly less confident in the high-instrumental/low-incidental effort condition ($M_{high\text{-}ins/low\text{-}inc} = 7.63$, SD = 2.09) than both in the low-instrumental/high-incidental effort condition (vs. $M_{low\text{-}ins/high\text{-}inc} = 8.27$, SD = 1.77; $t(597) = 2.38$, $p = .005$) and in the low-instrumental/low-incidental effort condition (vs. $M_{low\text{-}ins/low\text{-}inc} = 7.94$, SD = 1.78; $t(597) = 2.38$, p

= .177). There was no significant difference in decision confidence between the low-instrumental/high-incidental effort condition and the low-instrumental/low-incidental effort condition in the quality domain ($t(597) = 1.46$, $p = .146$). Conversely, decision confidence did not vary across decision effort conditions when choosing a coffee mug ($M_{\text{low-ins/low-inc}} = 8.90$, SD = 1.51 vs. $M_{\text{low-ins/high-inc}} = 9.15$, SD = 1.74 vs. $M_{\text{high-ins/low-inc}} = 9.20$, SD = 1.14; $t(597) = .87$, $p = .383$) (see figure 8a). The main effect of decision effort on decision confidence was not significant ($F(1, 597) = 2.11$, $p = .122$).

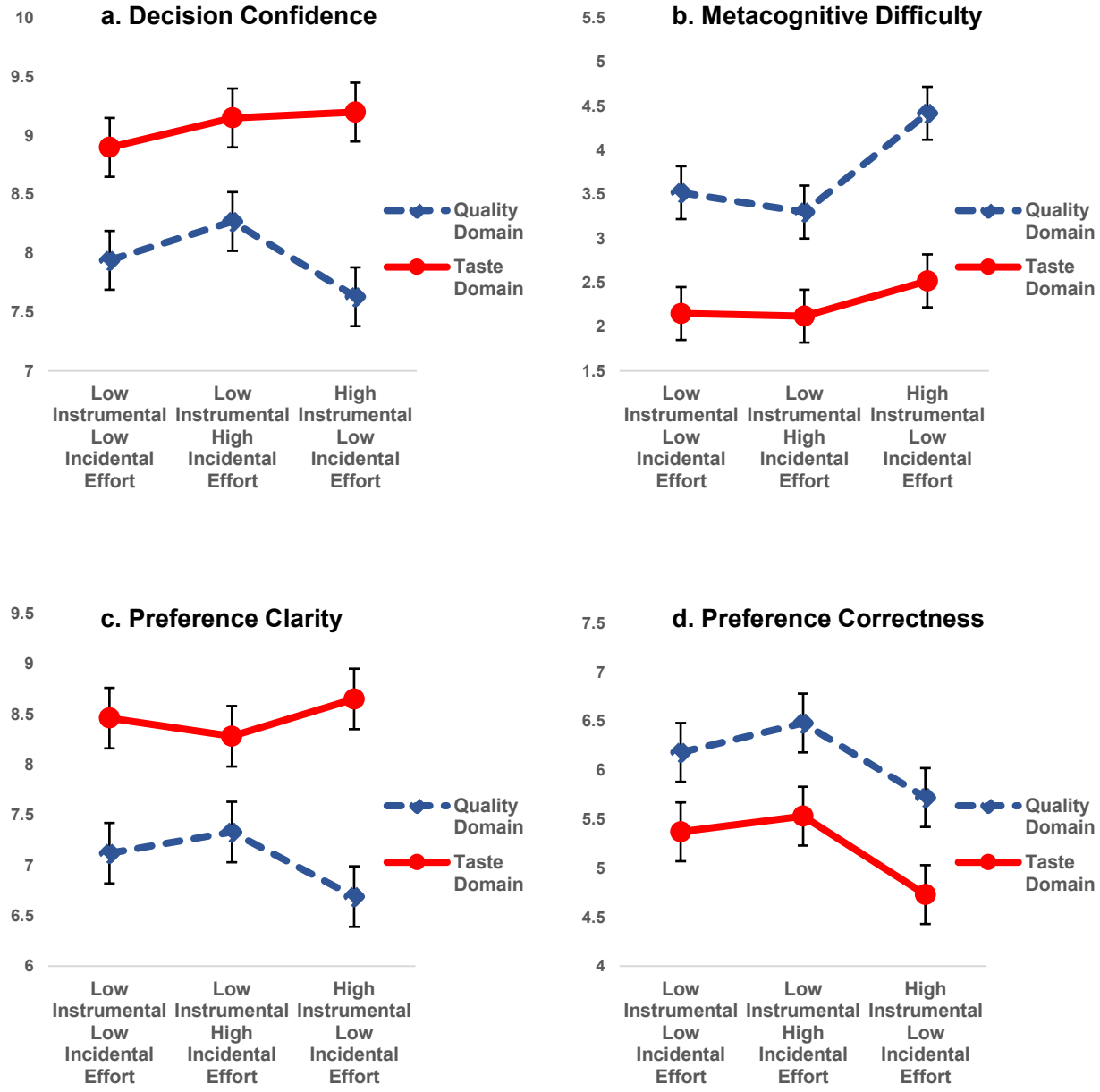
For ease of interpretation, we ran two separate two-way ANOVAs after collapsing the levels of exerted decision effort to high versus low instrumental effort (i.e., number of alternatives examined – 20 vs. 5) and to high versus low incidental effort (i.e., time spent in merely obtaining product information – 40 vs. 10 seconds). As predicted, the two-way ANOVA with instrumental decision effort (low vs. high) and decision domain (quality vs. taste) as independent variables revealed a significant interaction effect on decision confidence ($F(1, 599) = 5.40$, $p = .020$, $\eta_p^2 = .009$), such that exerting more instrumental effort increased confidence when choosing a coffee mug but decreased confidence when choosing a power bank. However, the two-way ANOVA with incidental decision effort (low vs. high) and decision domain (quality vs. taste) as independent variables did not reveal the predicted interaction effect ($F(1, 599) = .78$, $p = .378$). Taken together, these findings support our hypothesis that instrumental as opposed to incidental decision effort had a stronger impact on decision confidence in both quality and taste domains.

Metacognitive Difficulty. A two-way ANOVA with metacognitive difficulty as the dependent variable revealed a significant main effect of decision effort ($F(2, 597) = 3.67$, $p = .026$, $\eta_p^2 = .012$). Planned contrasts revealed that participants reported significantly greater

difficulty when choosing in the high-instrumental/low-incidental effort condition ($M_{\text{high-ins/low-inc}}$ = 3.46, SD = 3.24) than both in the low-instrumental/high-incidental effort condition (vs. $M_{\text{low-ins/high-inc}}$ = 2.75, SD = 3.02; $t(597) = 2.68$, $p = .008$) and in the low-instrumental/low-incidental effort condition (vs. $M_{\text{low-ins/low-inc}}$ = 2.83, SD = 2.98; $t(597) = 2.12$, $p = .034$) (see figure 8b). Metacognitive difficulty did not vary significantly between the low-instrumental/high-incidental effort condition and the low-instrumental/low-incidental effort condition ($t(597) = .55$, $p = .586$). These findings are consistent with our prediction that instrumental as opposed to incidental decision effort is the key determinant of metacognitive difficulty.

There was also a significant main effect of decision domain on metacognitive difficulty ($F(1, 597) = 37.27$, $p < .001$, $\eta_p^2 = .059$). Participants reported greater difficulty when choosing a power bank than when choosing a coffee mug (M_{quality} = 3.73, SD = 3.17 vs. M_{taste} = 2.26, SD = 2.83), which is consistent with our prediction that participants are more effort sensitive in quality domains than in taste domains. The interaction between decision effort and decision domain was not significant ($F(2, 597) = .78$, $p = .460$).

Figure 8:
Effects of Decision Effort in Quality versus Taste Domains on (a) Decision Confidence, (b) Metacognitive Difficulty, (c) Preference Clarity, and (d) Preference Correctness (Study 5)



Preference Clarity. A two-way ANOVA with preference clarity as the dependent variable revealed a significant main effect of decision domain ($F(2, 597) = 54.87$, $p < .001$, $\eta_p^2 = .084$) and a marginally significant interaction effect of decision effort and decision domain in the predicted direction ($F(2, 597) = 2.32$, $p = .099$, $\eta_p^2 = .008$). Overall, participants had a stronger belief that their chosen alternative reflected their true inclination when choosing a coffee mug than when choosing a power bank ($M_{quality} = 7.06$, SD = 2.67 vs. $M_{taste} = 8.46$, SD = 1.95). Planned contrasts revealed that when choosing a power bank participants reported less preference clarity in the high-instrumental/low-incidental effort condition ($M_{high\text{-}ins/low\text{-}inc} = 6.69$, SD = 2.84) than both in the low-instrumental/low-incidental effort condition (vs. $M_{low\text{-}ins/low\text{-}inc} = 7.12$, SD = 2.61; $t(597) = 1.94$, $p = .053$) and in the low-instrumental/high-incidental effort condition (vs. $M_{low\text{-}ins/high\text{-}inc} = 7.33$, SD = 2.55; $t(597) = 1.28$, $p = .200$) (see figure 8c). Preference clarity did not vary significantly between the low-instrumental/high-incidental effort condition and the low-instrumental/low-incidental effort condition in the quality domain ($t(597) = .65$, $p = .515$). Conversely, there was no significant difference in preference clarity across decision effort conditions when choosing a coffee mug ($M_{low\text{-}ins/low\text{-}inc} = 8.46$, SD = 1.87 vs. $M_{low\text{-}ins/high\text{-}inc} = 8.28$, SD = 2.17 vs. $M_{high\text{-}ins/low\text{-}inc} = 8.65$, SD = 1.81; $t(597) = .38$, $p = .704$).

For ease of interpretation, we ran separate two-way ANOVAs after collapsing the levels of exerted decision effort to high versus low instrumental effort (i.e., number of alternatives examined – 20 vs. 5) and to high versus low incidental effort (i.e., time spent in merely obtaining product information – 40 vs. 10 seconds). As predicted, the two-way ANOVA with instrumental effort (low vs. high) and decision domain (quality vs. taste) as independent variables revealed a significant interaction effect on preference clarity ($F(1, 599) = 3.95$, $p = .047$, $\eta_p^2 = .007$), such that exerting more instrumental effort increased preference clarity when choosing a coffee mug

but reduced preference clarity when choosing a power bank. However, the two-way ANOVA with incidental effort (low vs. high) and decision domain (quality vs. taste) as independent variables did not reveal the predicted interaction effect ($F(1, 599) = .06$, $p = .800$).

Preference Correctness. A two-way ANOVA with preference correctness as the dependent variable revealed a significant main effect of decision effort ($F(2, 597) = 6.10$, $p = .002$, $\eta_p^2 = .020$). Planned contrasts revealed that participants considered their preferred alternative to be less normatively valid when choosing in the high-instrumental/low-incidental effort condition ($M_{\text{high-ins/low-inc}} = 5.22$, SD = 2.30) than both in the low-instrumental/high-incidental effort condition (vs. $M_{\text{low-ins/high-inc}} = 6.03$, SD = 2.33; $t(597) = 2.36$, $p = .019$) and in the low-instrumental/low-incidental effort condition (vs. $M_{\text{low-ins/low-inc}} = 5.78$, SD = 2.34; $t(597) = 1.43$, $p = .152$) (see figure 8d). Preference correctness did not vary significantly between the low-instrumental/high-incidental effort condition and the low-instrumental/low-incidental effort condition ($t(597) = .93$, $p = .354$).

There was also a significant main effect of decision domain on preference correctness, such that participants considered their preferred power bank to be more normatively valid than their preferred coffee mug ($M_{\text{quality}} = 6.14$, SD = 2.18 vs. $M_{\text{taste}} = 5.21$, SD = 2.42; $F(1, 597) = 24.35$, $p < .001$, $\eta_p^2 = .039$). The interaction between decision effort and decision domain was not significant ($F(2, 597) = .08$, $p = .921$).

Tests of Moderated Mediation. In order to shed light on the differential impact of instrumental versus incidental decision effort, we conducted two separate moderated mediation analyses by collapsing the three decision effort conditions to high versus low instrumental effort conditions (i.e., examining 20 vs. 5 alternatives) and high versus low incidental effort conditions (i.e., waiting for 40 seconds vs. 10 seconds). For both analyses, we estimated a bias-corrected

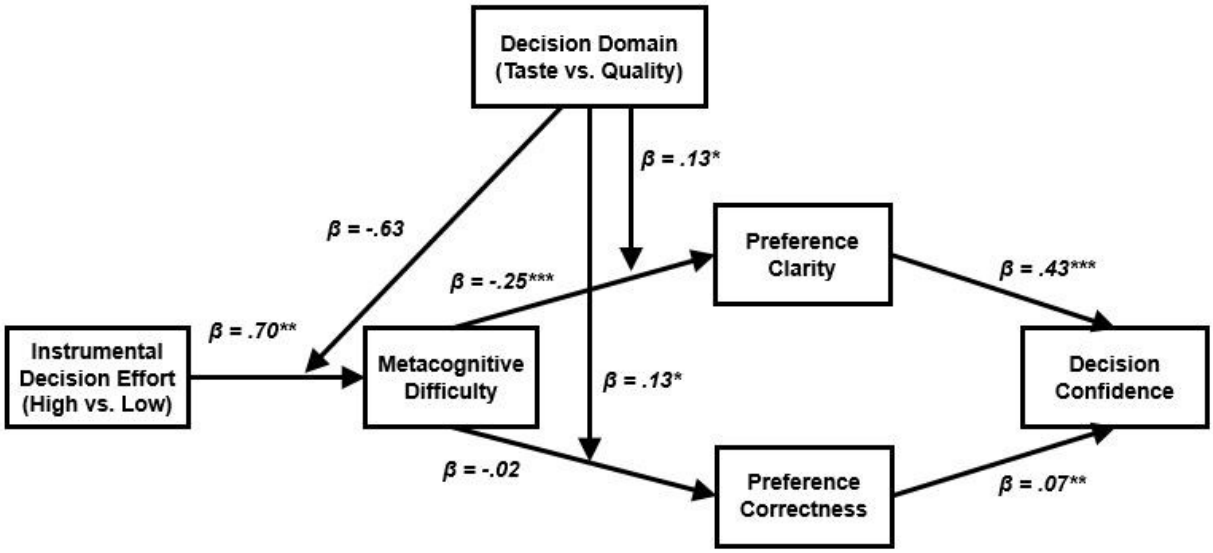
moderated mediation model (Hayes 2013; 10,000 bootstrap samples) to test the hypothesized nuanced effects of decision effort on decision confidence in quality versus taste domains, with metacognitive difficulty as a moderated serial mediator, and preference clarity and preference correctness as moderated parallel mediators.

The first analysis examined the effect of high versus low instrumental effort on decision confidence in taste versus quality domains (see figure 9a). The results indicate that, in the quality domain, the effect of instrumental decision effort on confidence was mediated via increased metacognitive difficulty, in turn reducing both preference clarity (a x b_1 x c_1 = –.1385, SE = .0650, 95% CI = [–.2844, –.0313]) and preference correctness (a x b_2 x c_2 = –.0062, SE = .0051, 95% CI = [–.0196, –.0001]). By contrast, in the taste domain, neither of these negative indirect effects of instrumental decision effort on decision confidence was statistically significant (preference clarity: a x b_1 x c_1 = –.0309, SE = .0303, 95% CI = [–.0958, .0256]; preference correctness: a x b_2 x c_2 = .0012, SE = .0021, 95% CI = [–.0030, .0060]).

The second analysis examined the effect of high versus low incidental effort on decision confidence in taste versus quality domains (see figure 9b). The results indicate that neither in the quality domain nor in the taste domain did incidental effort had a significant effect on decision confidence via the two indirect pathways (quality domain – preference clarity: a x b_1 x c_1 = –.0423, SE = .0535, 95% CI = [–.1530, .0603]; quality domain – preference correctness: a x b_2 x c_2 = –.0019, SE = .0030, 95% CI = [–.0088, .0032]; taste domain – preference clarity: a x b_1 x c_1 = –.0142, SE = .0288, 95% CI = [–.0767, .0390]; taste domain – preference correctness: a x b_2 x c_2 = .0006, SE = .0018, 95% CI = [–.0030, .0045]).

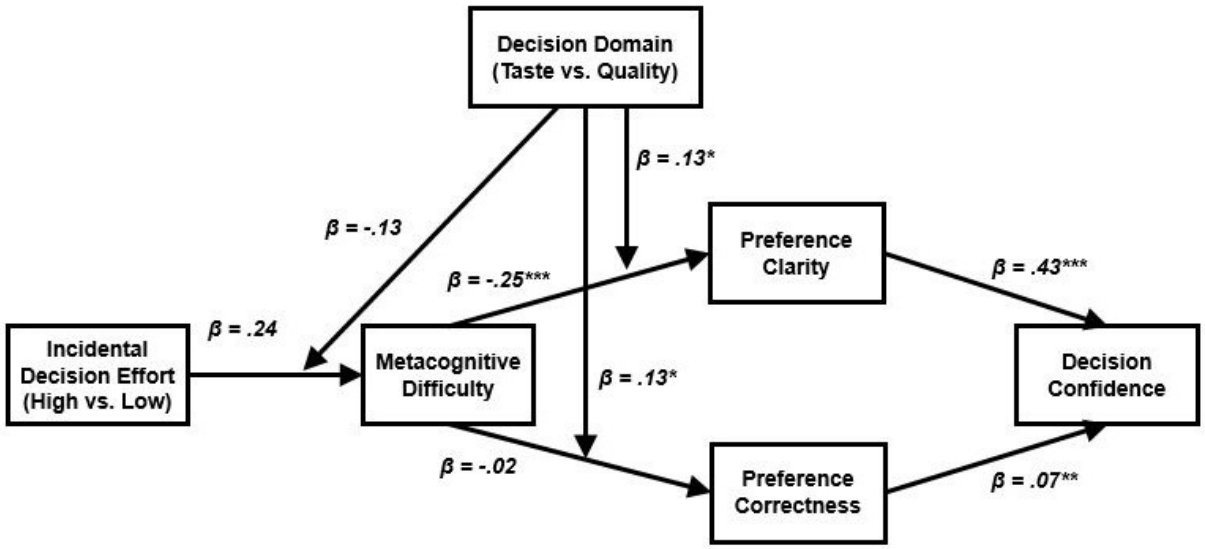
Figure 9:
Moderated Mediation Models (Study 5)

A. Effect of Instrumental Experienced Decision Effort on Decision Confidence



*** p < .001, ** p < .01, * p < .05, † p < .10

B. Effect of Incidental Experienced Decision Effort on Decision Confidence



*** p < .001, ** p < .01, * p < .05, † p < .10

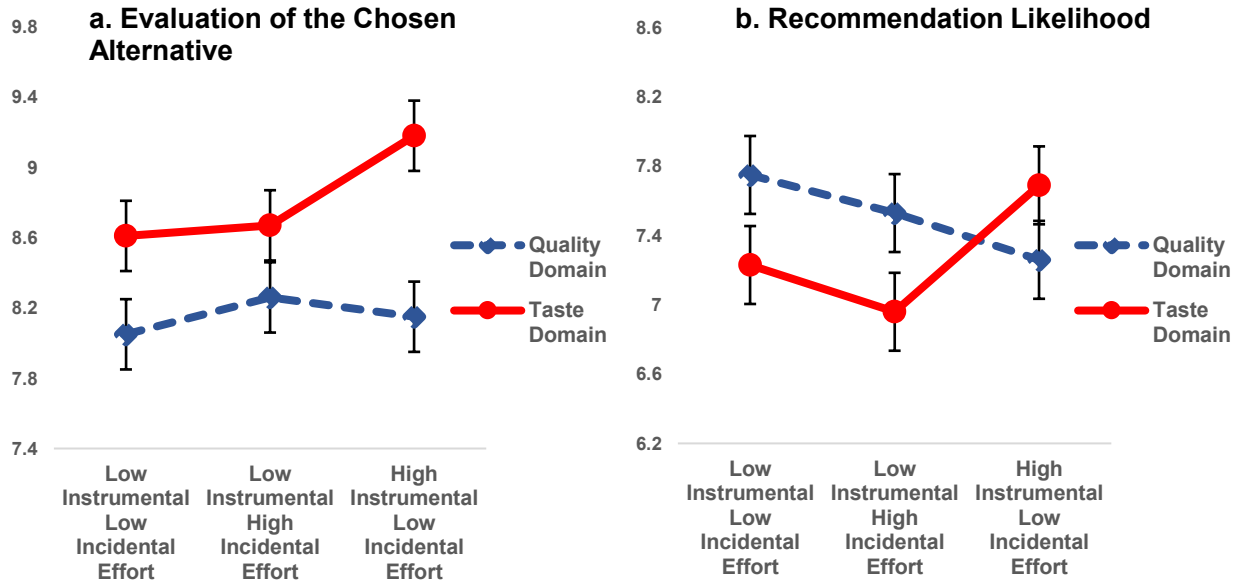
Taken together, the results of these moderated mediation analyses show that experiencing high (vs. low) instrumental effort has a stronger negative impact of decision confidence in quality domains (vs. taste domains) via increased metacognitive difficulty, undermining both preference clarity and preference correctness. However, experiencing high (vs. low) incidental effort does not significantly impact decision confidence in either domain.

Evaluation of the Chosen Alternative. A two-way ANOVA with the composite choice evaluation index as the dependent variable revealed a significant main effect of decision effort ($F(2, 597) = 3.08$, $p = .047$, $\eta_p^2 = .010$), a significant main effect of decision domain ($F(1, 597) = 36.22$, $p < .001$, $\eta_p^2 = .057$), as well as a marginally significant interaction effect of these two factors ($F(2, 597) = 2.77$, $p = .063$, $\eta_p^2 = .009$). Overall, participants evaluated their chosen coffee mug more favorably than their chosen power bank ($M_{quality} = 8.16$, SD = 1.36 vs. $M_{taste} = 8.82$, SD = 1.38). Planned contrasts revealed that participants' evaluation of their chosen power bank did not vary significantly across three decision effort conditions ($M_{low\text{-}ins/low\text{-}inc} = 8.05$, SD = 1.40 vs. $M_{low\text{-}ins/high\text{-}inc} = 8.26$, SD = 1.36 vs. $M_{high\text{-}ins/low\text{-}inc} = 8.15$, SD = 1.34; $t(597) = .02$, $p = .985$). Conversely, participants evaluated their chosen coffee mug more favorably in the high-instrumental/low-incidental effort condition ($M_{high\text{-}ins/low\text{-}inc} = 9.18$, SD = 1.10) than both in the low-instrumental/high-incidental effort condition (vs. $M_{low\text{-}ins/high\text{-}inc} = 8.67$, SD = 1.40; $t(597) = 2.61$, $p = .009$) and in the low-instrumental/low-incidental effort condition (vs. $M_{low\text{-}ins/low\text{-}inc} = 8.61$, SD = 1.54; $t(597) = 2.99$, $p = .003$) (see figure 10a). Here, the difference between the latter two conditions was not significant ($t(597) = .32$, $p = .753$).

Recommendation Likelihood. A two-way ANOVA with recommendation likelihood as the dependent variable revealed a significant interaction effect of decision effort and decision domain ($F(2, 597) = 3.02$, $p = .050$, $\eta_p^2 = .010$). Neither the main effect of decision effort ($F(2,$

597) = .72, p = .487) nor the main effect of decision domain (F(2, 597) = 1.40, p = .237) was significant. Planned contrasts revealed that, participants' likelihood of recommending their chosen power bank did not vary significantly across three decision effort conditions ($M_{\text{low-ins/low-inc}}$ = 7.75, SD = 1.95 vs. $M_{\text{low-ins/high-inc}}$ = 7.53, SD = 2.34 vs. $M_{\text{high-ins/low-inc}}$ = 7.26, SD = 2.06; t(597) = 2.75, p = .202). Conversely, participants were significantly more likely to recommend their chosen coffee mug to others in the high-instrumental/low-incidental effort condition ($M_{\text{high-ins/low-inc}}$ = 7.69, SD = 1.95) than both in the low-instrumental/high-incidental effort condition (vs. $M_{\text{low-ins/high-inc}}$ = 6.96, SD = 2.84; t(597) = 2.22, p = .027) and in the low-instrumental/low-incidental effort condition (vs. $M_{\text{low-ins/low-inc}}$ = 7.23, SD = 2.45; t(597) = 1.41, p = .158) (see figure 10b). Here, the difference between the low-instrumental/high-incidental effort condition and the low-instrumental/low-incidental effort condition was not significant (t(597) = .85, p = .398).

Figure 10:
Effects of Decision Effort in Quality versus Taste Domains on (a) Evaluation of the Chosen Alternative and (b) Recommendation Likelihood (Study 5)



Satisfaction with the Decision Process. A two-way ANOVA with the composite decision process satisfaction index (Cronbach's α = .87) as the dependent variable revealed a significant main effect of decision effort ($F(2, 597) = 3.53$, $p = .030$, $\eta_p^2 = .012$), as well as a significant interaction effect of decision effort and decision domain ($F(2, 597) = 9.96$, $p < .001$, $\eta_p^2 = .032$). Planned contrasts revealed that participants' satisfaction with decision process when choosing a power bank did not vary significantly across three decision effort conditions ($M_{\text{low-ins/low-inc}} = 7.69$, SD = 1.48 vs. $M_{\text{low-ins/high-inc}} = 7.78$, SD = 1.74 vs. $M_{\text{high-ins/low-inc}} = 7.46$, SD = 1.90; $t(597) = 1.24$, $p = .215$). Conversely, participants' satisfaction with decision process when choosing a coffee mug was significantly higher in the high-instrumental/low-incidental effort condition ($M_{\text{high-ins/low-inc}} = 8.52$, SD = 1.46) than both in the low-instrumental/high-incidental effort condition (vs. $M_{\text{low-ins/high-inc}} = 7.26$, SD = 2.21; $t(597) = 4.91$, $p < .001$) and in the low-instrumental/low-incidental effort condition (vs. $M_{\text{low-ins/low-inc}} = 7.73$, SD = 1.87; $t(597) = 3.16$, $p = .002$). The difference between the low-instrumental/high-incidental effort condition and the low-instrumental/low-incidental effort condition was marginally significant ($t(597) = 1.84$, $p = .066$).

Maximizing-Satisficing Tendency. A two-way ANCOVA with decision confidence as the dependent variable and the composite index of maximizing-satisficing tendency as a covariate yielded the same substantive results as reported above, and therefore are not discussed further.

Discussion

Study 5 demonstrates the differential impact of instrumental versus incidental experienced decision effort on decision confidence. Consistent with our findings in studies 3 and 4, experiencing more instrumental effort decreased confidence in quality domains, but it increased confidence in taste domains. Conversely, experiencing more incidental effort did not

speak to decision confidence in either domain, suggesting that instrumental as opposed to incidental forms of decision effort is the key driver of the predicted effects on decision confidence (H3). This study also documents further downstream consequences of effort exertion, such that a greater decision confidence in taste (vs. quality) domains translated into a more favorable evaluation of the chosen alternative and a greater likelihood of recommending it to others.

STUDY 6

The objective of study 6 was to investigate the effect of another form of incidental decision effort (vs. instrumental decision effort) on decision confidence – i.e., processing disfluency. Prior research suggests that the perceptual complexity of a decision task, such as presenting product information in difficult- versus easy-to-read fonts can increase the anticipated effort in a decision task and influence the subsequent judgment of task difficulty (Song and Schwarz 2008). Moreover, experiencing disfluency in information processing can increase one's preference for an alternative when effort is considered desirable in the goal pursuit (Labroo and Kim 2009). We speculated that effort that is induced by the processing disfluency of product information is independent of the effort induced by the cognitive reasoning processes about the presented alternatives, and can lead to distinct inferences that do not directly speak to decision confidence (e.g., desirability of the chosen alternative, Labroo and Kim 2009; specialness of the chosen alternative, Pocheptsova, Labroo, and Dhar 2010; perceived importance of the decision task, Sela and Berger 2012).

Method

Procedure. Five hundred and ninety-two Amazon Mechanical Turk workers (M_{age} = 37.87 yrs., SD = 12.69; 52.5% female) completed this study in exchange for a payment of $1.20. Participants' task was to choose their preferred alternative either from an assortment of wireless headphones or from an assortment of throw blankets. They were presented with 6 alternatives (in a 2 x 3 matrix) to choose from (see appendix D for sample screenshots). Unlike those in previous studies, the features of these alternatives were described verbally. The actual product image was not presented; instead, black and white images of a prototypical pair of wireless headphones and a prototypical throw blanket were presented as part of the product descriptions. The order in which the alternatives were presented was unique and random for each participant. Participants were asked to look at the description of each product and then indicate their choice. Unless otherwise noted, the rest of the procedure was the same as that for studies 3 and 4.

Design and Stimuli. Participants were randomly assigned to one of four conditions in a 2 (processing fluency: high vs. low) x 2 (decision domain: quality vs. taste) between-subjects product-choice paradigm. Processing fluency was manipulated similar to Alter et al. (2007; also see, Song and Schwarz 2008; Thompson and Ince 2013) by presenting the product descriptions in either an easy-to-read black Arial 12-point font or a difficult-to-read 75% grey Brush Script 12-point font on a white background.

In the quality domain, participants were asked to choose a pair of wireless headphones for themselves. These headphones had the same color and design, but they differed in quality and price. In particular, they varied in sound quality, noise-cancelling capability, battery life, charging time, and wireless range. The higher the quality of a pair of headphones, the higher was its price. In the taste domain, participants were asked to choose a throw blanket for themselves. These blankets were all of the same size and price, but they had different designs. In particular

they varied in color combination, texture, softness, usage occasion, and weight. Each blanket had a bold stripe pattern alternating a darker color and a lighter color.

Measures. The same measures as in prior studies were obtained. We also measured whether participants considered their chosen alternative to be more (vs. less) special using a two-item composite measure on 11-point scales (0 = "ordinary/common", 10 = "special/unique"; Cronbach's $\alpha = .93$). As a manipulation check of processing fluency, participants responded to a five-item composite measure of how difficult (vs. easy) the process of looking at the product descriptions was on 11-point scales (Cronbach's $\alpha = .87$; adapted from Graf, Mayer, and Landwehr 2018).

Results

Perceived Subjectivity of the Decision Domain. A two-way ANOVA with perceived subjectivity as the dependent variable revealed a significant main effect of decision domain, such that participants considered the choice among wireless headphones more of a matter of quality and the choice among throw blankets more of a matter of taste ($M_{quality} = 3.22$, SD = 2.45 vs. $M_{taste} = 7.96$, SD = 2.45; $F(1, 588) = 555.58$, $p < .001$, $\eta_p^2 = .486$). Neither the main effect of processing fluency ($F(1, 588) = .16$, $p = .690$) nor the interaction effect of decision effort and decision domain ($F(1, 588) = .56$, $p = .456$) was significant, indicating that our manipulation of perceived subjectivity was successful.

Decision Time. A two-way ANOVA with decision time (seconds; log-transformed) as the dependent variable revealed a significant main effect of decision domain ($F(1, 588) = 12.63$, $p < .001$, $\eta_p^2 = .021$), such that participants spent more time in choosing a pair of wireless headphones than choosing a throw blanket ($M_{quality} = 63.59$ seconds, SD = 46.00 vs. $M_{taste} = 49.27$

seconds, SD = 30.25). Neither processing fluency ($F(1, 588) = .18$, $p = .674$) nor its interaction with decision domain ($F(1, 588) < .01$, $p = .988$) had a significant effect on decision time.

Processing Fluency. A two-way ANOVA with the composite processing fluency index as the dependent variable revealed that participants found the process of looking at product descriptions significantly more difficult in the low fluency condition than in the high fluency condition ($M_{\text{high-fluency}} = 3.25$, SD = 2.16 vs. $M_{\text{low-fluency}} = 5.07$, SD = 2.62; $F(1, 588) = 85.64$, $p < .001$, $\eta_p^2 = .127$). Neither decision domain ($F(1, 588) < .01$, $p = .939$) nor its interaction with processing fluency ($F(1, 588) = 1.58$, $p = .209$) had a significant effect on the difficulty or ease of looking at the product descriptions.

Decision Confidence. A two-way ANOVA with decision confidence as the dependent variable revealed a non-significant effect of processing fluency ($F(1, 588) = .06$, $p = .800$), indicating that decision confidence did not vary between high fluency and low fluency conditions ($M_{\text{high-fluency}} = 7.95$, SD = 1.88 vs. $M_{\text{low-fluency}} = 7.99$, SD = 1.82). Decision domain also did not affect decision confidence ($M_{\text{quality}} = 7.90$, SD = 1.74 vs. $M_{\text{taste}} = 8.03$, SD = 1.96; $F(1, 588) = .74$, $p = .389$). Critically, unlike prior studies, there was no significant interaction between processing fluency and decision domain ($F(1, 588) = .59$, $p = .442$).

Metacognitive Difficulty. A two-way ANOVA with metacognitive difficulty as the dependent variable revealed that neither processing fluency ($M_{\text{high-fluency}} = 4.40$, SD = 2.94 vs. $M_{\text{low-fluency}} = 4.31$, SD = 2.93; $F(1, 588) = .15$, $p = .696$) nor decision domain ($M_{\text{quality}} = 4.40$, SD = 2.67 vs. $M_{\text{taste}} = 4.32$, SD = 3.16; $F(1, 588) = .11$, $p = .744$) had a significant effect of metacognitive difficulty. The interaction between processing fluency and decision domain was also not significant ($F(1, 588) = .02$, $p = .903$).

Preference Clarity. A two-way ANOVA with preference clarity as the dependent variable revealed that neither processing fluency ($M_{\text{high-fluency}} = 8.23$, SD = 1.84 vs. $M_{\text{low-fluency}} = 8.08$, SD = 2.03; $F(1, 588) = .88$, $p = .348$) nor decision domain ($M_{\text{quality}} = 8.11$, SD = 1.91 vs. $M_{\text{taste}} = 8.20$, SD = 1.96; $F(1, 588) = .30$, $p = .584$) had a significant effect of preference clarity. The interaction effect of processing fluency and decision domain was also not significant ($F(1, 588) = .19$, $p = .660$).

Preference Correctness. A two-way ANOVA with preference correctness as the dependent variable revealed a non-significant effect of processing fluency ($M_{\text{high-fluency}} = 5.76$, SD = 2.23 vs. $M_{\text{low-fluency}} = 5.93$, SD = 2.30; $F(1, 588) = .89$, $p = .345$), indicating that preference correctness did not vary between low fluency and high fluency conditions. However, there was a significant main effect of decision domain, such that participants considered their preferred pair of wireless headphones to be more normatively valid than their preferred throw blanket ($M_{\text{quality}} = 6.19$, SD = 2.25 vs. $M_{\text{taste}} = 5.50$, SD = 2.23; $F(1, 588) = 14.08$, $p < .001$, $\eta_p^2 = .023$). The interaction effect of processing fluency and decision domain was not significant ($F(1, 588) = .53$, $p = .466$).

Evaluation of the Chosen Alternative. A two-way ANOVA with the composite choice evaluation index (Cronbach's $\alpha = .89$) as the dependent variable revealed a marginally significant main effect of processing fluency ($F(1, 588) = 3.44$, $p = .064$, $\eta_p^2 = .006$), such that participants evaluated their chosen alternative less favorably in the low fluency condition than in the high fluency condition ($M_{\text{high-fluency}} = 8.18$, SD = 1.41 vs. $M_{\text{low-fluency}} = 7.95$, SD = 1.50). Neither processing fluency ($F(1, 588) = .96$, $p = .328$) nor its interaction with decision domain had a significant effect on participants' evaluation of their chosen alternative ($F(1, 588) = 1.46$, $p = .228$).

Specialness of the Chosen Alternative. A two-way ANOVA with the composite choice specialness index as the dependent variable revealed a significant main effect of decision domain ($F(1, 588) = 5.87$, $p = .016$, $\eta_p^2 = .010$), such that participants considered their chosen throw blanket to be more special and unique than their chosen pair of wireless headphones ($M_{quality} = 5.74$, SD = 2.42 vs. $M_{taste} = 6.24$, SD = 2.54). Neither processing fluency ($F(1, 588) = .18$, $p = .669$) nor its interaction with decision domain ($F(1, 588) = 1.97$, $p = .161$) had a significant effect on how special and unique participants considered their chosen alternative.

Perceived Importance of the Decision Task. A two-way ANOVA with perceived importance of the decision task revealed a significant main effect of decision domain ($F(1, 588) = 20.43$, $p < .001$, $\eta_p^2 = .034$), such that participants considered choosing a pair of wireless headphones more important than choosing a throw blanket ($M_{quality} = 7.06$, SD = 2.38 vs. $M_{taste} = 6.07$, SD = 2.91). Neither the main effect of processing fluency ($F(1, 588) = .28$, $p = .595$) nor its interaction with decision domain was significant ($F(1, 588) = .53$, $p = .467$). Importantly, a two-way ANCOVA with decision confidence as the dependent variable and perceived importance of the decision task as a covariate yielded the same substantive results.

Satisfaction with the Decision Process. A two-way ANOVA with the composite decision process satisfaction index (Cronbach's $\alpha = .89$) as the dependent variable revealed a significant main effect of processing fluency ($F(1, 588) = 11.63$, $p = .001$, $\eta_p^2 = .019$), such that participants were less satisfied with their experience of choosing their preferred alternative in the low fluency condition than in the high fluency condition ($M_{high\text{-}fluency} = 7.37$, SD = 1.88 vs. $M_{low\text{-}fluency} = 6.85$, SD = 1.96). There was also a significant main effect of decision domain ($F(1, 588) = 23.74$, $p < .001$, $\eta_p^2 = .039$), such that participants were more satisfied with their decision process when choosing their preferred pair of wireless headphones than when choosing their preferred throw

blanket ($M_{quality}$ = 7.50, SD = 1.58 vs. M_{taste} = 6.74, SD = 2.16). The interaction between processing fluency and decision domain was not significant ($F(1, 588) = .17$, $p = .676$).

Need for Cognition. A two-way ANCOVA with decision confidence as the dependent variable and the composite index of need for cognition (Cronbach's α = .92) as a covariate yielded the same substantive conclusions as reported above, and therefore are not discussed further.

Discussion

The findings of study 6 corroborates those of study 5 regarding the differential impact of instrumental versus incidental experienced decision effort on decision confidence. Consistent with prior findings in the processing fluency literature, we found that presenting product information in a visually degraded font negatively affected consumers' appraisal of their chosen alternative and their satisfaction with the decision process (Schwarz 2004, 2010; Winkielman et al. 2003; also see, Janiszewski 1993; Labroo and Lee 2006; Labroo, Dhar, and Schwarz 2008; Novemsky et al. 2007; Shen, Jiang, and Adaval 2010). However, this form of incidental decision effort was independent of instrumental decision effort (i.e., effort exerted in reasoning about the presented alternatives) and did not influence consumers' judgment about the optimality or appropriateness of their decisions – i.e., decision confidence, providing further support for H3. This study also rules out the alternative explanation that consumers were relying on their memorized evaluation of alternatives without actively processing the presented information, particularly in taste domains, by removing any diagnostic visual information about the products (i.e., affect-referral heuristic, Wright 1975; also see, Lingle and Ostrom 1979; Lynch, Marmorstein, and Weigold 1988; Pham 1998).

STUDY 7

The objective of study 7 was to provide further insights into the underlying cognitive processes governing the relationship between exerted mental effort and decision confidence using eye tracking technology. Prior research has defined mental effort as an intensive aspect of attention (Kahneman 1973), and attention plays a critical role in preference construction and decision making (see Orquin and Mueller Loose 2013 for a review). Conversely, a growing body of research shows that gaze behavior during decision making provides a measure of visual attention (e.g., Cavanagh et al. 2014; Krajbich and Rangel 2011; Krajbich et al. 2010, Mormann et al. 2012; Shimojo et al. 2003; Uggeldahl et al. 2016), both when such decisions involve top-down or stimulus driven processing as well as bottom-up or goal driven processing (Corbetta and Shulman 2002; see Duerrschmid and Danner 2018 for a review). For instance, pupil dilation and constriction have been linked to a broad range of cognitive processes (Andreassi 1980; Beatty and Lucero-Wagoner 2000; Sirois and Brisson 2014), including attention (Laeng, Sirois, and Gredebäck 2012), memory (Goldinger and Papesh 2012), and mental load (Just, Carpenter and Miyake 2003; Kramer 1990). Moreover, gaze behavior has been shown to be highly task dependent and coextensive with cognitive goals (Castelhano, Mack, and Henderson 2009; Graham, Orquin, and Visschers 2012), such that as cognitive processes differ from context to context so does the pattern of eye movements (Spivey and Dale 2011). For instance, prior research has shown that as decision difficulty increases – placing more demand on working memory – so does the number of fixations (Fiedler and Glöckner 2012; Krajbich et al. 2010; Krajbich et al. 2012). Importantly, since modern eye tracking devices are unobtrusive and entail minimal interaction with individuals, they shed light on consumers' natural gaze behavior and produce implicit psychological measures. Therefore, using eye tracking technology in this study enabled us to observe not only the extent to which consumers exert mental effort in

decision making – as a form of visual attention, but also the manner in which they process information in quality and taste domains.

Prior research in the choice and decision making literature has demonstrated that decision contexts, such as presentation format of choice options and goals activated during evaluative phase, have significant effects on how product information is processed, in turn affecting preference construction (e.g., Bettman and Kakkar 1977; Dhar 1996; Jang and Yoon 2016; McGill and Anand 1989; Bettman et al. 1998). In this research, first we focus our attention on pupillometry – studying the size and reactivity of the pupil in response to the stimuli – to gauge individuals' visual attention and its relationship with metacognitive difficulty during decision making. Prior research has shown that pupil dilation can be used as a robust measure of mental activity during task performance (Hess and Polt 1964; Kahneman 1973). For example, Hess and Polt (1964) found that individuals' peak pupil diameter and the latency to peak dilation varied as a function of difficulty of mathematical problem-solving. Here, we examine whether individuals' physiological response (i.e., pupil dilation) is reflected in individuals' psychological response (i.e., metacognitive difficulty) as they choose in quality and taste domains. Based on our key hypothesis that consumers tend to be more effort sensitive in quality versus taste domains, we predict there will be stronger (positive) correlation between pupil dilation and metacognitive difficulty in quality domains than in taste domains.

Second, we focus our attention on two distinct information processing strategies that consumers may adopt when evaluating alternatives in quality and taste domains: *attribute-based processing* and *alternative-based processing*. In attribute-based processing, consumers appraise alternatives analytically by comparing values on each attribute across alternatives, such that they rely more on piecemeal information and less on the global evaluation of each alternative (Dhar

1996). By contrast, in alternative-based processing, consumers appraise alternatives holistically by combining values across attributes within an alternative, such that they rely less on piecemeal information and more on the global evaluation of each alternative (Lerouge 2009; McGill and Anand 1989). We predict that consumers differ in their salient goals in quality and taste domains, in turn affecting the extent to which they lean on attribute-based versus alternative-based processing strategy to navigate through the decision process.

In quality domains, consumers are more attuned to enhancing preference correctness – that is choosing an alternative that can be validated as the normative choice. In this case, consumers lean more heavily on attribute-based processing to identify the option that has the highest expected value (i.e., utility) across all attributes determined by a combination of external preference criteria (e.g., choosing a car with higher mileage, greater reliability, and lower cost of ownership, ceteris paribus). However, when a decision requires greater mental effort exertion (e.g., in the absence of a clearly dominant option), this processing strategy can enhance conflict and introduce greater preference uncertainty (Dhar 1996). Therefore, we theorize that in quality domains, when decision makers rely more heavily on attribute-based information processing it will reduce their preference correctness, in turn undermining their decision confidence.

On the other hand, in taste domains, consumers are more attuned to enhancing preference clarity – that is choosing an alternative that reflects their true inclination, with less emphasis on whether that alternative reflects normative preferences. In this case, consumers lean more heavily on alternative-based processing to identify the option that has the highest expected value (i.e., utility) across all attributes determined by a combination of internal preference criteria (e.g., choosing a full-bodied wine that is moderate on sweetness and has fruity notes, ceteris paribus). We theorize that in taste domains, when decision makers rely more heavily on alternative-based

information processing it will enhance their preference clarity, in turn boosting decision confidence.

Method

Procedure. Sixty undergraduate students from a large North American university (M_{age} = 20.60 yrs., SD = 2.02; 43.3% female) completed this study in exchange for course credit. Participants were asked to complete a series of tasks during a thirty-minute laboratory session. The focal decision making tasks were positioned at the beginning and the end of the session with a 5-minute filler task in between. In these focal tasks, participants were asked to choose their preferred alternative from an assortment of electric toothbrushes and coffee tables. The order in which they chose in these product domains was counterbalanced across participants. Upon arrival, participants were told that they will be completing a series of tasks that aimed at understanding how consumers make decisions across various domains. They were seated in front of a computer equipped with Tobii Pro Nano (60 Hz) – a screen-based eye tracking device. They were required to sit still and keep their eyes on the screen during the experiment. Before each focal decision task, we calibrated the eye-tracking device by asking participants to focus on nine calibration dots that were presented sequentially on different areas of the screen (Brisson et al. 2013; Huang, Wong, and Wan 2020; Wedel and Pieters 2006). After calibration, participants were asked to complete the tasks by following the instructions on their screen. Participants' gaze behavior was recorded as they were presented with the set of alternatives in each decision domain until they indicated their choice.

Design and Stimuli. Participants were randomly assigned to a 2 (decision effort: low vs. high) x 2 (decision domain: quality vs. taste) x 2 (order of presentation: quality first vs. taste first) mixed design with decision effort and order of presentation manipulated between subjects

and decision domain manipulated within subjects.[11] Decision effort was manipulated by varying the assortment size (i.e., 3 vs. 12 alternatives) and the magnitude of tradeoffs among the presented alternatives. In the quality domain, participants chose from a vertically differentiated assortment of electric toothbrushes, where alternatives differed in cleaning performance, battery life, and price but not in aesthetic and ergonomic properties. By contrast, in the taste domain, participants chose from a horizontally differentiated assortment of coffee tables, where alternatives differed in shape, size, and design but not in quality and price.

Psychological Measures. After choosing their preferred alternative in each domain (i.e., electric toothbrushes and coffee tables), participants responded to the same battery of questions as in previous studies – i.e., decision confidence, preference clarity, preference correctness, metacognitive difficulty, and perceived subjectivity of the decision domain. The amount of time participants took to make their choice was measured unobtrusively.

Physiological Measures. The eye tracking device recorded participants' eye movements – direction, duration, and count – on the product information page. The recorded information was categorized into areas of interest (AOI) that were specified a priori (see appendix D for details). In the low effort condition, 3 AOIs were defined on the product information page, with each AOI defined as one of the three cells in a 3 x 1 matrix. In the high effort condition, 12 AOIs were defined on the product information page, with each AOI defined as one of the twelve cells in a 6 x 2 matrix. The number of fixations (i.e., relatively stable eye movements; velocity threshold < 30 degrees/second) and saccades (i.e., rapid eye movements; velocity threshold > 30 degrees/second) within an AOI, number of visits to each AOI (i.e., proportion of eye movements

[11] The order in which participants chose in quality and taste domains did not have a significant effect on the key dependent variables, and therefore are not discussed further. All the subsequent analyses entail a 2 x 2 repeated measures ANOVA with decision effort (low vs. high) as the between-subjects factor and decision domain (quality vs. taste) as the within-subjects factor.

occurring within an AOI between the start of the first fixation on the AOI and the end of the last fixation, before an exit saccade), and fixation duration on each AOI were computed. In addition, we calculated participants' average pupil size (in millimeters) for both left and right eyes at 3-second intervals from when alternatives were presented on the screen to when participants indicated their choice. These measures were then used to estimate the mean relative change in pupil size over the course of decision making (i.e., slope). A positive slope indicates that pupil size increased (i.e., pupils dilated) as participants spent more time in decision making. A negative slop indicates that pupil size decreased (i.e., pupils constricted) as participants spent more time in decision making.

Results: Psychological Measures

Perceived Subjectivity of the Decision Domain. A two-way repeated measures ANOVA with perceived subjectivity of the decision domains as the dependent variable revealed a significant main effect of decision domain, such that participants considered the choice among electric toothbrushes more of a matter of quality and the choice among the coffee tables more of a matter of taste ($M_{quality}$ = 2.20, SD = 1.66 vs. M_{taste} = 8.82, SD = 1.60; $F(1, 58) = 505.49$, $p < .001$, $\eta_p^2 = .897$). Neither the main effect of decision effort ($F(1, 58) = .15$, $p = .703$) nor the interaction effect of decision effort and decision domain ($F(1, 58) = .48$, $p = .491$) was significant.

Decision Time. A two-way repeated measures ANOVA with decision time (seconds; log-transformed) as the dependent variable revealed a significant main effect of decision effort, such that participants took significantly more time choosing from a larger assortment than choosing from a smaller assortment ($M_{low\text{-}effort}$ = 23.39 seconds, SD = 9.23 vs. $M_{high\text{-}effort}$ = 69.53 seconds, SD = 7.41; $F(1, 58) = 389.66$, $p < .001$, $\eta_p^2 = .870$). Neither the main effect of decision domain

($F(1, 58) = .12$, $p = .733$) nor the interaction effect of decision domain and decision effort ($F(1, 58) < .01$, $p = .465$) was significant.

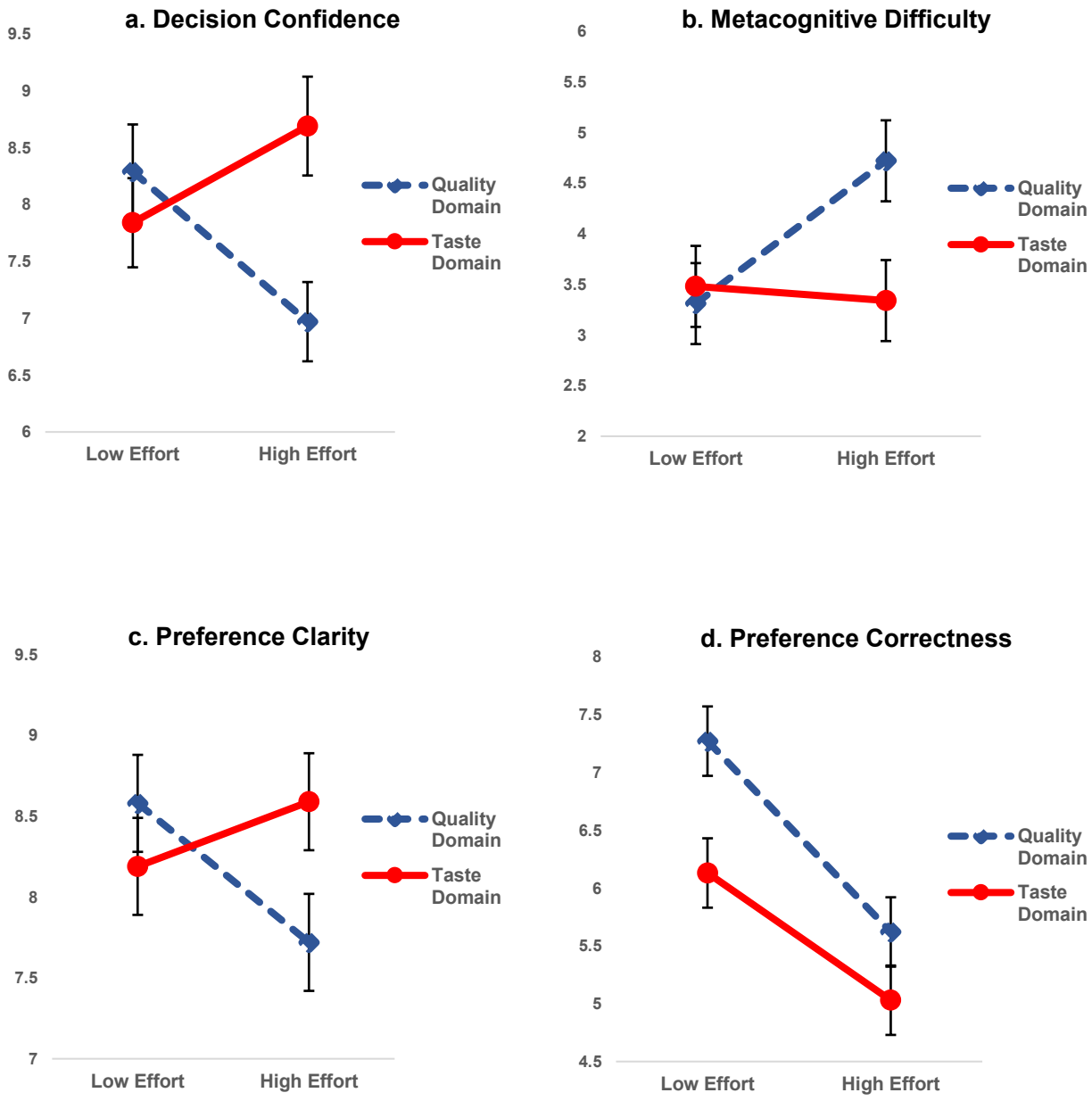
Decision Confidence. A two-way repeated measures ANOVA with decision confidence as the dependent variable revealed the predicted interaction effect of decision effort and decision domain ($F(1, 58) = 12.048$, $p = .001$, $\eta_p^2 = .172$), as well as a significant main effect of decision domain ($F(1, 58) = 4.121$, $p = .047$, $\eta_p^2 = .066$) (see figure 11a). Planned contrasts revealed that in the low effort condition, decision confidence did not vary between quality and taste domains ($M_{quality} = 8.29$, SD = 1.58 vs. $M_{taste} = 7.84$, SD = 1.73; $t(30) = 1.149$, $p = .260$). However, as predicted, in the high effort condition, participants were significantly more confident when choosing in the taste domain than when choosing in the quality domain ($M_{quality} = 6.97$, SD = 2.56 vs. $M_{taste} = 8.69$, SD = 1.47; $t(28) = 3.493$, $p = .002$). The main effect of decision effort on decision confidence was not significant ($F(1, 58) = .41$, $p = .524$).

Metacognitive Difficulty. A two-way repeated measures ANOVA with metacognitive difficulty as the dependent variable revealed a marginally significant interaction between decision effort and decision domain ($F(1, 58) = 3.403$, $p = .070$, $\eta_p^2 = .055$) (see figure 11b). Planned contrasts revealed that in the low effort condition, metacognitive difficulty did not vary between quality and taste domains ($M_{quality} = 3.13$, SD = 2.77 vs. $M_{taste} = 3.48$, SD = 2.89; $t(30) = .650$, $p = .521$). However, as predicted, in the high effort condition, participants found choosing in the quality domain significantly more difficult than choosing in the taste domain ($M_{quality} = 4.72$, SD = 2.90 vs. $M_{taste} = 3.34$, SD = 3.11; $t(28) = 1.774$, $p = .087$). Neither the main effect of decision effort ($F(1, 58) = 1.53$, $p = .221$) nor the main effect of decision domain on metacognitive difficulty ($F(1, 58) = 1.19$, $p = .280$) was significant.

Preference Clarity. A two-way repeated measures ANOVA with preference clarity as the dependent variable revealed the predicted interaction between decision effort and decision domain ($F(1, 58) = 6.313$, $p = .015$, $\eta_p^2 = .098$) (see figure 11c). Planned contrasts revealed that in the low effort condition, preference clarity did not vary between quality and taste domains ($M_{quality} = 8.58$, SD = 1.41 vs. $M_{taste} = 8.19$, SD = 1.25; $t(30) = 1.196$, $p = .241$). However, as predicted, in the high effort condition, participants reported greater preference clarity when choosing in the taste domain than when choosing in the quality domain ($M_{quality} = 7.72$, SD = 2.14 vs. $M_{taste} = 8.59$, SD = 1.40; $t(28) = 2.267$, $p = .031$). Neither the main effect of decision effort ($F(1, 58) = .51$, $p = .476$) nor the main effect of decision domain on preference clarity ($F(1, 58) = .91$, $p = .343$) was significant.

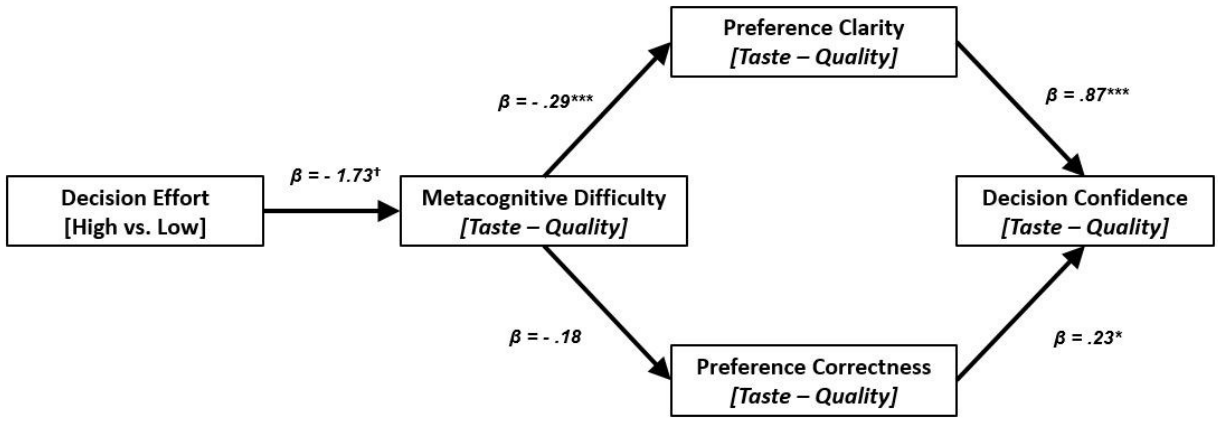
Preference Correctness. A two-way repeated measures ANOVA with preference correctness as the dependent variable revealed a significant main effect of decision effort ($F(1, 58) = 7.787$, $p = .007$, $\eta_p^2 = .118$), such that participants reported greater preference correctness when choosing in the low effort condition than when choosing in the high effort condition ($M_{low\text{-}effort} = 5.95$, SD = 1.90 vs. $M_{high\text{-}effort} = 4.50$, SD = 2.13) (see figure 11d). There was also a significant main effect of decision domain ($F(1, 58) = 7.820$, $p = .007$, $\eta_p^2 = .119$), such that participants reported greater preference correctness when choosing in the quality domain than when choosing in the taste domain ($M_{quality} = 5.83$, SD = 2.61 vs. $M_{taste} = 4.67$, SD = 2.71). The interaction between decision effort and decision domain was not significant ($F(1, 58) = .30$, $p = .584$).

Figure 11:
Effects of Decision Effort in Quality versus Taste Domains on (a) Decision Confidence, (b) Metacognitive Difficulty, (c) Preference Clarity, and (d) Preference Correctness (Study 7)



Test of Moderated Mediation. We followed the procedure by Judd, Kenny, and McClelland (2001) to test our moderated mediation hypothesis in a mixed design. We estimated a bias-corrected mediation model (10,000 bootstrap samples) to test the differential impact of decision effort on decision confidence in taste versus quality domains. First, we estimated the differences between taste and quality domains on the focal dependent variable (i.e., decision confidence), the serial mediator (i.e., metacognitive difficulty), and the parallel mediators (i.e., preference clarity and preference correctness). Then we regressed the effect of decision effort (high vs. low) on differential decision confidence [$\text{DecisionConfidence}_{\text{Taste – Quality}}$], with differential metacognitive difficulty [$\text{MetacognitiveDifficulty}_{\text{Taste – Quality}}$] as the serial mediator, affecting both parallel mediators – differential preference clarity [$\text{PreferenceClarity}_{\text{Taste – Quality}}$] and differential preference correctness [$\text{PreferenceCorrectness}_{\text{Taste – Quality}}$] (see figure 12). The results indicate that, as predicted, decision effort had a positive indirect effect on decision confidence in taste (vs. quality) domain via reduced metacognitive difficulty, in turn increasing preference clarity ($a \times b_1 \times c_1 = .1771$, SE = .0073, 95% CI = [.0492, .3957]). The indirect effect of decision effort on decision confidence via reduced metacognitive difficulty and preference correctness was not significant ($a \times b_2 \times c_2 = -.0394$, SE = .0131, 95% CI = [–.2309, .0109]). Again, these findings support our theorizing that consumers are more effort sensitive in quality domains than in taste domains, such that exerting more mental effort in decision making can boost decision confidence by increasing preference clarity.

Figure 12:
Repeated Measures Moderated Mediation Model (Study 7)

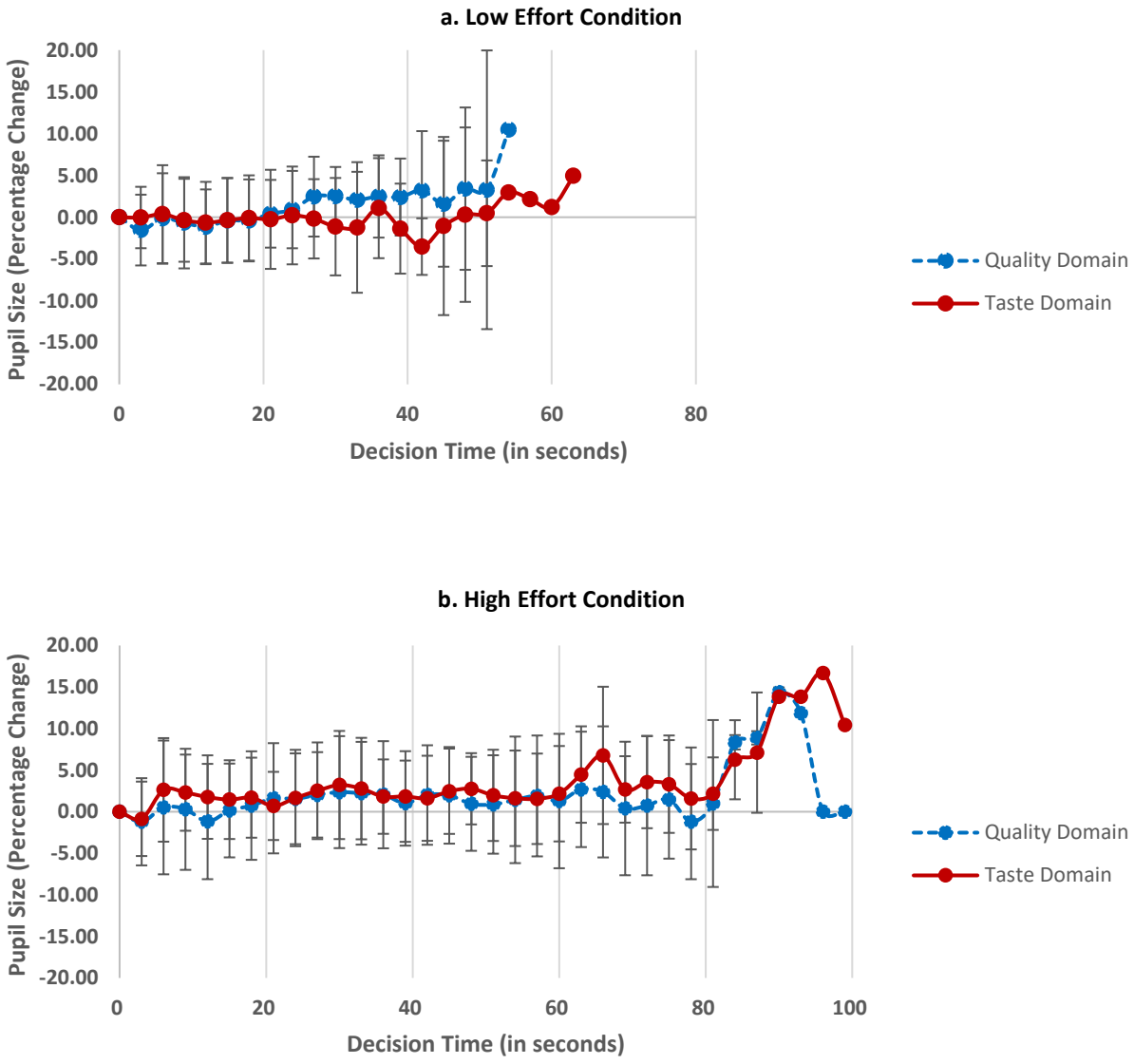


*** p < .001, ** p < .01, * p < .05, † p < .10

Results: Physiological Measures

Mean Relative Change in Pupil Dilation: A two-way repeated measures ANOVA with the slope of pupil dilation as the dependent variable revealed that the extent to which pupil size increased (i.e., pupil dilated) or decreased (i.e., pupil constricted) over the span of decision making did not vary significantly across conditions. Neither the main effect of decision effort ($F(1, 58) = .47$, $p = .402$) nor the main effect of decision domain ($F(1, 58) = .11$, $p = .741$) was significant. The interaction between these two factors was also not significant ($F(1, 58) = .47$, $p = .495$). Overall, pupil size increased over the span of decision time across all conditions ($M_{\text{low-effort-quality}} = .0022$, SD = .0145; $M_{\text{low-effort-taste}} = -.0002$, SD = .0170; $M_{\text{high-effort-quality}} = .0023$, SD = .0059; $M_{\text{high-effort-taste}} = .0032$, SD = .0074), suggesting that participants' steadily engaged their cognitive resources (i.e., visual attention) from when the alternatives were presented to when they indicated their choice (see figure 13).

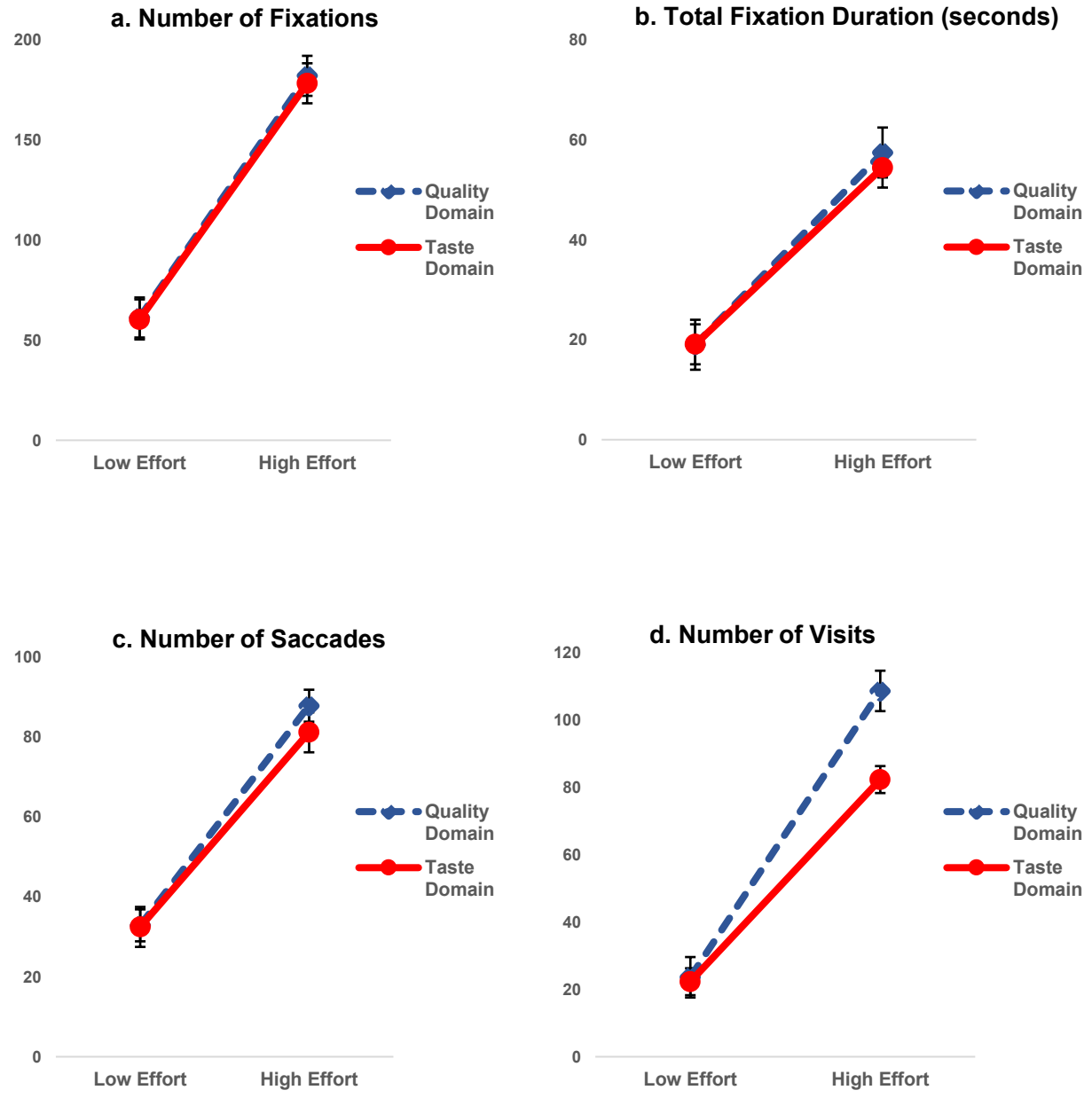
Figure 13:
Relative Changes in Pupil Size from the Stimulus Onset to the Indication of Choice (left eye; percentage change) for (a) Low Effort Condition and (b) High Effort Condition (Study 7)



Importantly, as predicted, in the quality domain, the mean relative change in pupil dilation had a significant positive relationship with participants' metacognitive difficulty (r = .2817, p = .029), suggesting that as participants steadily engaged their cognitive resources in processing information their feeling of decision difficulty also increased. By contrast, in the taste domain, the mean relative change in pupil dilation and metacognitive difficulty was virtually uncorrelated (r = -.0002, p = .999), suggesting that as participants steadily engaged their cognitive resources in processing information their feeling of decision difficulty did not increase correspondingly. These findings provide further support to our theorizing that consumers tend to be more effort sensitive in quality domains than in taste domains.

Number of Fixations. A two-way repeated measures ANOVA with the number of fixations as the dependent variable revealed that, consistent with our decision effort manipulation, participants had greater number of eye fixations on product AOIs in the high effort condition than in the low effort condition ($M_{\text{low-effort}}$ = 60.87, SD = 22.90 vs. $M_{\text{high-effort}}$ = 180.24, SD = 31.40; $F(1, 58) = 285.65$, $p < .001$, $\eta_p^2 = .831$) (see figure 14a). Neither the main effect of decision domain ($F(1, 58) = .55$, $p = .461$) nor the interaction effect of decision domain and decision effort ($F(1, 58) = .19$, $p = .664$) was significant. The amount of the time participants spent on all AOIs (i.e., total fixation duration in seconds; log-transformed) were also consistent with the decision effort manipulation, such that participants fixated on AOIs longer in the high effort condition than in the low effort condition ($M_{\text{low-effort}}$ = 19.05 seconds, SD = 7.37 vs. $M_{\text{high-effort}}$ = 55.97 seconds, SD = 8.76; $F(1, 58) = 322.05$, $p < .001$, $\eta_p^2 = .847$) (see figure 14b). Again in this case, neither the main effect of decision domain ($F(1, 58) = 1.16$, $p = .287$) nor the interaction effect of decision domain and decision effort ($F(1, 58) = 1.58$, $p = .214$) was significant.

Figure 14:
Effects of Decision Effort in Quality versus Taste Domains on the (a) Number of Fixations, (b) Total Fixation Duration (seconds), (c) Number of Saccades, and (d) Number of Visits on AOIs (Study 7)



Number of Saccades. A two-way repeated measures ANOVA with the number of saccades as the dependent variable revealed that, similar to the number of fixations, participants had greater number of saccades on product AOIs in the high effort condition than in the low effort condition ($M_{\text{low-effort}}$ = 32.68, SD = 12.85 vs. $M_{\text{high-effort}}$ = 84.50, SD = 25.03; $F(1, 58) = 103.72$, $p < .001$, $\eta_p^2 = .641$) (see figure 14c). Neither the main effect of decision domain ($F(1, 58) = 2.21$, $p = .143$) nor the interaction effect of decision domain and decision effort ($F(1, 58) = 1.75$, $p = .191$) was significant.

Number of Visits. A two-way repeated measures ANOVA with the number of visits as the dependent variable revealed that, as expected, participants had greater number of visits to product AOIs in the high effort condition than in the low effort condition ($M_{\text{low-effort}}$ = 22.92, SD = 7.36 vs. $M_{\text{high-effort}}$ = 95.40, SD = 23.28; $F(1, 58) = 271.67$, $p < .001$, $\eta_p^2 = .824$) (see figure 14d). There was also a significant main effect of decision domain on the number of visits to product AOIs ($F(1, 58) = 17.99$, $p < .001$, $\eta_p^2 = .237$), such that participants had greater number of visits to product AOIs in the quality domain than in the taste domain (M_{quality} = 66.07, SD = 27.79 vs. M_{taste} = 52.25, SD = 11.25). Importantly, there was a significant interaction between decision effort and decision domain ($F(1, 58) = 14.71$, $p < .001$, $\eta_p^2 = .202$), such that participants had greater number of visits in the high effort condition when they were choosing in the quality domain than when choosing in the taste domain (M_{quality} = 108.55, SD = 38.90 vs. M_{taste} = 82.21, SD = 13.62; $t(28) = 4.04$, $p < .001$). The number of visits in the low effort condition did not vary significantly between quality and taste domains (M_{quality} = 23.58, SD = 8.88 vs. M_{taste} = 22.26, SD = 8.43; $t(30) = 0.81$, $p = .427$).

Taken together, these findings suggest that the extent to which participants visually attend the information about product alternatives did not vary significantly between quality and

taste domains. Notably, the number of fixations, the number of saccades, and the total fixation duration did not vary significantly between decision domains. Given that, the interaction effect of decision effort and decision domain on the number of visits to product AOIs suggest that participants engaged in alternative-based processing (i.e., appraised alternatives holistically by combining values across attributes within an alternative) as opposed to attribute-based processing (i.e., appraised alternatives analytically by comparing values of each attribute across alternatives) to a greater extent in the taste domain than in the quality domain, particularly in the high effort condition. As an exploratory analysis, we estimated the differential ratio of fixation-to-visit-counts between taste and quality domains, and this measure positively correlated with the differential preference clarity in taste versus quality domains ($r = .257$, $p = .047$) suggesting a greater number of fixations per visit on product AOIs in taste (vs. quality) domains translated into greater preference clarity. Together, these findings provide initial support to our theorizing that when decisions require greater mental effort exertion, alternative-based processing enhances preference clarity in taste domains, in turn boosting decision confidence, whereas attribute-based processing diminishes preference correctness in quality domains, in turn undermining decision confidence.

Discussion

The findings of study 7 provide converging evidence to our proposed conceptual framework by not only replicating our key findings in a laboratory setting but also accounting for any individual level factors that may lead to a differential impact of mental effort exertion on decision confidence. Importantly, the analysis of gaze behavior – particularly, the mean relative changes in pupil dilation and its relationship with metacognitive difficulty, and the pattern of gaze behavior on product AOIs (i.e., number of fixations, saccades, and visits) – provide further

insight into the underlying cognitive processes driving these nuanced effects. Our findings suggest that the extent to which participants engage their cognitive resources (i.e., visual attention) over the span of decision making did not differ significantly across quality and taste domains. However, such engagement of resources (i.e., the mean relative change in pupil dilation) had nuanced relationship with consumers' psychological responses (i.e., metacognitive difficulty). As consumers engaged in more mental activity, their feeling of difficulty in making a choice increased significantly in quality domains but not in taste domains. Moreover, we found that although the amount of mental activity (i.e., visual attention) did not vary significantly in quality versus taste domains, consumers tend to rely more heavily on alternative-based (vs. attribute-based) information processing in taste domains than in quality domains.

GENERAL DISCUSSION

Decisions are often effortful, and extensive research has demonstrated that effortfulness as such leads to negative psychological and behavioral consequences (Chernev 2003a, 2003b; Dhar 1997; Iyengar and Lepper 2000; Tversky and Shafir 1992; also see, Anderson 2003). In contrast to these findings, the present research demonstrates that exerting mental effort has nuanced effects on decision confidence depending on whether consumers consider their decisions to be largely matters of quality versus largely matters of taste. Across seven studies, we provide converging evidence that while exerting more mental effort decreases confidence in quality domains, it can increase confidence in taste domains.

Theoretical Contribution

The current research advances our understanding of the underlying psychological forces that govern the relationship between decision effort and decision confidence. It contributes to the existing literature examining the psychological and behavioral consequences of decision effort (e.g., Chernev 2003a, 2003b; Dhar 1997; Iyengar and Lepper 2000; Luce 1998; Luce, Bettman, and Payne 1997; Luce, Payne, and Bettman 1999, 2000; Schrift, Netzer, and Kivetz 2011; Sela and Berger 2012; Redelmeier and Shafir 1995; Tversky and Shafir 1992). We introduce and test a theoretical model that suggests that whether exerting more mental effort increases or decreases decision confidence depends on consumers' effort sensitivity in a particular domain and of the inferences that consumers draw from the effort they exert.

We argue that effort exertion is a value-based decision process (Shenhav et al. 2017; Westbrook and Braver 2015; Kool et al. 2017) and consumers tend to be more or less sensitive to decision effort depending on whether effort exertion increases or decreases their likelihood of attaining their decision goals. We conceptualize effort sensitivity as the strength of the

relationship between effort exertion and metacognitive difficulty (i.e. the extent to which a decision is perceived or retrospectively evaluated to be difficult versus easy), and pinpoint conditions under which consumers' effort sensitivity differs systematically (i.e., matters of quality versus matters of taste), leading to a differential impact of decision effort on decision confidence.

We shed light on two distinct aspects of decision confidence that is affected by consumers' effort sensitivity in these domains, namely preference clarity and preference correctness. Critically, we demonstrate that these aspects contribute to consumers' decision confidence distinctively in quality and taste domains. In quality domains, preference clarity and preference correctness are interdependent and correspond to effort exertion in a similar fashion. By contrast, in taste domains, preference clarity and preference correctness are independent and correspond to effort exertion in distinct ways.

We further distinguish between instrumental decision effort (the effort exerted in considering and reasoning about product alternatives) and incidental decision effort (the effort exerted in acquiring and processing product information), and show that the former is the key driver of the predicted effects on decision confidence. We examine several potential alternative explanations, in particular, perceived importance of the decision task (studies 3, 4 and 6), perceived enjoyment of the decision task (study 3), hedonic versus utilitarian nature of the decision domain (study 4), chronic individual differences in effort valuation (i.e., need for cognition; studies 4 and 7), maximizing-satisficing tendencies (study 5), and accessibility of the memorized evaluation of alternatives (study 6), and demonstrate the robustness of our theoretical model in that it is not sensitive to the variations in these factors.

Finally, we use eye tracking technology to provide deeper insight into the information processing strategies consumers adopt when making decisions in quality versus taste domains. Evidence from the analysis of gaze behavior suggests that the extent to which consumers engage their cognitive resources in decision making (i.e., visual attention) does not vary as a function of the perceived subjectivity of the decision domain. However, as theorized, an increase in mental activity has a stronger, positive relationship with consumers' metacognitive difficulty in quality domains than in taste domains, lending further support to our proposed differential effort sensitivity hypothesis. In addition, in quality domains, consumers tend to rely more heavily on attribute-based information processing, whereas in taste domains, they tend to rely more heavily on alternative-based information processing. Consistent with our theorizing, these strategies appear to have a differential impact on consumers' preference correctness and preference clarity, in turn affecting their decision confidence. Particularly, when consumers are required to exert more mental effort in decision making, relying more heavily on attribute-based processing can backfire by enhancing conflicts among choice options, in turn undermining decision confidence in quality domains. By contrast, relying more heavily on alternative-based processing was associated with greater preference clarity, in turn boosting decision confidence in taste domains. Since eye movements themselves do not have causal effect on preference construction, further research is required to test the robustness of these associations between gaze behavior and decision confidence (see Duerrschmid and Danner 2018 for a review).

Practical Implications

Effort is a quintessential aspect of customer journey through the purchase decision process, and it is critically important to understand when and why consumers respond more favorably to exerting more versus less mental effort. The findings of this research can guide

decisions as to how firms can improve consumers' experience through the decision funnel by promoting versus restraining effort exertion. According to our theoretical model, firms can benefit from presenting larger assortments and sharing detailed information on products in taste domains since consumers are less sensitive to decision effort in this case, with greater mental effort boosting decision confidence. By contrast, in quality domains, firms can benefit from presenting assortments of limited size and/or provide consumers with decision assistance such as personalized product recommendations and product comparison tools (Häubl and Trifts 2000; also see, Dellaert and Häubl 2012; Häubl and Murray 2003) to minimize decision effort, since in this case less mental effort leads to greater decision confidence.

Limitations and Future Research

The current work might serve as a foundation for several promising avenues for research. First, there are potential moderating factors that can influence the relationship between decision effort and confidence that call for further examination. For example, prior research suggests that how consumers encode decision effort may depend on the extent to which they have a readily accessible preference structure for product attributes (Chernev 2003b; Mogilner, Rudnik, and Iyengar 2008). When consumers do not have well-articulated preferences, they have to form their ideal attribute combination and search for the alternative that matches their preferences, simultaneously. Alternatively, when consumers do have an ideal preference point, they can solely focus on finding the alternative that best matches that ideal point, which in turn attenuates the difficulty associated with the decision task. Consistent with this proposition, we predict that affording consumers the opportunities to articulate their preferences for product features prior decision making should reduce metacognitive difficulty and boost preference clarity, in turn

increasing decision confidence. We expect this effect to be more pronounced in quality domains (vs. taste domains) where consumers are more sensitive to effort exertion.

Moreover, people often engage in social comparison processes to seek validation for their own attitudes (e.g., Fazio 1979; Festinger 1954). In a similar vein, consumers often turn to other consumers (e.g., reading online reviews) to obtain information to make more correct or justifiable choices (Dai, Chan, and Mogilner 2020). Therefore, opportunities to observe or know about other consumers' preferences may boost not only how correct one believes his preference to be normatively ("Other people *also* agree with me") but also how correct one believes his preference to be prescriptively ("Other people *should* agree with me") (Festinger 1954; Gerard and Orive 1987; Orive 1988; Visser and Mirabile 2004; Petrocelli et al. 2007). This should be particularly true for quality domains where consumers believe that alternatives can be rank-ordered based on features reflecting objective superiority and thus others' preferences are strongly predictive of a product's absolute value (Feick and Higie 1992; Price, Feick, and Higie 1989; Simonson and Rosen 2014). This conjecture is consistent with the findings in the extant literature that consumers tend to examine consensus information in objective versus subjective domains more rigorously to understand the relative standing of available alternatives (Olson et al. 1983), as well as those of study 3 in this paper (i.e., preference for information on others' choices vs. additional information about the selected alternative in quality vs. taste domains). We predict that providing consumers with favorable consensus feedback will boost their preference correctness, in turn increasing their decision confidence. We expect this effect to be stronger in quality domains (vs. taste domains) as in this case consumers tend to engage in other-focused or extrinsic (vs. self-focused or intrinsic) reasoning processes.

Moreover, while the present research focused on the effects of decision effort on decision confidence around the time of purchase, future research could build on the current findings to examine how effort exertion affects outcomes further downstream – such as product trials, usage intensity, and product returns. It would be of particular interest to examine whether consumers adapt their product usage intensity based on how confident they feel while making their choices, which in turn might affect their likelihood of returning the product as well as their disposal behavior. For instance, evidence suggests that people tend to seek additional information before making decisions even in simple perceptual tasks when they are less confident than when they are more confident (Desender, Boldt, and Yeung 2018). Therefore, it is plausible that consumers lacking confidence tend to use their chosen alternatives more intensively to sample more information about the product, in turn boosting their confidence. It would be intriguing to examine whether the opposite is also true, that is purchases made with high confidence ironically result in the product being used less intensively and thus failing to realize its full potential.

Furthermore, the findings of this research can potentially reconcile the prior mixed findings in the choice overload literature (see Chernev, Böckenholt, and Goodman 2015; Scheibehenne, Greifeneder, and Todd 2010). Our findings suggest that consumers' effort-sensitivity systematically differs between quality and taste domains, and this may explain the variance in effect sizes obtained in both published and non-published work on choice overload. Since our research speaks to the experience of decision effort more generally, a meta-analysis of current findings in the choice overload literature by coding decision domains as matters of quality and matters of taste would be particularly informative in this regard.

Finally, in the present research, we conceptualize and operationalize perceived subjectivity of the decision domain based on the features of presented alternatives – i.e., the

extent to which consumers believe that alternatives can be rank-ordered based on the features reflecting objective superiority. However, there could be other individual and contextual factors that may influence whether a decision is considered more of a matter of quality or a matter of taste, in turn informing the dynamics of decision effort and decision confidence. It is worth investigating whether perceived subjectivity of the decision domains evolves as consumers gain more expertise in a particular domain and the direction of such evolution. For instance, are taste domains construed to be more objective as consumers gain more expertise in these domains? Do consumers consider choosing for others to be more objective than choosing for themselves? These conjectures are ripe for future research.

Conclusion

The theorizing and the evidence presented in the current research shed light on the nuanced effects of decision effort on decision confidence and examine the psychological forces that govern this relationship. Although consumers are considered to be effort averse in general, we develop and test the idea that consumers' effort sensitivity differs systematically between matters of quality and matters of taste, in turn affecting the inferences they draw from their exerted effort in the decision process. In quality domains, greater decision effort reduces preference correctness, in turn undermining consumers' decision confidence. By contrast, in taste domains, greater decision effort boosts preference clarity, in turn increasing consumers' decision confidence. These novel insights will provide guidance to firms on how to manage effort in consumer decision making.

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NUANCED EFFECTS OF DECISION EFFORT ON DECISION CONFIDENCE

APPENDICES

Appendix A. Descriptive Statistics and Pairwise Comparisons of Key DVs across 16 Product Domains (Study 1)

Table 1: Pairwise Comparisons of Perceived Subjectivity across 16 Product Domains

	Beer	Clothing Store	Credit Card	Digital Camera	Fast Food Chain	Gas Station	Hotel	Laptop	Moisturizer	Package Delivery	Search Engine	Sedan	Shoe	Smartphone	Soda	Television
Mean (SD)	8.60 (1.85)	6.87 (2.52)	3.72 (2.46)	2.96 (2.03)	8.17 (1.90)	5.32 (2.84)	4.69 (2.55)	3.13 (2.08)	5.31 (2.69)	3.39 (2.45)	5.05 (2.89)	4.83 (2.63)	6.23 (2.61)	4.29 (2.48)	9.11 (1.34)	3.27 (2.26)
Beer																
Clothing Store	**1.74***															
Credit Card	**4.88***	**3.14***														
Digital Camera	**5.64***	**3.90***	**.76***													
Fast Food Chain	.43	**-1.31***	**-4.45***	**-5.21***												
Gas Station	**3.29***	**1.55***	**-1.60***	**-2.36***	**2.85***											
Hotel	**3.92***	**2.18***	**-.96***	**-1.72***	**3.49***	.63										
Laptop	**5.48***	**3.74***	.60	-.16	**5.05***	**2.19***	**1.56***									
Moisturizer	**3.29***	**1.56***	**-1.59***	**-2.35***	**2.86***	.01	-.62	**-2.18***								
Package Delivery	**5.21***	**3.47***	.33	-.43	**4.78***	**1.93***	**1.29***	-.27	**1.92***							
Search Engine	**3.56***	**1.82***	**-1.33***	**-2.09***	**3.12***	0.27	-.36	**-1.92***	0.26	**-1.66***						
Sedan	**3.78***	**2.04***	**-1.11***	**-1.87***	**3.34***	0.49	-.14	**-1.70***	0.48	**-1.44***	.22					
Shoe	**2.38***	.64	**-2.51***	**-3.27***	**1.94***	**-.91***	**-1.54***	**-3.10***	**-.92***	**-2.84***	**-1.18***	**-1.40***				
Smartphone	**4.31***	**2.57***	-.57	**-1.33***	**3.88***	**1.02***	.39	**-1.17***	**1.02***	**-.90***	**.76***	.54	**1.94***			
Soda	**-.50***	**-2.24***	**-5.38***	**-6.14***	**-.94***	**-3.79***	**-4.42***	**-5.98***	**-3.80***	**-5.71***	**-4.06***	**-4.28***	**-2.88***	**-4.81***		
Television	**5.33***	**3.59***	.45	-.31	**4.90***	**2.05***	**1.41***	-.15	**2.04***	.12	**1.78***	**1.56***	**2.96***	**1.02***	**5.83***	

Note. Values represent mean differences. * indicates that the mean difference is significant at the .05 level.

Table 2: Pairwise Comparisons of Subjective Knowledge across 16 Product Domains

	Beer	Clothing Store	Credit Card	Digital Camera	Fast Food Chain	Gas Station	Hotel	Laptop	Moisturizer	Package Delivery	Search Engine	Sedan	Shoe	Smartphone	Soda	Television
Mean (SD)	4.98 (3.14)	6.50 (2.34)	6.03 (2.43)	5.58 (2.46)	7.39 (2.11)	6.33 (2.30)	5.90 (2.34)	7.31 (2.16)	5.34 (2.71)	6.18 (2.28)	7.23 (2.24)	5.22 (2.46)	6.85 (2.29)	7.24 (2.33)	7.33 (2.36)	6.71 (2.17)
Beer																
Clothing Store	**-1.53***															
Credit Card	**-1.06***	.47														
Digital Camera	-.61	**.92***	.45													
Fast Food Chain	**-2.42***	**-.89***	**-1.36***	**-1.81***												
Gas Station	**-1.36***	.17	-.30	**-.75***	**1.06***											
Hotel	**-.92***	**.60***	.13	-.31	**1.49***	.43										
Laptop	**-2.33***	**-.80***	**-1.27***	**-1.72***	.09	**-.98***	**-1.41***									
Moisturizer	-.37	**1.16***	.69	.24	**2.05***	**.99***	0.56	**1.96***								
Package Delivery	**-1.20***	.33	-.14	-.59	**1.22***	.16	-0.28	**1.13***	**-.83***							
Search Engine	**-2.26***	**-.73***	**-1.20***	**-1.65***	.16	**-.90***	**-1.34***	.07	**-1.89***	**-1.06***						
Sedan	-.24	**1.29***	**.82***	.37	**2.18***	**1.11***	**.68***	**2.09***	.13	**.96***	**2.02***					
Shoe	**-1.87***	-.35	**-.82***	**-1.27***	.54	-.52	**-.95***	.46	**-1.51***	**-.67***	.38	**-1.63***				
Smartphone	**-2.27***	**-.74***	**-1.21***	**-1.66***	.15	**-.91***	**-1.34***	.07	**-1.90***	**-1.07***	-.01	**-2.02***	-.39			
Soda	**-2.36***	**-.83***	**-1.30***	**-1.75***	.06	**-1.00***	**-1.43***	-.02	**-1.99***	**-1.16***	-.10	**-2.11***	-.48	-.09		
Television	**-1.73***	-.20	**-.67***	**-1.12***	**.69***	-.38	**-.81***	**.60***	**-1.36***	-.53	**.53***	**-1.49***	.14	**.54***	**.62***	

Note. Values represent mean differences. * indicates that the mean difference is significant at the .05 level.

Table 3: Pairwise Comparisons of Willingness to Exert Effort (i.e., time in minutes) across 16 Product Domains

	Beer	Clothing Store	Credit Card	Digital Camera	Fast Food Chain	Gas Station	Hotel	Laptop	Moisturizer	Package Delivery	Search Engine	Sedan	Shoe	Smartphone	Soda	Television
Mean (SD)	14.94 (47.64)	58.31 (379.93)	198.29 (576.53)	175.17 (474.69)	13.48 (19.98)	10.15 (22.01)	173.29 (548.903)	299.84 (672.32)	76.53 (552.03)	23.55 (39.72)	17.54 (95.68)	862.71 (1348.12)	98.00 (538.01)	264.71 (934.08)	31.62 (379.63)	257.82 (777.27)
Beer																
Clothing Store	-43.37															
Credit Card	**-183.35***	**-139.98***														
Digital Camera	**-160.22***	**-116.85***	23.13													
Fast Food Chain	1.47	44.84	**184.82***	**161.69***												
Gas Station	4.80	48.17	**188.15***	**165.02***	3.33											
Hotel	**-158.35***	**-114.98***	25.00	1.87	**-159.82***	**-163.15***										
Laptop	**-284.89***	**-241.52***	-101.54	**-124.67***	**-286.36***	**-289.69***	**-126.54***									
Moisturizer	-61.58	-18.21	121.77	98.64	-63.05	-66.38	96.77	**223.31***								
Package Delivery	-8.61	34.76	**174.74***	**151.62***	**-10.07***	**-13.40***	**149.74***	**276.29***	52.98							
Search Engine	-2.60	40.78	**180.76***	**157.63***	-4.06	-7.39	**155.76***	**282.30***	58.99	6.01						
Sedan	**-847.76***	**-804.39***	**-664.41***	**-687.54***	**-849.23***	**-852.56***	**-689.41***	**-562.87***	**-786.18***	**-839.16***	**-845.17***					
Shoe	-83.06	-39.69	100.29	77.16	-84.53	-87.86	75.29	**201.83***	-21.48	-74.45	-80.46	**764.70***				
Smartphone	**-249.77***	**-206.40***	-66.42	-89.55	**-251.24***	**-254.57***	-91.42	35.12	-188.19	**-241.16***	**-247.18***	**597.99***	-166.71			
Soda	-16.68	**26.69***	**166.67***	**143.54***	-18.15	-21.48	**141.67***	**268.21***	44.90	-8.07	-14.09	**831.08***	66.38	**233.09***		
Television	**-242.88***	**-199.51***	-59.53	-82.66	**-244.35***	**-247.68***	-84.53	42.01	**-181.30***	**-234.27***	**-240.29***	**604.88***	-159.82	6.89	**-226.20***	

Note. Values represent mean differences. * indicates that the mean difference is significant at the .05 level.

Appendix B. Results Summary of Repeated Measures Mixed Model Analysis (Study 1)

Table 1:
The Effects of Perceived Subjectivity and Subjective Knowledge on Participants' Willingness to Exert Effort across 16 Product Domains (Study 1)

Estimates of Fixed Effects	Parameters	*β*	SE	df	*t*	*p*	95% CI [Lower Bound, Upper Bound]	-2 Log Likelihood	Chi-Square Difference Test
Model 1	Intercept	1.908	.023	1988.06	83.35	<.001	[1.863,1.953]	8239.532	
	Perceived Subjectivity	-.094	.003	2936.56	-28.28	<.001	[-.100,-.088]		
Model 2	Intercept	1.742	.060	2334.42	29.17	<.001	[1.625,1.859]	8222.731	$\chi^2(2) = 16.801$, $p<.001$
	Perceived Subjectivity	-.086	.009	2535.68	-9.50	<.001	[-.104,-.068]		
	Subjective Knowledge	.025	.008	2439.47	2.99	.003	[.009,.042]		
	Perceived Subjectivity x Subjective Knowledge	-.001	.001	2739.84	-.97	.334	[-.004,.001]		

Note: Participants' willingness to exert effort while choosing across 16 decision domains (i.e., time in minutes; log-transformed) was the DV in all analyses. Chi-square difference test of log likelihoods indicates that model 2 has a significantly better fit than model 1.

Appendix C. Measuring Preference Clarity and Preference Correctness (Study 2)

Table 1a:
Correlations of Preference Clarity and Preference Correctness Items with Each Other and Other Key Outcome Variables in Total Sample (N=494)

	P.Clar. 1	*P.Clar. 2*	*P.Clar. 3*	*P.Clar. 4*	*P.Corr. 1*	*P.Corr. 2*	*P.Corr. 3*	*Decision Confidence*
P.Clar. 1								
P.Clar. 2	.617**							
P.Clar. 3	.678**	.693**						
P.Clar. 4	.350**	.456**	.422**					
P.Corr. 1	.572**	.550**	.619**	.406**				
P.Corr. 2	.211**	.114*	.228**	.109*	.228**			
P.Corr. 3	.316**	.378**	.392**	.175**	.507**	.281**		
Decision Confidence	.595**	.608**	.729**	.360**	.592**	.298**	.403**	
Metacognitive Difficulty	-.412**	-.406**	-.462**	-.265**	-.372**	-.155**	-.168**	-.488*

*** p < .001, * p < .05*

Table 1b:
Correlations of Preference Clarity and Preference Correctness Items with Each Other and Other Key Outcome Variables in the *Quality* Domain (N=253)

	P.Clar. 1	*P.Clar. 2*	*P.Clar. 3*	*P.Clar. 4*	*P.Corr. 1*	*P.Corr. 2*	*P.Corr. 3*	*Decision Confidence*
P.Clar. 1								
P.Clar. 2	.603**							
P.Clar. 3	.661**	.644**						
P.Clar. 4	.421*	.586**	.552**					
P.Corr. 1	.588**	.609**	.664**	.542**				
P.Corr. 2	.276**	.182**	.311**	.259**	.329**			
P.Corr. 3	.410**	.443**	.473**	.318**	.624**	.267**		
Decision Confidence	.522**	.552**	.680**	.434**	.626**	.418**	.490**	
Metacognitive Difficulty	-.366**	-.360**	-.431**	-.253**	-.381**	-.272**	-.248**	-.465**

*** p < .001, * p < .05*

Table 1c:
Correlations of Preference Clarity and Preference Correctness Items with Each Other and Other Key Outcome Variables in the *Taste* Domain (N=241)

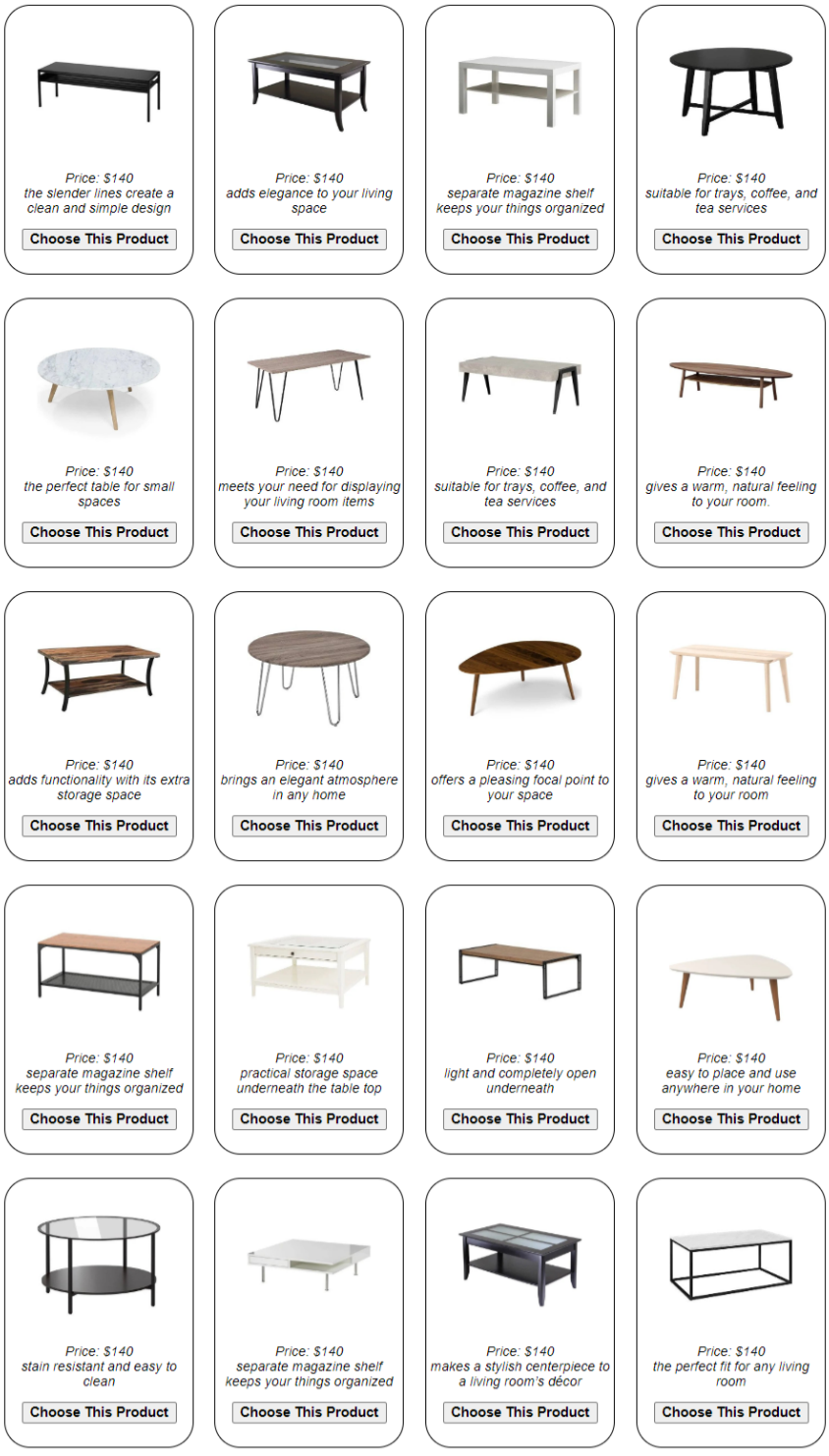
	P.Clar. 1	*P.Clar. 2*	*P.Clar. 3*	*P.Clar. 4*	*P.Corr. 1*	*P.Corr. 2*	*P.Corr. 3*	*Decision Confidence*
P.Clar. 1								
P.Clar. 2	.594**							
P.Clar. 3	.666**	.747**						
P.Clar. 4	.262**	.305**	.270**					
P.Corr. 1	.531**	.433**	.532**	.258**				
P.Corr. 2	.155*	.041	.145*	-.030	.114			
P.Corr. 3	.261**	.356**	.359**	.066	.412**	.294**		
Decision Confidence	.695**	.673**	.791**	.270**	.521**	.155*	.359**	
Metacognitive Difficulty	-.410**	-.411**	-.441**	-.266**	-.321**	-.031	-.118	-.461**

*** p < .001, * p < .05*

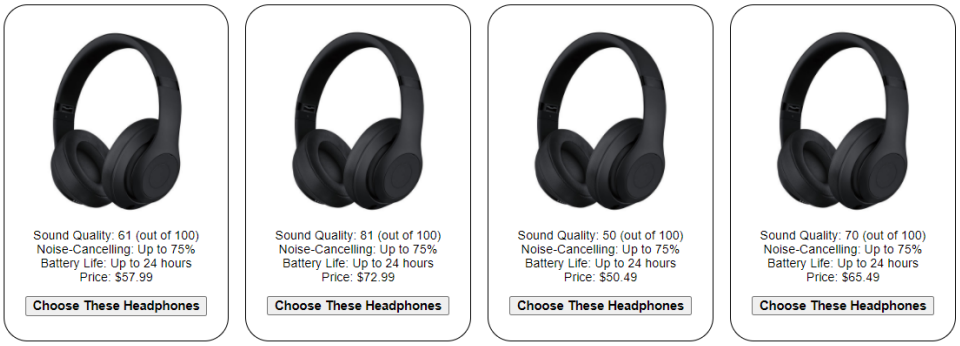
Appendix D. Sample Screenshots of Choice Interfaces (Studies 2–7)

Study 2: Assortment of Electric Toothbrushes

Study 2: Assortment of Coffee Tables



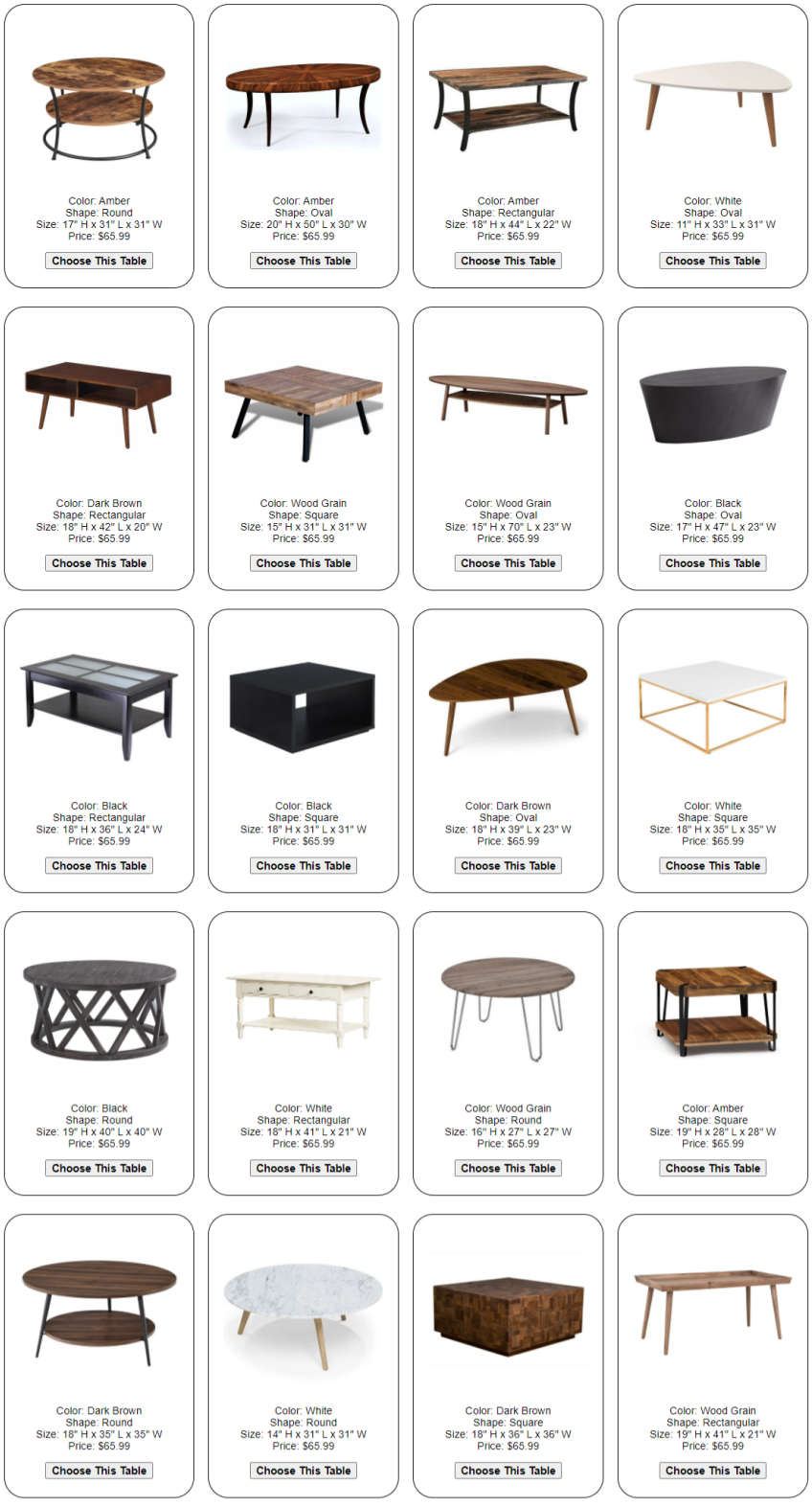
Study 3: Low Effort – Quality Domain



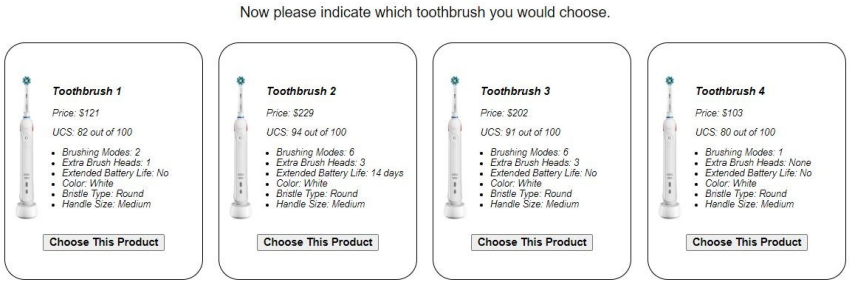
Study 3: Low Effort – Taste Domain

Study 3: High Effort – Quality Domain

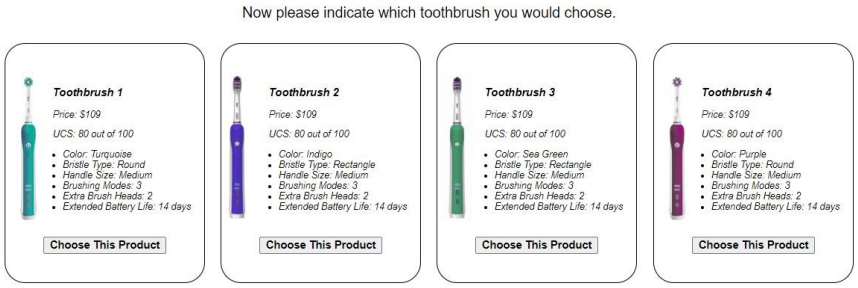
Study 3: High Effort – Taste Domain



Study 4: Low Effort – Quality Domain



Study 4: Low Effort – Taste Domain



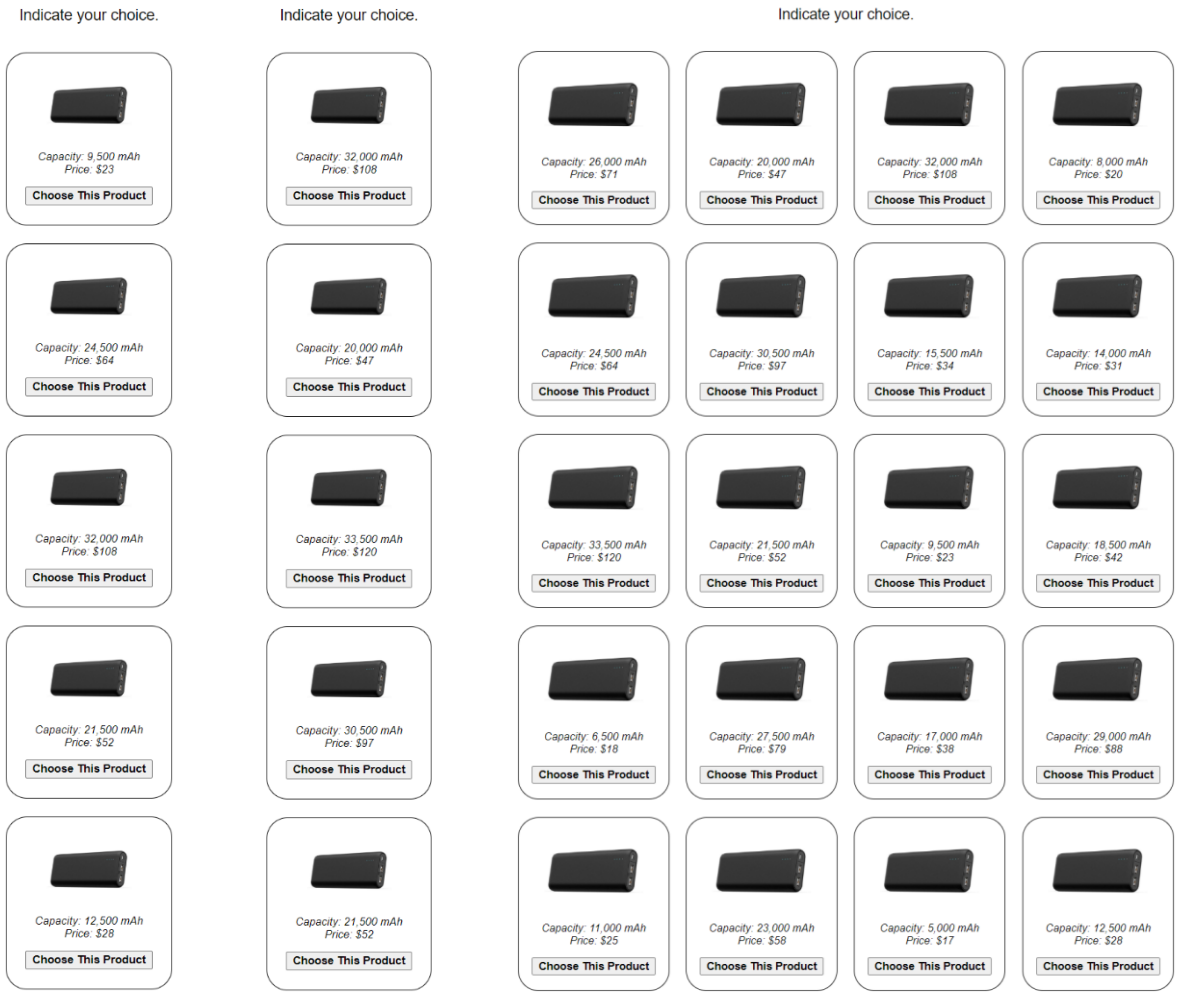
Study 4: High Effort – Quality Domain

Study 4: High Effort – Taste Domain

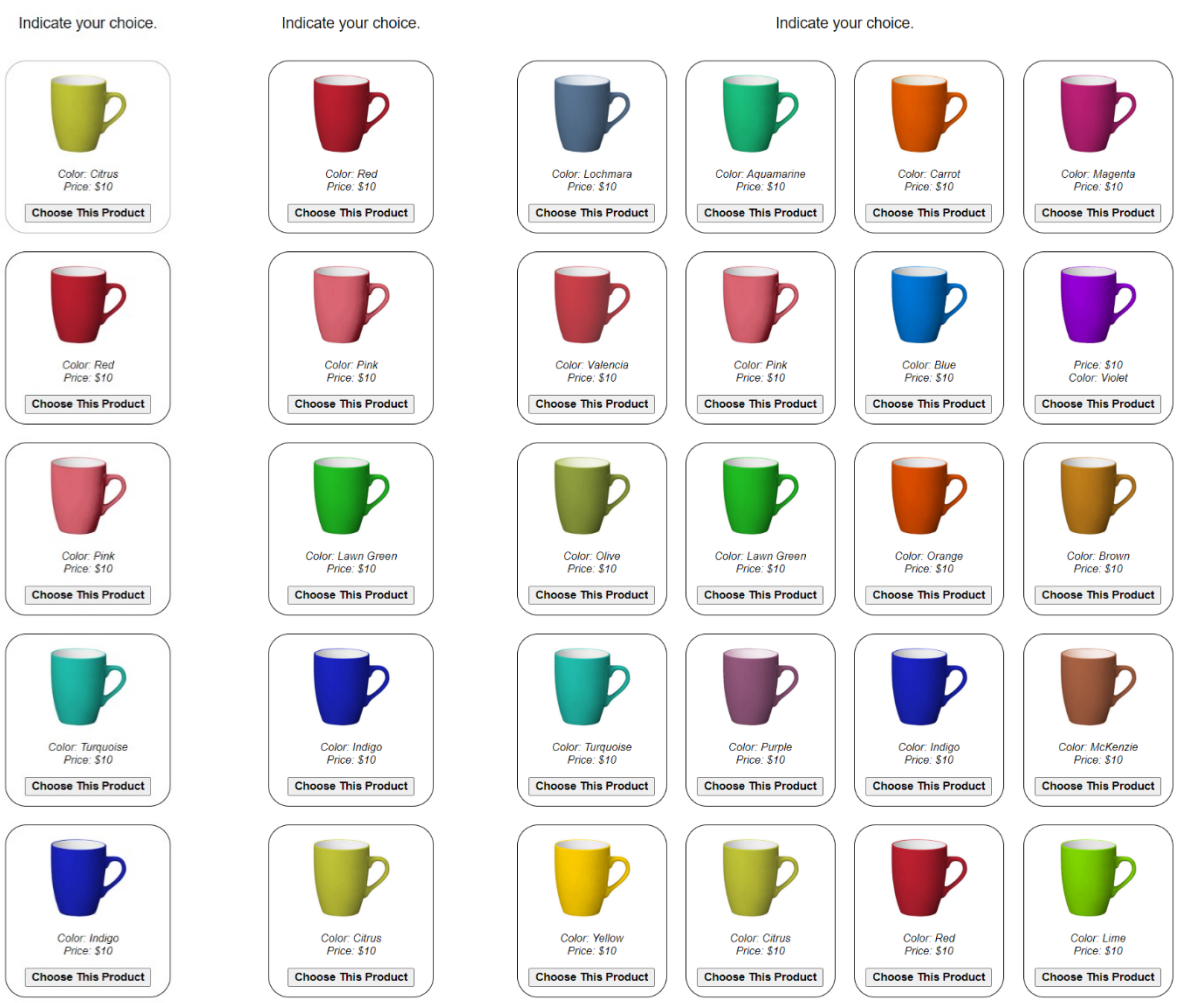
Now please indicate which electric toothbrush you would choose.

Study 5: Quality Domain

Low Instrumental – Low Incidental Effort Condition ***(Alternatives became visible every 2 seconds)***	Low Instrumental – High Incidental Effort Condition ***(Alternatives became visible every 8 seconds)***	High Instrumental – Low Incidental Effort Condition ***(Alternatives became visible every 2 seconds)***



Study 5: Taste Domain

Low Instrumental –Low Incidental Effort Condition ***(Alternatives became visible every 2 seconds)***	Low Instrumental – High Incidental Effort Condition ***(Alternatives became visible every 8 seconds)***	High Instrumental – Low Incidental Effort Condition ***(Alternatives became visible every 2 seconds)***
	

Study 6: High Fluency – Quality Domain

Look at the Headphones. Then Indicate Your Choice.

Headphones 1

- Sound Quality Score: 79 (out of 100)
- Noise-Cancelling Capability: Up to 70%
- Battery Life: 16 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $124

Choose These Headphones

Headphones 2

- Sound Quality Score: 73 (out of 100)
- Noise-Cancelling Capability: Up to 40%
- Battery Life: 24 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $79

Choose These Headphones

Headphones 3

- Sound Quality Score: 64 (out of 100)
- Noise-Cancelling Capability: Up to 50%
- Battery Life: 20 hrs.
- Charging Time: 5 hrs.
- Wireless Range: 40m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $41

Choose These Headphones

Headphones 4

- Sound Quality Score: 94 (out of 100)
- Noise-Cancelling Capability: Up to 60%
- Battery Life: 12 hrs.
- Charging Time: 5 hrs.
- Wireless Range: 40m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $379

Choose These Headphones

Headphones 5

- Sound Quality Score: 85 (out of 100)
- Noise-Cancelling Capability: Up to 40%
- Battery Life: 24 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $194

Choose These Headphones

Headphones 6

- Sound Quality Score: 67 (out of 100)
- Noise-Cancelling Capability: Up to 70%
- Battery Life: 16 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $51

Choose These Headphones

Study 6: Low Fluency – Quality Domain

Look at the Headphones. Then Indicate Your Choice.

Headphones 1

- Sound Quality Score: 94 (out of 100)
- Noise-Cancelling Capability: Up to 60%
- Battery Life: 12 hrs.
- Charging Time: 5 hrs.
- Wireless Range: 40m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $379

Choose These Headphones

Headphones 2

- Sound Quality Score: 73 (out of 100)
- Noise-Cancelling Capability: Up to 40%
- Battery Life: 24 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $79

Choose These Headphones

Headphones 3

- Sound Quality Score: 79 (out of 100)
- Noise-Cancelling Capability: Up to 70%
- Battery Life: 16 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $184

Choose These Headphones

Headphones 4

- Sound Quality Score: 88 (out of 100)
- Noise-Cancelling Capability: Up to 50%
- Battery Life: 30 hrs.
- Charging Time: 5 hrs.
- Wireless Range: 40m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $243

Choose These Headphones

Headphones 5

- Sound Quality Score: 61 (out of 100)
- Noise-Cancelling Capability: Up to 40%
- Battery Life: 24 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $33

Choose These Headphones

Headphones 6

- Sound Quality Score: 67 (out of 100)
- Noise-Cancelling Capability: Up to 70%
- Battery Life: 16 hrs.
- Charging Time: 2 hrs.
- Wireless Range: 10m
- Weight: 0.75 lbs.
- Color Combination: Black-Silver
- Price: $51

Choose These Headphones

Study 6: High Fluency – Taste Domain

Look at the Blankets. Then Indicate Your Choice.

Blanket 1

- Darker Color: Burgundy Red
- Lighter Color: Peach Pink
- Texture: Faux Fur
- Softness: High
- Occasion: Winter
- Weight: 7 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 2

- Darker Color: Hunter Green
- Lighter Color: Lemon Yellow
- Texture: Knitted
- Softness: Moderate
- Occasion: Winter
- Weight: 9 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 3

- Darker Color: Saffron Orange
- Lighter Color: Ivory White
- Texture: Knitted
- Softness: Moderate
- Occasion: Winter
- Weight: 9 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 4

- Darker Color: Deep Pink
- Lighter Color: Lavender Purple
- Texture: Knitted
- Softness: Moderate
- Occasion: Winter
- Weight: 9 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 5

- Darker Color: Chocolate Brown
- Lighter Color: Rose Pink
- Texture: Faux Fur
- Softness: High
- Occasion: Winter
- Weight: 7 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 6

- Darker Color: Ruby Red
- Lighter Color: Sky Blue
- Texture: Embroidered
- Softness: Moderate
- Occasion: All Season
- Weight: 6 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Study 6: Low Fluency – Taste Domain

Look at the Blankets. Then Indicate Your Choice.

Blanket 1

- Darker Color: Moss Green
- Lighter Color: Sea Blue
- Texture: Velvet
- Softness: High
- Occasion: All Season
- Weight: 8 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 2

- Darker Color: Ruby Red
- Lighter Color: Sky Blue
- Texture: Embroidered
- Softness: Moderate
- Occasion: All Season
- Weight: 6 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 3

- Darker Color: Saffron Orange
- Lighter Color: Ivory White
- Texture: Knitted
- Softness: Moderate
- Occasion: Winter
- Weight: 9 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 4

- Darker Color: Chocolate Brown
- Lighter Color: Rose Pink
- Texture: Faux Fur
- Softness: High
- Occasion: Winter
- Weight: 7 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Blanket 5

- Darker Color: Navy Blue
- Lighter Color: Tomato Red
- Texture: Faux Fur
- Softness: High
- Occasion: Winter
- Weight: 7 lbs.
- Size: 50" W x 70" L
- Price: $55

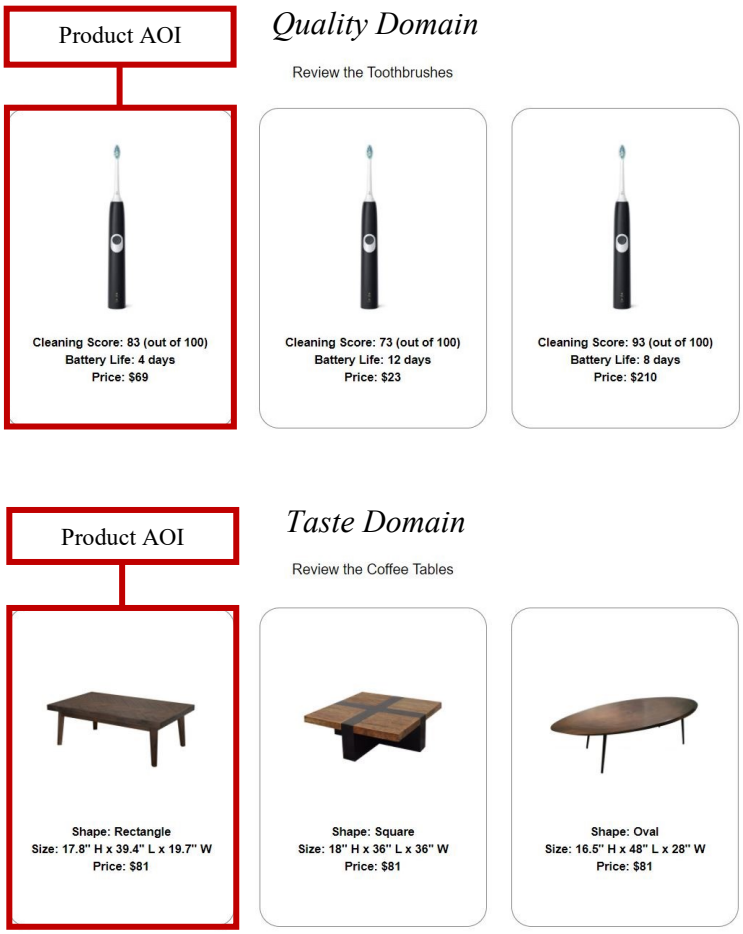
Choose This Blanket

Blanket 6

- Darker Color: Ash Gray
- Lighter Color: Light Orange
- Texture: Embroidered
- Softness: Moderate
- Occasion: All Season
- Weight: 6 lbs.
- Size: 50" W x 70" L
- Price: $55

Choose This Blanket

Study 7: Stimuli in the Low Effort Condition with Prespecified Areas of Interest (AOIs) for Gaze Behavior Analysis



Study 7: Stimuli in the High Effort Condition with Prespecified Areas of Interest (AOIs) for Gaze Behavior Analysis

Appendix E. List of Measures and Scales (Studies 1–7)

Passage Explaining Matters of Quality versus Matters of Taste (Studies 1–7)

Please read the instructions below carefully before answering the next set of questions.

Instructions

Some products are considered **matters of objective quality**. For instance, a water filter that removes 99.9% of contaminants is objectively better than one that removes 99.3%.

Other products are considered **matters of subjective taste**. For instance, a strawberry popsicle is neither better nor worse than a mango popsicle, yet many consumers clearly prefer one over the other.

These two examples represent the opposite ends of a continuum that can be used to characterize any product category.

matters of quality ——— matters of taste

The water filters differ in **quality**. The product itself is the source of value, and the superiority of one product over another is considered a matter of fact.

The popsicles differ in **taste**. The match between the product and the individual's preference is the source of value, and the superiority of one product over another cannot be established as a matter of fact.

Continue

Test of Understanding (Study 1)

Before you proceed, please answer the following questions about the instructions you just read.

Differences among products are considered **matters of quality** when:

- ○ (a) one product is objectively better than another
- ○ (b) superiority of one product over another cannot be established as a matter of fact
- ○ (c) superiority of one product over another can be established as a matter of fact
- ○ (d) individuals choose products based on the match between products and their own preferences
- ○ (e) both a and c
- ○ (f) both b and d
- ○ (g) both a and b
- ○ (h) all of the above

Differences among products are considered **matters of taste** when:

- ○ (a) superiority of one product over another cannot be established as a matter of fact
- ○ (b) one product is objectively better than another
- ○ (c) superiority of one product over another can be established as a matter of fact
- ○ (d) individuals choose products based on the match between products and their own preferences
- ○ (e) both a and c
- ○ (f) both b and d
- ○ (g) both a and d
- ○ (h) all of the above

Click here to continue

Perceived Subjectivity of the Decision Domain (Study 1)

Hotel

To what extent do you believe differences among **hotels** are matters of quality versus matters of taste?

matters of **quality** ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ matters of **taste**

Willingness to Exert Effort (Study 1)

Hotel

When choosing a **hotel**, what is the maximum amount of time you would be comfortable actively spending on this decision?

00 : 00
hr min

Subjective Knowledge of the Decision Domain (Study 1)

Hotel

How much do you know about **hotels**?

very little ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ a lot

Measures Used in Studies 1–7

Measures	*Scale and End Points*	*Item(s)*
Decision Confidence	11 points; 0 = "not confident at all" to 10 = "very/extremely confident"	"How confident are you that you chose the best [product] for yourself from the presented set?"
Metacognitive Difficulty	11 points; 0 = "not difficult at all" to 10 = "very/extremely difficult"	"How difficult was it for you to decide which [product] to choose?"
Preference Clarity	11 points; 0 = "strongly disagree" to 10 = "strongly agree"	Please indicate to what extent you agree or disagree with the following statement about the [product] you selected. "The [product] I chose really reflects my true preference"
Preference Correctness	11 points; 0 = "strongly disagree" to 10 = "strongly agree"	Please indicate to what extent you agree or disagree with the following statement about the [product] you selected. "Other people would have chosen the same [product] as I did from the presented choice set."
Perceived Subjectivity of the Decision Domain	10 points; 1 = "matters of quality" to 10 = "matters of taste"	Followed by the passage explaining matters of quality versus matters of taste (see above): "To what extent do you believe that differences among the [products] you were presented with are matters of quality (i.e., they are chosen based on objective superiority) or matters of taste (i.e., they are chosen based on individuals' preferences?"
Satisfaction with the Decision Process (Zhang and Fitzsimons 1999)	11 points; 0 = "strongly disagree" to 10 = "strongly agree"	Please indicate to what extent you agree or disagree with the following statement about your experience of choosing the [product]. 1. "I found the process of deciding which [product] to choose satisfying." 2. "Several good [products] were available for me to choose among." 3. "I thought the selection of [products] was good." 4. "I would be happy to choose from the same set of [products] were I presented with the same circumstances." 5. "I found the process of deciding which [product] to choose interesting." 6. "I was satisfied with my experience of deciding which [product] to choose."
Product Purchase Likelihood	11 points; 0 = "not at all likely" to 10 = "very likely"	"How likely would you be to purchase the [product] you selected for yourself if you saw it at the store?"

Preference for Additional Information	1= "Information about what other people chose for themselves", 0= "Additional information about the product I selected for myself"	"If you had an opportunity to choose either to find out which [product] other people chose for themselves or to see additional information about the [product] you selected for yourself, what would you choose?"
Evaluation of the Chosen Alternative	11 points; 0 = "bad/unattractive/undesirable/unpleasant" to 10 = "good/attractive/desirable/pleasant"	Please evaluate the [product] you selected for yourself on the following dimensions. 1. bad/good 2. unattractive/attractive 3. undesirable/desirable 4. unpleasant/pleasant
Specialness of the Chosen Alternative	11 points; 0 = "ordinary/common" to 10 = "special/unique"	Please evaluate the [product] you selected for yourself on the following dimensions. 1. ordinary/special 2. common/unique
Processing Fluency	11 points; 0 = "easy/fluent/effortless/easy to read/a quick read" to 10 = "difficult/disfluent/effortful/difficult to read/a slow read"	Please indicate how you felt about the process of looking at the descriptions of [products]. It was 1. easy/difficult 2. fluent/disfluent 3. effortless/effortful 4. easy to read/difficult to read 5. a quick read/a slow read
Perceived Importance of the Decision Task	11 points; 0 = "not important at all" to 10 = "very important"	"How important do you consider the decision of choosing a [product] for yourself?"
Subjective Knowledge of the Decision Domain	11 points; 0 = "very little" to 10 = "a lot"	"How much do you know about [products]?"
Willingness to Exert Effort	Hours and minutes	"When choosing a [product], what is the maximum amount of time you would be comfortable actively spending on this decision?"
Need for Cognition (Cacioppo, Petty, and Kao 1984)	11 points; 0 = "extremely uncharacteristic of me" to 10 = "extremely characteristic of me"	For each of the statements below, please indicate to what extent the statement is characteristic of you or of what you believe. 1. "I prefer complex to simple problems." 2. "I like to have the responsibility of handling a situation that requires a lot of thinking." 3. "Thinking is not my idea of fun." [reverse-coded] 4. "I would rather do something that requires little thought than something that is sure to

		challenge my thinking abilities." [reverse-coded] 5. "I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something." [reverse-coded] 6. "I find satisfaction in deliberating hard and for long hours." 7. "I only think as hard as I have to." [reverse-coded] 8. "I prefer to think about small, daily projects to long-term ones." [reverse-coded] 9. "I like tasks that require little thought once I've learned them." [reverse-coded] 10. "The idea of relying on thought to make my way to the top appeals to me." 11. "I really enjoy a task that involves coming up with new solutions to problems." 12. "Learning new ways to think doesn't excite me very much." [reverse-coded] 13. "I prefer my life to be filled with puzzles that I must solve." 14. "The notion of thinking abstractly is appealing to me." 15. "I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought." 16. "I feel relief rather than satisfaction after completing a task that required a lot of mental effort." [reverse-coded] 17. "It's enough for me that something gets the job done; I don't care how or why it works." [reverse-coded] 18. "I usually end up deliberating about issues even when they do not affect me personally."
Maximizing-Satisficing Tendency (Nenkov et al. 2008)	11 points; 0 = "strongly disagree" to 10 = "strongly agree"	Please indicate to what extent you agree or disagree with the following statement about yourself. 1. "When I am in the car listening to the radio, I often check other stations to see if something better is playing, even if I am relatively satisfied with what I'm listening to." 2. "I often find it difficult to shop for a gift for a friend." 3. "No matter what I do, I have the highest standards for myself." 4. "No matter how satisfied I am with my job, it's only right for me to be on the lookout for better opportunities." 5. "Renting videos is really difficult. I'm always struggling to pick the best one." 6. "I never settle for second best."