# Human Judgements and Decision-Making Preferences Informed by Desirability and The First Attribute Heuristic

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## Abstract

Historically, judgement and decision-making research has been dominated by normative and descriptive behavioural theories which assumed that people have stable and consistent preferences, informed by computational processing (e.g., Kahneman & Tversky, 1979; Tversky & Kahneman, 1992; von Neumann & Morgenstern, 1947). These assumptions have been challenged by contemporary research, which has revealed that people's preferences are constructed 'on the fly' (e.g., Kusev et al., 2020) using a variety of psychological mechanisms which are contingent on features of the context and task (e.g., Brandstätter et al., 2006; Gigerenzer et al., 1999; Kusev et al., 2020; Payne, Bettman, Coupey & Johnson, 1992; Pedroni et al., 2017; Slovic, 1995; Stewart et al., 2006). For instance, in their Decision by Sampling (DbS) relative rank model, Stewart et al. (2006) argued that people's decisions among and about choice options are represented by their relative rank within a single attribute, not absolute values. Indeed, Ungemach et al. (2011) provided experimental support for DbS predictions by revealing that participants' preference for safe and risky gambles were influenced by monetary amounts which were sampled from recent memory. However, in this thesis I argue that Ungemach and colleagues used gambles with negligible and non-desirable prizes, which did not trigger participants' risk preferences, and prompted sampling from experience. Accordingly, in Experiments 1 and 2, I demonstrated that participants' preferences for risky gambles are influenced by the desirability of gambles' prizes (i.e., absolute values). Moreover, in the remaining experiments of this thesis (Experiments 3-7), I explored the first attribute heuristic (a novel psychological mechanism), in which I proposed that people compare choice options binary on the first contextually available attribute and prefer the option with the dominant value on the first contextually available attribute relatively more than the option with the inferior value on the first contextually available attribute. Specifically, I demonstrated that the first attribute heuristic influences participants' risky choice preferences (Experiments 3 and 4). This result is not anticipated by the leading normative and descriptive behavioural theories and the DbS relative rank model. Furthermore, I found that with non-risky tasks participants' willingness to pay (WTP) judgements are also influenced by the first attribute heuristic (Experiments 5-7). Once again, this result is not anticipated by the leading behavioural theories of evaluability and WTP judgements (González-Vallejo & Moran, 2001; Hsee, 1996). Therefore, the novel behavioural effect (desirability) and psychological mechanism (first attribute heuristic) discovered in this thesis pose a challenge for existing judgement and decision-making research which has not methodologically, empirically, or theoretically accounted for (or controlled for) them. Overall, this thesis provides theoretical and empirical evidence that people's preferences are constructed 'on the fly', using a variety of decision-making mechanisms that are contingent on features of the context and task. Finally, as I discuss in the last chapter, both phenomena have the potential to be explored further within applied settings.

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## List of Abbreviations

CE – Certainty Equivalent

DbS – Decision by Sampling

EUT – Expected Utility Theory

EV – Expected Value

FAH – First Attribute Heuristic

JE – Joint Evaluation Mode

JND – Just Noticeable Difference

PT – Prospect Theory

SE – Separate Evaluation Mode

SEU – Subjective Expected Utility Theory

WEIRD – White, educated, industrialised, rich and democratic

WTP – Willingness to Pay

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# Chapter 1

# Theoretical Exploration and Motivation for the Thesis

## 1.1 Overview of Chapter 1

Chapter 1 aims to provide a theoretical background to the multidisciplinary risky and non-risky judgement and decision-making field, and to introduce my theoretical and empirical contributions. Accordingly, in the theoretical background I provide an overview of the contributions that philosophers, behavioural scientists, economists, psychophysicists, and cognitive psychologists have made to risky and non-risky judgement and decision-making research. In Section 1.2 I introduce Utilitarianism (Bentham, 1776/1988; 1789/2007) as it is, arguably, the most influential theory of normative decision-making, and has provided the foundation and structure which has guided the development of judgement and decision-making research. Moreover, to provide further backdrop for Utilitarianism, in Section 1.2 I contrast Utilitarianism against Kantian Deontology (Kant, 1785/1989), and briefly discuss the predictive differences between these theories within the context of research investigating moral dilemmas.

In Section 1.3 I introduce prominent normative theories of decision-making (e.g., Expected Utility Theory; von Neumann & Morgenstern, 1947) which assume that people use computational processing to maximise their individual utility, and behave consistent with axioms of rational choice. Having introduced normative theories, I explore evidence that people do not maximise their utility, and in fact violate normative axioms. Then I introduce Prospect Theory (PT, Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), the leading descriptive theory (seeks to describe how people behave) of risky decision-making. Moreover, in Section 1.3 I introduce and discuss contemporary evidence which reveals that people violate Prospect Theory (PT) predictions, and have preferences which are unstable, constructed 'on the fly' and prone to influences from the decision-making context, task, and experience.

In Section 1.4 I introduce classic psychophysics (the study of human sensation) research which, like the normative theories of decision-making, suggests that people possess internal scales on which an objective magnitude is translated into subjective sensation. Moreover, in Section 1.4 I also introduce and explore more contemporary research which indicates that people do not possess absolute representations of value or internal weighting scales. Accordingly, I explore Decision by Sampling (DbS, Stewart et al., 2006) which was informed by relative judgement research, and is one of the most significant contemporary theories of judgement and decision-making. Accordingly, DbS successfully challenges the most prominent normative and descriptive theories.

Section 1.5 explores evidence that people's judgements and decisions are constructed using heuristics (simple psychological processes) rather than complex computational processing, as they enable people to navigate their evolved cognitive limitations, and exploit information in memory and the environment. Specifically, I discuss evidence from two opposing perspectives. The first – the heuristics and biases program (e.g., Tversky & Kahneman, 1974) – suggests that heuristics are shortcuts which bias human judgements and decisions, as they cause departures from normative rationality. The second – the fast and frugal heuristics program (see Gigerenzer et al., 1999) rejects the idea that normative standards are the benchmark for human rationality and proposes that people possess a 'toolbox' of heuristics which if applied to the correct task are ecologically rational and can outperform normative models using less information (less is more effect).

In Section 1.6 I explore and discuss evidence from psychological research which suggests that 'firsts' have a unique influence on human cognition. Specifically, I introduce primacy, predecisional distortion, first-run effect, anchoring, and the first is best effect.

In Section 1.7, I introduce the novel theoretical proposals which I explore throughout this thesis (desirability and first attribute heuristic) and discuss my contributions to the fields of risky and non-risky judgement and decision-making. Specifically, I present my desirability proposal and explore the theoretical problems which it poses for Ungemach et al. (2011) and more broadly DbS (Stewart et al., 2006), which predicts that absolute values do not influence people's judgements and decisions. Moreover, I also introduce my novel proposal – the first attribute heuristic (FAH), provide evidence for its assumptions, and discuss its implications for risky judgement and decision-making research. The first attribute heuristic is a general theoretical proposal supported by experimental evidence in this thesis. FAH is simpler than many alternate theoretical proposals, and crucially, has not been anticipated and controlled for by the most prominent behavioural theories and their experimental methods (including PT and DbS). Furthermore, I also explore how the FAH can influence people's willingness to pay (WTP) preferences in non-risky tasks and discuss how this could be problematic for Hsee's (1996) evaluability research, as well as other researchers who used his experimental method without controlling for the FAH's influence (e.g., González-Vallejo & Moran, 2001).

The chapter closes at Section 1.8, where I outline the experimental methods that I have used to validate my theoretical proposals (desirability and first attribute heuristics) and their predictions. Moreover, in Section 1.8 I also provide a brief overview of the remaining chapters in this thesis (Chapters 2 – 6).

## 1.2 The Philosophical Principles of Behaviour: Utilitarianism and Deontology

### 1.2.1 The Utilitarianism and Kantian Deontology: The Utility Maximisation Principle

In a similar vein to the Ancient Greek philosopher Epicurus (for a discussion see Scarre, 2020), in *An Introduction to the Principles of Morals and Legislation* Jeremy Bentham (1789/2007) argues that human moral behaviour is governed by pleasure and pain. Extending this argument, and in congruence with hedonistic pleasure-seeking philosophy, Bentham proposed the Greatest Happiness Principle (Utilitarianism) according to which the moral appropriateness of an action is determined by its capacity to produce the greatest happiness for the greatest number of people affected by the action (Bentham 1776/1988). Specifically, Bentham proposed that pleasure (measured as utility) should be maximised, and pain (measured as disutility) should be minimised. Accordingly, utilitarianism is a consequentialist theory which judges the morality of an action by its outcome, rather than the nature of the action itself.

As Bentham's utilitarian perspective judges the morality of an action by its consequences (i.e., maximisation of utility and minimisation of disutility), it focused on the quantitative aspects of pleasure and pain. Although, as pleasure and pain are challenging to quantify, Bentham suggested that the value of a pleasure and pain is determined by seven factors: its intensity; its duration; its certainty or uncertainty; its propinquity or remoteness; its fecundity (the chance of being followed by a sensation of the same kind); and, its purity (the chance of it not being followed by sensations of the opposite kind (Bentham, 1789/2007; see also Scarre, 2020). Therefore, to determine the utility of an action Bentham suggested that humans use felicific calculus, where each person affected by the action makes a subjective numerical interpretation of pleasure and pain on each factor, and then sums the overall total for pain and pleasure across all seven factors. After the values have been summed, Bentham suggested that it will be possible to determine the moral appropriateness of the action; if the total value for pleasure exceeds the total value for pain, then the action as a whole will have good tendency. However, if the total value for pain exceeds that of pleasure, then the action will have a bad tendency.

Like all theoretical ideas, Bentham's utilitarianism, specifically his quantitative perspective on pleasure and pain, was subsequently criticised. Specifically, it was considered to be 'a doctrine worthy only of swine' (see Mill, 1863/2009, p. 14) as it implied that humans are no different from other animals. To rebut this argument, Mill (1863/2009; see Scarre, 2020; West, 2004) suggested that pleasures and pains should also be measured according to their quality, rather than solely their quantity. Accordingly, Mill developed Bentham's utilitarianism by arguing that there are quantitative differences between pleasures. Specifically, he argued that some pleasures (mental pleasures; e.g., intellect, feelings, imagination, morality) are higher than others (bodily pleasures; e.g., eating and sleeping), and that higher pleasures can only be experienced using human cognitive faculties. Thus, Mill believed that whilst lower pleasures can be experienced by both humans and animals, only higher pleasures can be experienced by humans (West, 2004). Consistent with this reasoning, Mill (1863/2009) suggested that human agents prefer mental pleasures, even in small amounts, over bodily pleasures, even in vast amounts, and that mental pleasures are generally more beneficial to society than bodily pleasures.

To better appreciate the reasoning presented by advocates of utilitarianism, it is beneficial to explore the alternate ethical theory of deontology, as it offers a starkly contrasting perspective. For instance, whilst utilitarianism is based on consequentialism, and thus judges the morality of an action by its outcome, in *Foundation of the Metaphysics of Morals,* Kant (1785/1989) – a leading advocate of deontological ethics – argued that the morality of an act is determined by the intention behind the act itself. Specifically, Kant suggested that people ought to behave consistent with a categorical imperative; an act done from duty out of respect for a moral law. To determine whether an act should be moral law, Kant suggests that one should consider if one would like it to be a universal law, and if so, then one should always behave consistent with the law. For example, if one believes that there should be a universal law to never lie under duress then, to be morally appropriate, one should never act inconsistent with the moral law (i.e., to lie under duress). Thus, from the perspective of Kant, the morality of a behaviour is judged by the intention behind the behaviour (to respect the moral law), not by the outcome of the behaviour, or even the behaviour itself; one could still decide not to lie under duress, but if this is done for a reason other than respect for the moral law (e.g., lying to maintain trust), then it cannot be regarded as a moral behaviour. In contrast, advocates of utilitarianism would take a consequentialist perspective, and argue that it is morally appropriate to lie when lying will produce the greatest happiness for the greatest number of people.

The contrast between deontological and utilitarian ethics can be examined using moral dilemma scenarios (e.g., Greene et al., 2001; Kusev et al., 2016; see also Martin et al., 2017; Martin, Kusev & van Schaik, 2021; Martin, Kusev, Teal, et al., 2021). For instance, consider a trolley dilemma where participants are informed that a runaway trolley is travelling along a track towards a group of ten people, and that the only way to save them is to pull a lever which will divert the trolley onto an alternate track where one person is stood. Accordingly, if the lever is not pulled then ten people will die and one person will survive, whilst if the lever is pulled then one person will die and ten people will survive. The question is, should the lever be pulled? Advocates of utilitarianism argue in favour of pulling the lever, as they believe it morally appropriate to sacrifice a smaller number of lives to save a larger number of lives; this would maximise utility for the most people. However, in contrast, deontologists such as Kant (1785/1989) argue that everyone has a right to live and therefore killing anyone is wrong under any circumstance, even when it might be beneficial to do so (i.e., to save ten lives).

In addition to being a central theory in moral decision-making research, utilitarianism has had a profound influence on the development of economic theories of human behaviour. In particular, a core assumption of research in economics is that economically rational human agents seek to maximise their utility and minimise their disutility. Given that it was economists, not psychologists, who lay the foundations for the exploration of human behaviour under risk, it is not surprising that utilitarian assumptions were integrated into leading theories of human risky and non-risky judgement and decision-making. Accordingly, in the next section of this thesis I will introduce and discuss leading normative and descriptive theories of human behaviour (Expected Utility Theory, Subjective Expected Utility Theory, and Prospect Theory), all of which have been informed by utilitarian principles.

Prior to discussing the utilitarian foundation of risky judgement and decision-making research, I will briefly re-cap the difference between Bentham and Mill's utilitarian assumptions. In particular, whilst both Bentham and Mill were concerned with maximising pleasure (utility) and minimising pain (disutility) for the majority, Bentham did not differentiate between different types of pleasures and pain; he treated them as equal. In contrast, Mill argued that pleasures were not equal. Specifically, Mill proposed that there are quantifiable differences between 'mental pleasures' (e.g., intellect, feelings) and 'bodily pleasures' (e.g., eating, sleeping), and that mental pleasures (or higher pleasures) require human cognitive faculties whilst bodily pleasures (or lower pleasures) do not. Moreover (as discussed in the next sub-heading), in contrast to the utilitarianism of Bentham and Mill, normative theories of judgement and decision-making assume that utility maximisation (and disutility minimisation) occur at the level of each individual agent, rather than at societal level. Accordingly, normative theories take into consideration individual differences in utility and maximisation.

## 1.3 Normative and Descriptive Approaches to Decision-Making

### 1.3.1 Normative Decision-Making: Expected Utility Theory and Subjective Expected Utility Theory

Jeremy Bentham's (1789/2007) utilitarianism has significantly influenced the approach which behavioural economists and decision theorists have taken towards developing theories of rational choice (see Baron, 2004). For instance, when faced with a choice, it is assumed that human agents always seek to maximise their individual utility. Accordingly, both most prominent normative theories, Expected Utility Theory (EUT; von Neumann & Morgenstern, 1947) and Subjective Expected Utility Theory (SEU; Savage, 1954), outline how agents ought to behave if they are normatively rational (the axioms of rational choice), and also provide a method as to how utility maximisation is to be achieved. Specifically, to maximise, human agents are expected to determine the utility of a choice by computing its possible outcomes using either objectively known values (e.g., probability or money) in the case of EUT, or subjective interpretations of the values in the case of SEU. Thus, whilst both theories are concerned with utility maximisation and provide a method to achieve maximisation, SEU facilitates individual differences in the subjective interpretation of probability and value whilst EUT does not. As SEU and EUT are the benchmark against which many contemporary judgement and decision-making theories are contrasted, I will now introduce each of them separately.

As discussed in the preceding paragraph, EUT (von Neumann & Morgenstern, 1947) provides a prescriptive method to achieve utility maximisation at the level of individual choice. Specifically, in the context of economic decisions, normatively rational human agents are expected to make optimal decisions (those which maximise their utility and minimise their disutility) during choices involving known monetary outcomes and probabilities. To achieve this, EUT suggests that human agents should: (i) for each option use a computational process to transform objective values (e.g., probability and money) into a common scale which represents utility (expected value; EV)[1]; (ii) perform a trade-off between the overall EV offered by each option; and (iii) choose the option which offers the highest EV. Accordingly, EV is formalised as: EV = $\Sigma P(Xi) * Xi$, where $X$ is an outcome (here outcome $i$) and $P$ represents

[1] If the option has more than one possible outcome, then the overall EV of the option is the summed EV offered by each possible outcome (the average EV across all possible outcomes).

the probability of $Xi$ occurring (von Neumann & Morgenstern, 1947). Thus, during (i) the expected value of an option (or each of its possible outcomes) is computed by multiplying the value of the outcome (its monetary outcome) by the probability of obtaining the outcome. For example, consider a choice between:

A. 10% chance to win £100 otherwise nothing
B. 90% chance to win £30 otherwise nothing

In this example, EUT expects a normatively rational human agent to calculate the EV of each option. For A the EV is its outcome (£100) multiplied by its probability (10%) = £10. For B the EV is the outcome (£30) multiplied by its probability (90%) = £27. Thus, in this choice B should be chosen because over many plays it will lead to a higher EV. In theory, this computational process could be applied to any number of choice options, with any number of possible outcomes inside each choice option. For instance, as an additional example, consider a choice between the following options which offer more than one possible outcome:

A. 10% chance to win £100 or 20% chance to win £200
B. 5% chance to win £300 or 10% chance to win £400

In this example, the EV for A is the first possible monetary outcome (£100) multiplied by its probability (10%) plus the second possible monetary outcome (£200) multiplied by its probability (20%) = £50. Likewise, the EV for B is the first possible monetary outcome (£300) multiplied by its probability of occurrence (5%) plus the second possible monetary outcome (£400) multiplied by its probability (10%) = £55. Accordingly, in this example choice option B has a higher EV, and therefore should be chosen by a normatively rational human agent.

However, despite the elegance of EUT in dealing with known outcomes and probabilities, it cannot account for choices involving uncertainty or choices which are informed by subjective interpretations of outcomes and probabilities. For example, a person’s preference to either go for a picnic in the park or work on writing an essay is likely to be influenced by uncertain factors (e.g., the likelihood of rain or whether someone that they dislike will be at the picnic), as well as their individual preference for each activity (Ayton, 2005). Accordingly, EUT is an axiomatic theory and therefore not concerned with people's actual behaviour (utilitarian or not). However, experimental evidence testing for these axiomatic assumptions (e.g., St. Petersburg's paradox) motivated the creation of SUT in which individual differences regarding utility are taken into consideration. Indeed, Savage (1954) created SEU by adapting EUT so that it can account for a person's subjective interpretations of outcomes and probabilities in the calculation of EV (see Sugden, 1991). Whilst this appears similar to the felicific calculus proposed by Bentham (1789/2007), in the case of SEU, the decision-maker is making a subjective interpretation of probability and value for a choice which will influence their personal utility, rather than the utility of the greatest number.

Accordingly, despite the difference in the origin of outcome and probability information (objective or subjective) between EUT and SEU, they both assume that normatively rational agents seek to maximise expected value and can achieve this using the same computational process. Moreover, both EUT and SEU assume preference consistency/stability, and that a normatively rational maximising agent will adhere to a number of axioms developed by von Neumann and Morgenstern (1947) and Savage (1954). Specifically, only when the axioms are obeyed is an agent able to maximise EV and demonstrate consistent/stable preferences, and thus behave as a normative rational agent (Simon, 1959). The main axioms are as follows (Ayton, 2005):

1. Comparability[2]: when making an evaluation about choice options, an agent should be able to express either preference or indifference. For instance, in a choice between A and B, decision-makers should be able to express either $A < B$, $A > B$, or $A = B$.

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[2] This axiom is also known as completeness.

2. Transitivity: decision-makers should be able to order their preferences, and the order of preferences should be logical. For instance, if A > B, and B > C, then A > C.

3. Dominance: a dominant option should always be preferred over a dominated option.

4. Independence: an outcome independent from the decision-maker's choice (e.g., a shared outcome) should not influence the evaluation of choice options.

5. Invariance: a decision-maker's evaluation of choice options should not be influenced by how options are presented (descriptive invariance). Moreover, the method of elicitation should produce the same preference order (procedural invariance; see Tversky et al., 1988).

However, despite the logic behind these axioms, behavioural science research has provided evidence that human agents typically do not express preferences which are normative. In particular, people do not appear to maximise EV or possess stable and consistent preferences, and frequently violate all five of the discussed axioms. Accordingly, evidence that human agents behave inconsistent with the assumptions and expectations of the normative theories will be discussed in the next section of this chapter.

### 1.3.2 Descriptive Violations of Normative Decision-Making

Normative theories of judgement and decision-making assume that human decision-makers have preferences which are rational and consistent. Accordingly, people are expected to maximise utility by performing a computational process, and by consistently obeying the normative axioms of EUT and SEU regardless of context and task (Savage, 1954; von Neumann & Morgenstern, 1947). However, in contrast to normative behavioural expectations, behavioural science research has demonstrated that people routinely violate the axioms of EUT and SEU (e.g., Allais, 1953; Edwards, 1955; Ellsberg, 1961; Lichtenstein & Slovic, 1971, 1973; Slovic & Lichtenstein, 1968; Tversky, 1969; Tversky & Kahneman, 1981).

For instance, Tversky (1969) demonstrated that human decision-makers are prone to violating the axiom of transitivity. Specifically, in one experiment from Tversky (1969) participants were presented with all possible pairs of hypothetical university applicants (see Table 1) and asked to choose the applicant that they would rather accept. All applicants were defined on three dimensions: intellectual ability, emotional stability, and social facility. Additionally, the participants were informed that the intellectual ability dimension should be regarded as the most important dimension. Tversky found that typical participants preferred applicants A to B, B to C, C to D, D to E, E to F, F to G, G to H, H to I, and I to J. However, a significant number of participants also preferred applicant J to applicant A, and thus demonstrated an intransitive ordering of preferences.

**Table 1**

*University Applicants*

| Applicants | Intellectual Ability | Emotional Stability | Social Facility |
|---|---|---|---|
| A | 63 | 96 | 95 |
| B | 66 | 90 | 85 |
| C | 69 | 84 | 75 |
| D | 72 | 78 | 65 |
| E | 75 | 72 | 55 |
| F | 78 | 66 | 45 |
| G | 81 | 60 | 35 |
| H | 84 | 54 | 25 |
| I | 87 | 48 | 15 |
| J | 90 | 42 | 5 |

*Note.* Adapted from “Intransitivity of Preferences” by A. Tversky. 1969, *Psychological Review, 76*(1), p. 37.

To explain this, Tversky suggested that the participants did not compare the overall valuation for each participant (sum the scores horizontally for each dimension and use this as a basis for choice) as expected by normative theories of choice, but instead evaluated each dimension individually. Furthermore, he argued that humans simplify choice by ignoring small differences between dimensions. Therefore, according to this proposal, participants ignored the small differences in scores on the Intellectual Ability dimension (and thus based their choices on the remaining dimensions), until they were asked to choose between applicants A and J.

During this choice, the difference between applicants on the Intellectual Ability dimension was large and therefore participants used this dimension as a basis for choice.

Furthermore, Allais (1953; see also Allais, 1979; Ellsberg, 1961) demonstrated a violation of the independence axiom during choice between two lotteries; situation 1 and situation 2 (see Table 2). In situation 1 participants had to make a choice between choice A offering 100% of winning £1,000,000, and choice B offering 1% chance of winning £0, 10% chance to win £5,000,000, and 89% chance to win £1,000,000. Allais found that during situation 1 the majority of participants demonstrated a preference for choice A. In contrast, in situation 2 where participants had to make a decision between choice C offering 1% chance to win £1,000,000, 10% chance to win £1,000,000, and 89% chance to win £0, and choice D offering 1% chance to win £0, 10% chance to win £10,000,000, and 89% chance to win £0, the majority of participants favoured choice D. Accordingly, the pattern of preferences demonstrated by the majority of participants indicate that they failed to ignore irrelevant shared outcomes, and therefore violated the normative axiom of independence. Specifically, as shown in Table 2, if participants had ignored the shared outcomes of lottery tickets 12-100, then they should have made consistent choices across situations 1 and 2, as they both offered an identical choice between 11% chance to win £1,000,000 otherwise nothing, or 10% chance to win £5,000,000 otherwise nothing. Therefore, across both situations a human decision-maker with consistent risk preferences should have favoured either choice A and choice C, or choice B and choice D.

**Table 2**

*The Allais Paradox*

| | | Lottery ticket numbers (1 – 100) | | |
|---|---|---|---|---|
| | | 1 | 2 – 11 | 12 – 100 |
| Situation 1 | Choice A | £1,000,000 | £1,000,000 | £1,000,000 |
| | Choice B | £0 | £5,000,000 | £1,000,000 |
| Situation 2 | Choice C | £1,000,000 | £1,000,000 | £0 |
| | Choice D | £0 | £5,000,000 | £0 |

*Note.* Adapted from “Judgement and Decision-Making” by P. Ayton. 2005, in N. Braisby & A. Gellaty (Eds.) *Cognitive Psychology*. New York: Oxford University Press.

Additionally, the results from Allais (1953) imply that participants tended not to maximise their utility, as expected by both EUT (von Neumann & Morgenstern, 1947) and SEU (Savage, 1954). Specifically, if participants were concerned with maximising their utility, they should have favoured choice B in situation 1, and choice D in situation 2, as both of these choices offered the highest expected value (EV):

Situation 1
Choice A: (1% x £1,000,000) + (10% x £1,000,000) + (89% x £1,000,000) = EV of £1,000,000
Choice B: (1% x £0) + (10% x £5,000,000) + (89% x £1,000,000) = EV of £1,390,000
Situation 2
Choice C: (1% x £1,000,000) + (10% x £1,000,000) + (89% x £0) = EV of £110,000
Choice D: (1% x £0) + (10% x £5,000,000) + (89% x £0) = EV of £500,000

The non-optimal pattern of preferences demonstrated by the majority of Allais's (1953) participants is consistent with research which suggests that human agents do not appear to compute EV, or demonstrate concern for maximising their utility. For instance, Edwards (1955; see also Edwards, 1992) asked participants to make choices between lotteries which offered equal expected value. For example, (Ayton, 2005):

Gamble A: 60% chance to win £2 and 40% chance to win £4
Or
Gamble B: 20% chance to win £14 and 80% chance to win £0

Despite offering an equal EV of £2.80, in this example Edwards found that participants generally demonstrated a strong preference for the gamble option (B) which offered a small chance to win a large amount. Accordingly, as both gamble options offered the same EV, participants who had a preference for one of the gambles violated the normative axiom of comparability as they should have regarded the gambles as equal, and subsequently chosen randomly.

However, whilst the results from Allais (1953) indicate that participants did not maximise their utility, the results provided an early example of the certainty effect where human decision-makers typically demonstrate a strong preference towards options which offer a certain outcome (see Tversky & Kahneman, 1981). Specifically, in situation 1 the majority of participants were unwilling to give up a certain win of £1,000,000 (choice A) for an almost certain chance to win either £1,000,000, or possibly an even greater amount of £5,000,000 (choice B). However, in situation 2 when neither option offered a certain win, participants were generally not concerned with maximising the chance of gain (option C), and instead favoured the lottery which offered a smaller probability of a larger gain (option D). The certainty effect was later incorporated into Prospect Theory (PT), the leading theory of descriptive choice, which fits data demonstrating that human agents underweight high probability events (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992).

In addition to the violations of intransitivity, independence, and comparability already discussed, a plethora of behavioural research experiments have demonstrated that human agents frequently violate the normative axiom of descriptive (preferences should not be influenced by how choice options are presented) and procedural (the method of elicitation should produce the same preference order) invariance. Accordingly, people often demonstrate unstable and inconsistent preferences which are sensitive to influences from context, task, and the method of elicitation (e.g., Frey et al., 2017; Kusev et al., 2009; Kusev, van Schaik, & Aldrovandi, 2012; Kusev et al., 2020; Lichtenstein and Slovic, 1971, 1973; Pedroni et al., 2017; Slovic & Lichtenstein, 1968; Slovic & Lichtenstein, 1983; Tversky et al., 1990; Tversky & Kahneman, 1981; Tversky et al., 1988; see also Slovic, 1995; Payne, 1982). For instance, Tversky and Kahneman (1981) famously demonstrated a violation of descriptive invariance, where preferences changed depending on whether a choice problem was framed as a gain or a loss. Specifically, Tversky and Kahneman (1981) asked participants to imagine that the US was preparing for the outbreak of a disease. Following this, half of the participants were informed that they had to choose between normatively equivalent programs which were framed as gains (Tversky & Kahneman, 1981, p.453):

Program A: 200 people will be saved (EV = 200 people saved)

Or

Program B: 1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved (EV = 200 people saved)

In contrast, the remaining half of participants had to choose between two normatively equivalent programs which were framed as losses (Tversky & Kahneman, 1981, p.453):

Program C: 400 people will die (EV = 200 people will be saved)

Or

Program D: 1/3 probability that no people will die and 2/3 probability that 600 people will die (EV = 200 people saved).

Accordingly, as all programs offer the same EV, if participants have a preference for one of the programs, then they will violate the normative axiom of comparability (see also Edwards, 1955). In contrast to assumption of comparability, Tversky and Kahneman (1981) found that participants demonstrated strong choice preferences, and that preferences were influenced by framing the outcome of each program as either saved (gain) or die (loss). Specifically, when the outcomes were described as a gain (i.e., in programs A and B) 72% of participants preferred program A. In contrast, when the programs were described as a loss (i.e., programs C and D) 78% of participants preferred program D. Consequently, participants violated the normative axiom of descriptive invariance, as preferences for structurally identical options should not be influenced by how they are described. As a result of Tversky and Kahneman's experimental finding, the influence of framing (loss or gain) was incorporated into PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), which can account for the results of Tversky and Kahneman (1981). In particular, PT predicts that human agents are typically risk-seeking in the domain of loss, and risk-averse in the domain of gain (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981; Tversky & Kahneman, 1992).

Moreover, research has demonstrated that human agents tend to reverse their preferences between choice and judgement, which violates the normative axiom of procedural invariance (Tversky et al., 1990) and possibly the axiom of transitivity (Fishburn, 1984; Loomes & Sugden, 1982, 1983; Loomes et al., 1989; for a review see Tversky et al., 1990; Seidl, 2002). For example, building on the work of Slovic and Lichtenstein (1968), Lichtenstein and Slovic (1971; see also Lindman, 1971; Lichtenstein & Slovic, 1973; Slovic & Lichtenstein, 1983) hypothesised that it would be possible to elicit choice-pricing preference reversal where participants would prefer to play one bet, but would demand a higher selling price for the alternate bet. Accordingly, Lichtenstein and Slovic presented participants with choice pairs which were constructed of a P bet offering a higher probability to win a modest amount of money, and a $ bet offering the possibility of a larger win, but with a lower probability. For instance:

| **P bet** | **S bet** |
|---|---|
| 99% chance to win $4 | 33% chance to win $16 |
| 1% chance to lose $1 | 67% chance to lose $2 |

After being presented with each choice pair, participants were required to choose which bet that they would prefer to play, and then to indicate the minimum amount which they would be willing to sell each bet for. As predicted, Lichtenstein and Slovic found that a significant number of participants demonstrated preference reversals. Specifically, participants typically preferred the P bet during choice, but stated a higher selling price for the $ bet. Moreover, this behaviour has been replicated in follow-up studies by Grether and Plott (1979), Pommerehne et al. (1982), and Reilly (1982); for a review see Slovic and Lichtenstein (1983), and Tversky et al. (1990).

Crucially, the choice-pricing preference reversals[3] demonstrated by Lichtenstein and Slovic (1971) lend weight to a non-normative argument that human agents processing of information is sensitive to changes in task and context (see Payne, 1976; 1982; Payne et al., 1988; Payne, Bettman, Coupey, & Johnson, 1992), and that is not necessarily the same for judgement and choice (Rosen & Rosenkoetter, 1976). Specifically, choice-pricing preference reversals like those demonstrated by Lichtenstein and Slovic have been largely attributed to a response mode bias called the compatibility hypothesis (Tversky et al., 1988). The compatibility hypothesis proposes that the compatibility between a cue (i.e., an attribute) and the required response determines how strongly a cue influences the response (Lichtenstein & Slovic, 1973; Tversky et al., 1988; Tversky et al., 1990; Slovic et al., 1990). Accordingly, this interpretation suggests that participants' information processing is biased by compatibility between attributes and the response mode (see Slovic, 1995; Slovic et al., 1990; Tversky et al., 1988). For instance, with regard to the choice-pricing preference reversal demonstrated in Lichtenstein and Slovic (1971), the compatibility hypothesis suggests that as prices were expressed in $ values, participants were primed to consider the gamble options' outcomes more during pricing than during choice, which subsequently led to higher preference for the $ bet during pricing than during choice (see Lichtenstein & Slovic, 1973).

However, in contrast to existing preference reversals which used different response modes across judgement and choice, more recent studies have revealed that preference reversals are also possible when response mode is held constant (e.g., Hsee, 1996, 1998; see Hsee et al., 1999). Specifically, participants can reverse their preferences between two options depending

[3] In addition to choice-pricing preference reversals, there is a second type of classic preference reversal which occurs between choice and matching. It has been largely attributed to a prominence effect where participants are influenced more by the most prominent attribute during choice than pricing (see Fischer & Hawkins, 1993; Slovic, 1975; Tversky et al., 1988), but also a general compatibility hypothesis (Tversky et al., 1988), where the relative weight of an attribute is determined by the task. However, I have not discussed this type of preference reversal in the main body, as providing an in-depth exploration of preference reversal literature is beyond the scope of this thesis.

on their evaluation mode; whether they are evaluated together (joint evaluation mode; JE), or in isolation (separate evaluation mode; SE; e.g., Bazerman et al., 1992; Bazerman et al., 1994; Hsee, 1996, 1998; for reviews see Bazerman et al., 1999; Hsee et al., 1999). For instance, in one study from Hsee (1996; see also Hsee et al., 1999) participants were asked to imagine that they were a consultant and that they were looking to hire a computer programmer to use a computer language called KY. Participants were then required to evaluate and state their willingness to pay (WTP) annual salary for one (in SE) or two (in JE) job candidates who were defined on the attributes GPA and experience with KY. Moreover, the attributes required a trade-off as candidate A had a superior GPA (and candidate B and inferior GPA), whilst candidate B had more experience with KY (and candidate A less experience); see Table 3.

**Table 3**

*Job Candidate Information*

| | Candidate A | Candidate B |
|---|---|---|
| GPA | 4.9 | 3.0 |
| Experience with KY | has written 10 KY programs in the last 2 years | Has written 70 KY programs in the last 2 years |

*Note.* Adapted from “The Evaluability Hypothesis: An Explanation for Preference Reversals between Joint and Separate Evaluations of Alternatives” by C. Hsee. 1996, *Organizational Behaviour and Human Decision Processes, 67*(3), p. 250.

The results revealed that preferences reversed between the evaluation modes, even when response mode was held constant. Specifically, participants favoured candidate A more (higher WTP) than candidate B during SE, and candidate B more than candidate A during JE. Accordingly, Hsee (1996) argued that the explanations for classic preference reversals could not account for JE-SE preference reversals. Instead, Hsee (1996; see also Bazerman et al., 1999; Hsee, 1998; Hsee et al., 1999) argued that JE-SE preference reversals for choice options defined on an easy-to-evaluate attribute (e.g., GPA) and a hard-to-evaluate attribute (e.g., experience with KY) that require a trade-off, can be explained by his evaluability theory.

In his evaluability theory Hsee (1996, 1998; see also Hsee et al., 1999) proposes that JE-SE preference reversals occur because some attributes are easier to evaluate than others (for factors which determine evaluability see Hsee & Zhang, 2010). Specifically, attributes which are easy-to-evaluate in isolation can be easily understood in isolation, without comparison with other attribute values. In contrast, attributes which are hard-to-evaluate independently require comparison with other values to interpret. Accordingly, (Hsee, 1996) proposed that in SE people's preferences are determined by easy-to-evaluate rather than hard-to-evaluate attributes, whilst in JE preferences are determined by both easy and hard to evaluate attributes. Therefore, as hard-to-evaluate attributes have relatively more influence in JE than in SE, and easy-to-evaluate attribute have relatively more influence in SE than in JE, Hsee (1996) predicts a preference reversal from the option superior on the hard-to-evaluate attribute in JE to the option superior on the easy-to-evaluate attribute in SE. Or in other words, preferences can reverse between JE and SE, if evaluability of the easy-to-evaluate in isolation attribute in SE is not bolstered by JE, but evaluability of the hard-to-evaluate in isolation attribute in SE is bolstered by JE (Hsee & Zhang, 2010).

Accordingly, with regard to the job candidate example, presumably as participants (who were all students) had rich knowledge about the GPA attribute, but not experience with KY attribute (Hsee & Zhang, 2010), they were able to easily evaluate the GPA attribute in isolation but were unable to evaluate the experience with KY attribute. Therefore, their WTP judgements in SE were determined predominantly by the easy-to-evaluate in isolation attribute GPA, on which candidate A (4.9) was dominant to candidate B (3.0). In contrast, in JE both attributes are easy-to-evaluate, as they can be directly compared (Hsee & Zhang, 2010). Thus, as people can use both attributes to inform their preferences, Hsee predicts a relative increase in WTP for candidate B dominant on the experience with KY attribute (70 KY programs), but not candidate

A inferior on the experience with KY attribute (10 KY programs). Therefore, if the increase in WTP for dictionary B is big enough in joint evaluation, a preference reversal should occur.

However, Hsee's evaluability theory does not necessitate JE-SE preference reversal, only a relative shift in preferences. Consequently, to create the preference reversals demonstrated in Hsee (1996) the hard-to-evaluate in isolation attribute was often also the most important attribute (Hsee, 2000). Informed by Hsee's (2000) proposal that attribute importance also influences WTP judgements, González-Vallejo and Moran (2001) explored the influence of attribute importance and evaluation difficulty on WTP preferences and found that in JE participants favoured the option superior on the most important attribute, whilst in SE participants' judgements (and choices) were informed by evaluability and also attribute importance.

Moreover, whilst the evaluability hypothesis (henceforth theory) is the leading explanation for JE-SE preference reversals (see Sher & McKenzie, 2014), and has been demonstrated across a wide range of contexts including consumer choice (Hsee & Leclerc, 1998) and healthcare (Zikmund-Fisher et al., 2004), due to the variety in JE-SE preference reversals which have been elicited, there are alternative explanations (Bazerman et al., 1999). For instance, alternate possible explanation for at least some JE-SE preference reversals include the want/should proposition (Bazerman et al., 1998) which suggests that human agents feel tension between what they want to do and what they believe that they should do, and that they are more likely to do what they want during SE and what they should in JE. Moreover, Norm Theory (Kahneman & Miller, 1986) has been proposed as an explanation for some JE-SE preference reversals (Ritov & Kahneman, 1997; see Bazerman et al., 1999).

Providing a comprehensive review of behavioural science studies which have experimentally demonstrated that human agents do not behave in congruence with normative expectations and assumptions is beyond the scope of this thesis. However, the discussed studies provide sufficient evidence that human behaviour is not adequately described by either EUT (von Neumann & Morgenstern, 1947) or SEU (Savage, 1954). Accordingly, I will next introduce and explore Prospect Theory (PT; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), a behavioural theory which does, in many instances, provide an accurate description of human judgement and decision-making behaviour.

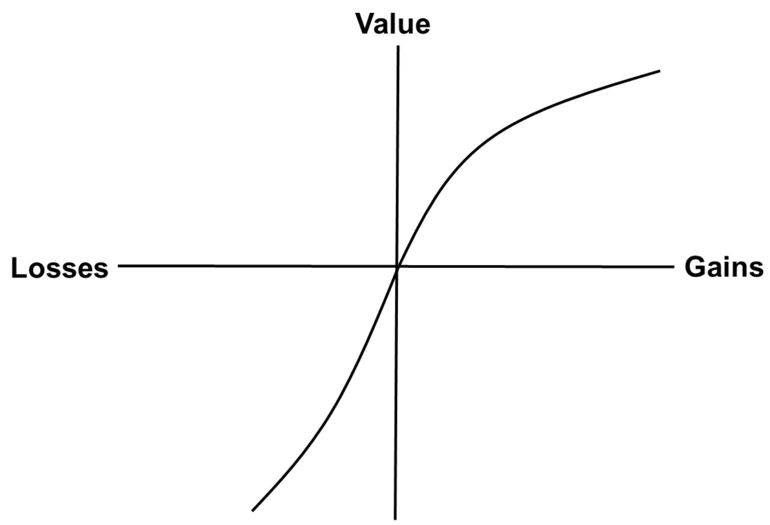
### 1.3.3 Prospect Theory

Given the failure of normative theories of judgement and decision-making to accurately describe human behaviour, Kahneman and Tversky (1979) and Tversky and Kahneman (1992) developed PT, which fits extensive experimental data demonstrating that human agents behave as if their preferences are determined by probability levels (high or low) and framing (gain or loss; see Tversky & Kahneman, 1981). Accordingly, as PT fits data from participants who choose between risky gambles, it predicts many of the behavioural phenomena which violated EUT (von Neumann & Morgenstern, 1947) and SEU (Savage, 1954), and revealed previously unknown behavioural phenomena. To achieve this, PT assumes that participants' choice preferences are informed by information integrated from a value weighting function and a probability weighting function.

The hypothetical value weighting function introduced by Kahneman and Tversky (1979) reveals that the utility of a choice is relative to a reference point (e.g., current wealth) rather than a change in state caused by its outcome, as assumed by the normative theories. Moreover, the hypothetical value function is S-shaped to account for framing (gain or loss; see Tversky & Kahneman, 1981), and to fit data which demonstrates that human participants feel decreasing sensitivity to gains and losses as they shift away from the reference point (see Figure 1). For example, if a person has a reference point of £0 and gains £20, then they would feel a greater increase in their utility compared to if they had a reference point of £100 and gained £20, even though the overall gain is identical. Furthermore, to account for loss aversion, a common finding which demonstrates that people feel more the disutility of loss than the utility of equivalent gain (e.g., Kahneman & Tversky, 1979; Novemsky & Kahneman, 2005; Tversky & Kahneman, 1991; Thaler, 1980; although for an alternate perspective see Gal & Rucker, 2018); in other words, the hypothetical value weighting function is steeper for losses than for gains (see Figure 1). Therefore, for example, from a reference point of £0 a loss of £50 will feel worse than a gain of £50 would feel good.

**Figure 1**

*Prospect Theory: Hypothetical Value Weighting Function*

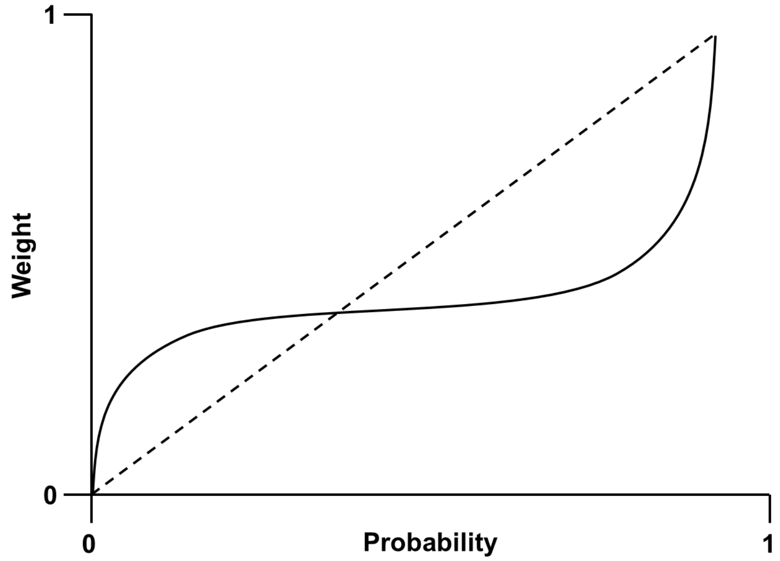



*Note.* Adapted from "Prospect Theory: An Analysis of Decision under Risk" by D. Kahneman, and A. Tversky, 1979, *Econometrica, 47*(2), p. 279.

In addition to the hypothetical value function, PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) also assumes that preferences are influenced by the probability levels. Specifically, the probability weighting function from Tversky and Kahneman (1992) reveals that human agents do not weight probability linearly. Instead, for both gains and losses, human agents overweight the likelihood of small probability events, and underweight the likelihood of medium and large probability events (see Figure 2). Accordingly, PT's probability weighting function can account for people's seemingly inconsistent choice to purchase lottery tickets (they overweight the very small likelihood of gain) and also purchase insurance products (they overweight the very small likelihood of loss; see Friedman & Savage, 1948). Moreover, the underweighting of almost certain probabilities can explain the certainty effect from Allais (1953). Specifically, participants underweighted the likelihood of an almost certain gain, and therefore favoured the option which offered certainty.

**Figure 2**

*Prospect Theory: Probability Weighting Function*

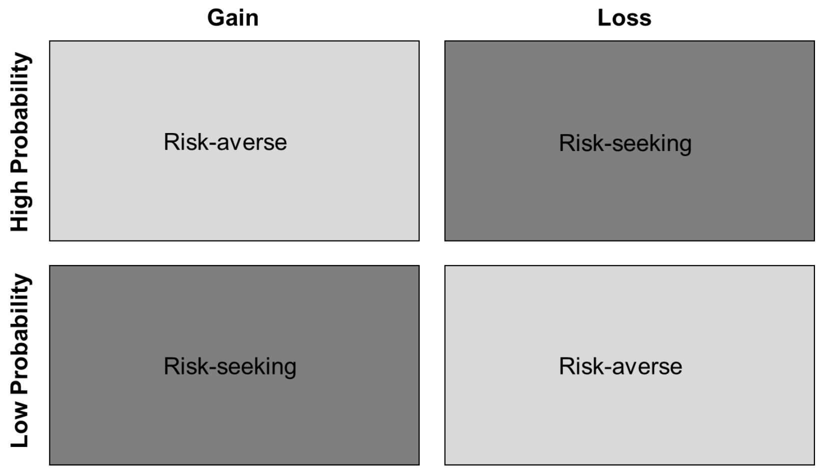



*Note.* Adapted from "Advances in Prospect Theory: Cumulative Representation of Uncertainty" by A. Tversky, and D. Kahneman, 1992, *Journal of Risky and Uncertainty, 5*(4), p. 313.

Overall, once the outputs from the hypothetical value weighting function and the probability weighting function have been integrated, PT predicts a four-fold pattern of risk preferences; risk-aversion for high probability gains and low probability losses, and risk-seeking for low probability gains and high probability losses (Tversky & Kahneman, 1992; see also Kusev et al., 2020); see Figure 3.

**Figure 3**

*Prospect Theory: Four-Fold Pattern of Risk Preferences*




*Note.* Adapted from "Preference Reversals During Risk Elicitation" by P. Kusev et al., 2020, *Journal of Experimental Psychology: General, 149*(3), p. 586.

EUT is a normative axiomatic theory and therefore not concerned with people's actual behaviour (utilitarian or not). Accordingly, EUT makes normative assumptions regarding how agents (human or non-human) 'should behave' and these standards are the norms of agency. For example, agents should maximise utility and minimise disutility under all circumstances (the axioms provide the rationale about how this should be done). In contrast, PT is a descriptive theory of 'human' agency, but uses the normative assumptions underlying EUT as a reference point for measuring how human agents 'actually behave'. This makes PT partially normative as it relies on underlying utilitarian assumptions in relation to processing of information, expected values, maximisation of utility and minimisation of disutility via a decision-making trade-off mechanism (Kusev et al., 2009, 2017, 2020; Pothos et al., 2017).

### 1.3.4 Descriptive Violations of Prospect Theory

Despite the phenomenal popularity of PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), which has been cited more than 78,000 times, and its broad predictive success (for a review see Edwards, 1996), like the normative theories before it, PT has faced criticism as experimental research has revealed that human agents sometimes behave inconsistent with its predictions (e.g., Baltussen et al., 2006; Birnbaum, 2004, 2006, 2008a; Birnbaum & Chavez, 1997; Birnbaum et al., 2008; Levy & Levy, 2002; see also Edwards, 1996). For instance, PT's four-fold pattern does not account as evidence, indicating that preferences are 'constructed on the fly' (e.g., Kusev, van Schaik, & Aldrovandi, 2012; Kusev et al., 2020), and strongly influenced by context and task (e.g., Brandstätter et al., 2006; Kusev & van Schaik, 2011; Kusev et al., 2009; Payne, 1982; Slovic, 1995; Vlaev et al., 2010), as well as the method of elicitation (Hertwig et al., 2004; Kusev et al., 2020; Pedroni et al., 2017).

Crucially, the theoretical argument that the method of elicitation can influence preferences is important, as it suggests that the success of any theoretical proposal is largely determined by the elicitation method used to test and validate its claims. For example, PT was modelled using participants' risk preferences which were elicited using the certainty equivalent (CE) method in which they had to make repeated choices between an option with a certain outcome and an option with a probabilistic outcome. However, in a recent experiment Kusev et al. (2020) argued that participants demonstrated the four-fold pattern because their responses were biased by the uneven (logarithmic) distribution of the option offering the certain outcome around the EV. Accordingly, Kusev and colleagues demonstrated that when the certain options were evenly (linear) spaced around the EV, then participants were not influenced by probability levels, and therefore demonstrated the two-fold pattern of risk-seeking in the domain of loss and risk-aversion in the domain of gain. Furthermore, as participants in Kusev et al.'s experiment participated in experimental conditions with both logarithmically and linearly spaced gamble options, they demonstrated preference reversals. Therefore, collectively, the results revealed that the four-fold pattern of risk preferences predicted by PT is an artefact of the elicitation method.

A further example demonstrating the importance of the method of elicitation can be seen in Hertwig et al. (2004; see also Barron & Erev, 2003), who argued that the decisions typically made in daily life are not represented by the probabilistic choice options used to model PT or used to validate theories in most of the research exploring risky judgement and decision-making. Specifically, Hertwig et al. (2004; see also Barron & Erev, 2003) drew a distinction between preferences elicited from description (decision from description), where participants are asked to make a choice between options for which they are given probabilistic information, and preferences elicited from experience (decision from experience), where participants have to gain information about the options from experience by sampling their outcomes and remembering the frequency of the outcomes. Crucially, this interpretation has been supported by subsequent research which revealed a discrepancy between how small probability events are interpreted between decisions from description and decisions from experience. In particular, there is a description-experience gap where participants making decision from description tend to overweight small probability events as predicted by PT (e.g., Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), whilst participants making decisions from experience tend to underweight small probability events (e.g., Barron & Erev, 2003; Hau et al., 2010; Hertwig & Erev, 2009; Hertwig et al., 2004; see Hertwig et al., 2006). This has led to a call that decisions from description and decisions from experience require separate descriptive theories (Hertwig et al., 2004; although see Fox & Haddar, 2006; Rakow et al., 2008).

The description experience gap has been largely attributed to under sampling prior to choice which results in the underweighting of small probability events as they are less likely to be experienced (Fox & Haddar, 2006; Hau et al., 2008; Hertwig & Pleskac, 2008, 2010; Hertwig et al., 2004). Although, in contrast to this perspective, the description-experience gap has been found in studies which have eliminated the possibility of under sampling (e.g., Barron & Ursino, 2013; Hau et al., 2008; Ungemach et al., 2009). Therefore, in addition to under sampling, the description-experience gap has been linked to psychological effects, including the effect of recency on memory (Hertwig et al., 2004; although see Ungemach et al., 2009), and the overweighting of extreme outcomes (Ludvig et al., 2014), among others (e.g., Hertwig et al., 2018; Hills & Hertwig, 2010; Hotaling et al., 2019; Wulff et al., 2015; for a review see Wulff et al., 2017).

Taken together, behavioural research has revealed that whilst some psychological effects do appear to consistently influence risky choice preferences (e.g., gain and loss framing; Kusev et al., 2020), overall human decision-makers do not abide by normative assumptions. In contrast, a relatively large body of behavioural science research has provided evidence that human preferences appear to be 'constructed on the fly' (Kusev et al., 2020) and influenced by effects from context and task, as well as the method of elicitation (e.g., Kusev et al., 2009; Kusev, van Schaik, & Aldrovandi, 2012; Kusev et al., 2020; Kusev & van Schaik, 2011; Stewart et al., 2003; Stewart et al., 2005; Stewart et al., 2006; Payne, 1982; Payne, Bettman, & Johnson, 1992; Pedroni et al., 2017; Slovic, 1995; Vlaev et al., 2010).

## 1.4 Judgement and Decision-Making based on Experience and Sampling

### 1.4.1 Evidence in Favour of Absolute Value Representations (Desirability)

Psychophysics research is concerned with understanding how objective magnitudes of stimuli are translated into subjective sensation (Weber, 2004). Crucially, similar to the normative assumption that people have internal scales of utility which are used to guide decision-makers towards expected value maximisation, classic (and prominent) theories of psychophysics assume that people possess internal scales on which their subjective interpretations of objective magnitudes are captured (Chater & Vlaev, 2011). Given this similarity, it is unsurprising that more contemporary psychophysics research which has demonstrated relative judgement (discussed in sub-section 1.4.2) has been used as inspiration for the development of judgement and decision-making theories (e.g., DbS) which also assume that people's interpretation of attribute values is relative. Accordingly, given the relevance of psychophysics research to judgement and decision-making research, particularly DbS (a core theory in this thesis), I will now briefly discuss major theories of psychophysics.

Whilst, classic theories of psychophysics agree that people possess internal scales on which their subjective interpretations of objective magnitudes are captured (Chater & Vlaev, 2011), there is an unresolved (Krueger, 1989) debate about whether people's internal scales are best represented linearly, logarithmically, or as a power function (Dehaene, 2003). For instance, Weber identified that the minimum change that a person can detect in stimulus magnitude can be identified using just noticeable difference (JND), which is a constant fraction of the initial stimulus (Algom, 2021). For example, people can just notice a difference between a reference weight of 100 grams and a comparison weight of 103 grams, but cannot differentiate between weights weighing 1,000 and 1,003 grams (Nutter Jr & Esker, 2006). Instead, the JND for a weight weighing 1,000 grams is 1,030 grams (Nutter Jr & Esker, 2006). Although, Weber's Law is mute about weather all JNDs are equal (Algom, 2021).

Building upon the work of Weber, Fechner argued that a relationship between stimulus intensity and perceived magnitude can be determined if the validity of Weber's law is assumed (that JND is a constant fraction of the stimulus), and it is also assumed that each JND is equal and produces the same subjective change in sensation (Algom, 2021; Nutter Jr & Esker, 2006). Specifically, Fechner proposed that the magnitude of a stimulus can be determined by adding JNDs onto the threshold level of detection (the first JND; Nutter Jr & Esker, 2006). Accordingly, if a weight is 5 JNDs above the threshold level, then it should be perceived as half as heavy as a weight which is 10 JNDs above the threshold level. However, more recently Stevens argued that the relationship between stimulus magnitude and perceived intensity is better represented by a power law function (Chater & Vlaev, 2011).

### 1.4.2 Psychophysical Evidence Against Absolute Value Representations

In contrast to aforementioned theories of psychophysics which assume that people's representations of magnitudes are absolute, some classic theories suggest that people's psychophysical judgements are determined by the ordering of previously encountered stimuli. For instance, Adaptation Level Theory (see Helson, 1947, 1948) posits that people's subjective judgements of attributes are not influenced by absolute values, but are instead relative to an adaptation level (a current reference point; Kahneman & Tversky, 1979; for a review see Edwards, 2018) constructed by the weighted mean of the values of past stimuli (Luhmann & Intelisano, 2018). Accordingly, the adaptation level - which is constantly updated as new stimuli are experienced - determines whether stimuli are experienced as positive (above the adaptation level), neutral (equal to the adaptation level), or negative (below the adaptation level); (Luhmann & Intelisano, 2018). For example, the weight of an object will be experienced as heavy if it is above the adaptation level (i.e., if it is heavier than the weighted mean of previous objects) and light if it is below the adaptation level (i.e., if it is lighter than the weighted mean of previous objects).

Moreover, in congruence with Adaptation Level Theory (see Helson, 1947, 1948), Range-Frequency Theory (Parducci, 1965; see also Parducci, 2011) assumes that novel stimuli are compared against previously encountered stimuli. However, in contrast to Adaptation Level Theory, Range-frequency Theory assumes that the evaluation of novel stimuli is determined by two factors: (i) the range principle and (ii) the frequency principle (also referred to as the rank principle; e.g., Aldrovandi et al., 2015). Specifically, with regard to the range principle, novel stimuli are judged according to how they relate to the minimum and maximum distribution of previously encountered stimuli (Aldrovandi et al., 2015; Luhmann & Intelisano, 2018). With regard to the frequency/rank principle, novel stimuli are evaluated according to where they rank with the frequency of previously encountered stimuli (Aldrovandi et al., 2015; Luhmann & Intelisano, 2018). Accordingly, within the domain of psychophysics, the range and frequency/rank principles have been demonstrated to influence people's judgements about perceptual stimuli (e.g., Parducci & Perrett, 1971).

Subsequently, contemporary research has provided further evidence that the context in which stimuli are presented influences people's psychophysical judgements (Lockhead, 2004). Specifically, due to information processing constraints, people's psychophysical judgements are relative to context and recent memory, and thus prone to influences from sequence effects (e.g., Chater & Vlaev, 2011; Kusev et al., 2011; Kusev, Tsaneva-Atanasova, et al., 2012; Lockhead, 1992, 2004; Stewart et al., 2003, 2005; see also Garner, 1954). For example, Kusev et al. (2011) found that participants asked to make judgements about the frequency of sequentially encountered stimuli (e.g., auditory stimuli) made their judgements using a simple heuristic which exploited a sequence effect (participants judged that the first repeated category in a sequence as the more frequent category), rather than considering the absolute frequency of each category in the sequence. However, whilst the proposal that people's psychophysical judgements are influenced by past experiences is well accepted, in their relative judgement model Stewart et al. (2005) took this perspective further by proposing that people do not possess (or do not use) long term representations of absolute values. Thus, according to the relative judgement model when people judge the magnitude of a current stimulus, they must do so relative to the magnitude of the immediately preceding stimulus. Despite the compelling empirical evidence provided by Stewart and colleagues, more recently Edwards et al. (2012) demonstrated that people can switch between absolute and relevant judgement (and categorisation) of visual stimuli depending on contextual factors. Thus, the research by Edwards and colleagues implies that people do have long term representations of absolute values, which are used in particular circumstances (e.g., having larger categories of similar stimuli to judge).

However, demonstrations of relative judgement are not unique to psychophysical studies, as they have also been found in the domain of risky judgement and decision-making. Specifically, research has demonstrated that people's certainty equivalents for risky gambles (Birnbaum, 1992; Stewart et al., 2003), judgements regarding the attractiveness of risky prospects (Mellers et al., 1992), and risky decisions (Vlaev et al., 2007) are influenced by previously considered options and also options in the immediate context.

### 1.4.3 Decision by Sampling Relative Rank Model: Sampling and Binary Comparison Cognitive Mechanisms

Motivated by evidence that people's judgements and decisions are relative and informed by experience, Stewart et al. (2006) developed the Decision by Sampling (DbS) relative rank model, which offers a process level account of how people evaluate attribute information and make judgements and decisions (Stewart et al., 2006). Accordingly, in contrast to classical theories from psychophysics (e.g., see Chater & Vlaev, 2011) and behavioural economics (e.g., Kahneman & Tversky, 1979; Savage, 1954; Tversky & Kahneman, 1992; von Neumann & Morgenstern, 1947), DbS does not assume that people possess stable internal weighting functions and are not able to form or use absolute representations of attribute values (Stewart et al., 2006; see Stewart et al., 2005). Instead, Stewart and colleagues (see also Stewart, 2009; Stewart & Simpson, 2008; Vlaev et al., 2011) argued that the subjective worth of an attribute value (e.g., an amount of money) is represented by its relative rank within the attribute (e.g., money) when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory or the immediate context). Specifically, DbS assumes that people construct relative ranks using three domain-general cognitive tools: (i) sampling from experience; (ii) binary ordinal comparison; and (iii) frequency accumulation – tallies the number of favourable comparisons for each attribute value (relative rank is the proportion of favourable comparisons; Stewart et al., 2006; Stewart, 2009; see also Stewart & Simpson, 2008). For example, consider how DbS proposes that a £20 win would be evaluated in the context of the following sample of values from experience:

1. £2, £7, £15, £30, and £40

According to DbS, to evaluate the attractiveness of the £20, it would be necessary to determine its relative rank within the sample. Therefore, DbS assumes that the £20 would be compared binary against each of the sampled values, and that for each outcome which favours the £20 (each time £20 is larger) its frequency accumulator would increase by a single increment. Accordingly, in this example £20 would be favourably compared against the sampled values of £2 (0/5), £7 (1/5), and £15 (2/5) but not £30 (4/5) and £40 (5/5). Therefore, as £20 would win in three of the comparisons it would have a relative rank of 3/5, and as this is a mid-ranking value it would likely be evaluated as reasonably attractive. Now, consider how a £20 win would be evaluated in the context of the following sample of values from experience:

2. £21, £28, £30, £35, and £40

In this sample, the £20 win would not be favourably compared against any of the sampled values (£20 – 0/5, £21 – 1/5, £28 – 2/5, £30 – 3/5, £35 – 4/5, £40 – 5/5). Therefore, as it would have the lowest relative rank (0/5) in this distribution of sampled values, it would be evaluated as a very unattractive win. Accordingly, even though the absolute value of the amount being judged (£20) is constant across both examples, as £20 would rank higher in the first example (3/5) than in the second example (0/5), DbS predicts that the £20 would have a higher subjective value and be evaluated as more attractive in the context of the first distribution of sampled values, then in the context of the second distribution of sampled values. This simple example of relative judgements captures the core DbS prediction that the distribution of sampled values strongly influences people's evaluation of attribute values (their judgements of subjective value), and their subsequent judgements and decisions in a predictable manner (e.g., Stewart & Simpson, 2008; Stewart et al., 2006; Stewart et al., 2015; Stewart, 2009; Ungemach et al., 2011; Walasek & Stewart, 2015; 2019).

For instance, assuming that the distribution of attribute values in memory reflect reality, Stewart et al. (2006; see also Stewart, 2009) demonstrated that a random sample from one year of credits and debits from a leading UK bank could explain the origin of PT's S-shaped hypothetical value function. Specifically, in the domains of gain and loss Stewart et al. (2006; see also Stewart, 2009) found that credits and debits were negatively skewed (many small amounts but relatively fewer larger amounts), and therefore DbS predicts a subjective value function that is concave for gains and convex for losses (as assumed by PT). Moreover, Stewart and colleagues found that there were more small debits than small credits, and thus provided evidence that a loss of a monetary amount will have a higher relative rank than a gain for the same monetary amount (loss aversion). Furthermore, Stewart et al. (2006) demonstrated evidence that the real-world distribution of probability phrases represents the shape of PT's probability weighting function. Therefore, taken together, Stewart and colleagues demonstrated that when DbS predictions are applied to the real-world distribution of gains, losses and probability phrases, human agents will demonstrate subjective value and probability weighting functions which closely match those modelled by PT. Accordingly, DbS can explain the four-fold pattern or risk preferences predicted by PT without assuming that people possess stable psychological features (e.g., psychoeconomic functions, and trait-like loss-aversion) or engage in computational processing.

Subsequent evidence from eye-tracking studies (Noguchi & Stewart, 2014; Stewart et al., 2016) supported DbS's process level account that human agents compare between options in a single attribute, and therefore DbS has been extended by Noguchi and Stewart (2018) to account for the attraction (Huber et al., 1982), similarity (Tversky, 1972a) and compromise effects (Simonson, 1989) during multi-alternative decisions. However, despite this recent advancement, the majority of DbS studies have explored human risk preferences and have demonstrated that manipulating the intra-experimental (within) distribution of recently sampled values determines the shape of subjective value, weighting and discounting functions[4] (Stewart et al., 2015; also see Alempaki et al., 2019). Accordingly, DbS research predicted and revealed that people's risky choices are influenced by recent experiences (e.g., Stewart et al., 2015; Ungemach et al., 2011; Walasek & Stewart, 2015, 2019).

For instance, Ungemach et al. (2011) demonstrated that participants' risky choice preferences were influenced by recently experienced prices (sampled monetary amounts) in live and experimental contexts. Specifically, in one experiment, participants were asked to choose between a safe gamble option offering a high probability of winning a smaller monetary prize (55% chance of winning £0.50), or a risky gamble option offering a low probability of winning a larger monetary prize (15% chance of winning £1.50). However, prior to making a choice, participants sampled monetary amounts either inside the range of the gambles' prizes (£0.74 and £1.07) or outside (below and above) the range of the gambles' prizes (£0.19 and £3.80). Accordingly, in congruence with DbS, Ungemach and colleagues predicted that because the relative rank difference between the gambles' prizes was larger when sampled amounts were inside the range of the gambles' prizes than outside the range of the gambles' prizes, more participants would choose the risky option with sampled monetary amounts (prices) inside the range of the gambles' prizes than outside the range of the gambles' prizes (see Figure 4).

[4] It is important to note that DbS does not assume the existence of weighting functions. However, DbS experiments demonstrate that if they do exist, then they are malleable.

**Figure 4**

*Relative Rank Difference of the Safe and Risky Gambles in Ungemach et al. (2011)*


Consistent with their prediction, Ungemach et al. (2011) found that participants who sampled amounts inside the range of the gambles' prizes chose the risk gamble option more, than participants who sampled amounts outside the range of the gambles' prizes. This behaviour was predicted by Ungemach and colleagues because for participants who sampled amounts inside the range of the gambles' prizes the relative rank difference between the safe and risk gamble prizes was large (2/2 – 0/2 = 2/2), and therefore the risky gamble prize seemed very attractive. In contrast, for participants who sampled amounts outside (below and above) the range of the gambles' prizes, the relative rank difference between the safe and risk gamble prizes was small (1/2 – 1/2 = 0/2) and therefore the prize for the risky gamble did not seem more attractive than the prize for the safe gamble, leading to a majority preference for the safe gamble. Accordingly, one possibility is that when the relative rank difference between the gambles' prizes was small/equal, participants may have considered the large difference on the probability attribute, which favoured the safe gamble.

## 1.5 Judgement and Decision-Making: Simple Theoretical Mechanisms of Behaviour

### 1.5.1 Bounded Rationality

In contrast to the assumptions made by EUT (von Neumann & Morgenstern, 1947) and SEU (Savage, 1954), Simon (1955, 1956) argued that human agents are unable to maximise their utility or perform computation on all decisions. This is because to do so would require an immense amount of information (e.g., regarding options and their possible outcomes), time, energy, and computational ability, as well as 'essentially unlimited demonic or supernatural reasoning power' (Gigerenzer et al., 1999, p. 7). Accordingly, Simon (1955; 1956, 1990; see also Gigerenzer et al., 1999; Payne, Bettman, & Johnson, 1992; Simon, 1978) proposed that human agents possess bounded rationality because they must operate within the limits of their evolved cognitive architecture and computational ability, as well as the structure of the task and information in the environment (e.g., the availability of information). To do this, Simon suggested that human agents employ simple heuristic mechanisms, which simplify complex tasks and enable them to satisfice[5]; to find outcomes that are good enough to satisfy a predetermined aspiration level (Simon, 1955, 1956, 1990; see also Simon, 1978). However, crucially, satisficing behaviour is not necessarily optimal or rational in the normative sense (Gigerenzer et al., 1999; see Simon, 1990). Supporting evidence for Simon's proposal comes from recent research by Pothos et al. (2021) which has revealed that whilst human agents are capable of rational reasoning (i.e., Bayesian inference), when overloaded with information they simplify information processing and reason less rationally.

Simon's proposal that human agents overcome bounded rationality by using simple heuristics, has had a significant influence on the narrative of judgement and decision-making research (March, 1978). For instance, evidence has revealed that human information processing is contingent on task (characteristics of the task) and context (associated with the attribute values) effects (for a review see Payne, 1982; Payne, Bettman & Johnson, 1992; see also Einhorn & Hogarth, 1981). For example, across a number of experiments Payne (1976) demonstrated that information processing varies as a function of task complexity. Specifically,

[5] In a more general sense, the term satisfice is used to refer to a mechanism which ignores information and uses little information that results in an outcome which is good enough. This is how I use the term throughout the remainder of this thesis.

participants used more normative processing with simple tasks, but were more likely to use simplifying heuristics as task complexity increased (see also Olshavsky, 1979).

Taken together, experimental findings indicate that human agents can process information using a range of compensatory strategies, as well as cognitively simple, but reasonably accurate heuristics (Payne, Bettman, Coupey, & Johnson, 1992, Payne et al., 1993) which enable them to adapt to complex environments (Payne et al., 1988; Payne & Bettman, 2004). Accordingly, as preferences are constructed 'on the fly' using a variety of means (e.g., Kusev & van Schaik, 2011; Payne, Bettman, & Johnson, 1992; Payne, Bettman, Coupey, & Johnson, 1992; Slovic, 1995) which are triggered by environmental features, inconsistencies in information processing could in some circumstances lead to preference instability (although, this might not always be the case). However, whilst the two most prominent heuristic programs, the heuristics and biases program and the fast and frugal heuristics program assume that heuristics are stored in memory and not themselves constructed (for a contrasting argument see Payne, Bettman, Coupey, & Johnson, 1992), they have reached little consensus regarding nature of human rationality and the influence of heuristics on human inferences and preferences. Therefore, both most prominent heuristic programs will now be briefly explored.

### 1.5.2 Cognitive Limitations and Behaviour: Heuristics and Biases

#### 1.5.2.1 Availability and Accessibility to Information

When people need to assess the frequency of an event or the probability of an event to occur (e.g., the risk of a marriage ending in divorce) they often do so using the availability heuristic, defined as 'the process of judging frequency by the ease with which instances come to mind' (Kahneman, 2012, p. 132; see also Tversky and Kahneman, 1973, 1974). Specifically, if recall of instances (e.g., of divorce) from memory is easy, then the judged frequency/probability will be high (e.g., the probability of divorce will be judged as high; Kahneman, 2012). In contrast, if recall of instances from memory is hard, then the judged frequency/probability will be low. Accordingly, the availability heuristic can bias people's judgements. For example, in one of their experiments, Tversky and Kahneman (1973) gave participants several letters (e.g., R) of the alphabet (all of which were more commonly the third letter in a word than the first letter), and asked them to judge: (I) if the letter was more likely to appear in the first letter position or the third letter position of a word, and (ii) to estimate the ratio for the position in which the letter appeared. The results revealed that for the majority of letters, people overwhelmingly (and erroneously) judged that they are found more frequently in the first letter position than in the third letter position. Presumably, as it is easier to search for words by their first letter than by their third, participants were able to recall more words in which began with the letter (e.g., R) than in which the letter was in the third letter position, and therefore judged the former as more frequent than the latter (Tversky & Kahneman, 1974).

Furthermore, research has also revealed that the availability heuristic can influence and bias people's evaluations of risk. Specifically, people tend to overestimate the frequency and probability of salient risks which are easy to recall from memory (e.g., the risk of dying in an accident) over other risks which are objectively more probable, but less salient and more difficult to recall from memory (e.g., the risk of dying from heart disease; Lichtenstein et al., 1978; Kuran & Sunstein, 1999). For example, due to their notoriety in mass media, people generally believe that shark attacks cause more fatalities per year than falling airplane parts, even though death from falling airplane parts is more common (Plous, 1993). Accordingly, biased perception towards risk caused by the availability heuristic can promote risk-seeking behaviour. For example, in the wake of the 9/11 terrorist attacks, many Americans temporarily substituted flying (a statistically safer method of transportation) for cars (a statistically riskier method of transportation), which resulted in an increased number of road traffic fatalities (Gigerenzer, 2004a; see also Ayton et al., 2019).

However, despite compelling evidence that people's judgements about the frequency and probability of risky and non-risky events are frequently determined and biased by the availability heuristic, for many years the nature of its underlying psychological process was ambiguous. Specifically, as discussed by Schwartz et al. (1991) the availability heuristic could be driven by two separate psychological processes: (i) the ease at which instances are recalled from memory (as assumed by Tversky & Kahneman, 1973, 1974) or (ii) content of recall – the number of instance recalled from memory (regardless of ease; see Kahneman, 2012). Therefore, to determine which of these processes underlie the availability heuristic, Schwartz and colleagues disentangled the impact of content of recall and ease of recall on participants' judgements. For instance, in one of their experiments, participants were asked to evaluate their own assertiveness after they had listed either six or twelve examples of either their own assertive or unassertive behaviour. Accordingly, Schwartz and colleagues predicted that if availability is driven by content of recall, then evaluations of assertiveness would be higher for participants who had recalled examples of assertive rather than unassertive behaviour. Moreover, it was predicted that this effect would be more pronounce when the number of examples was greater (twelve examples rather than six). In contrast, if availability is driven by ease of recall, then it was predicted that participants would rate their assertiveness as higher after recalling fewer (six) instances of assertiveness rather than a greater (twelve) number of instances, and that participants would rate their unassertiveness as higher after recalling a greater (twelve) number of instances of unassertiveness than fewer (six) instances of unassertiveness. In congruence with the assumption made by Tversky and Kahneman (1973, 1974), the results revealed that participants' evaluations of their assertiveness were influenced by ease of recall and not content of recall; participants rated their assertiveness as higher after recalling six rather than twelve examples of assertive behaviour, and rated their unassertiveness as higher after recalling twelve rather than six examples of unassertive behaviour.

Although, as it is the case with many psychological mechanisms, the influence of availability heuristic on the quality of human judgement and decision-making is determined by features of the task and context in which the heuristic is applied. Accordingly, in contrast to aforementioned experimental studies by Tversky and Kahneman, it is possible to design tasks and contexts where the availability heuristic increases people's likelihood of making normatively rational judgements and decisions. For instance, recent experimental research exploring moral preferences has revealed that increasing participants' accessibility (see Kahneman, 2003) to utilitarian information increased their likelihood of making normatively rational judgements and decisions (e.g., Kusev et al., 2016; Martin, Kusev & van Schaik, 2021; Martin, Kusev, Teal, et al., 2021). For example, by providing full accessibility to descriptive information regarding moral actions and their consequences, Kusev et al. (2016) were able to eliminate the typical inconsistency found between the trolley and footbridge moral dilemmas (Greene et al., 2001; see Martin et al., 2017). Specifically, with full accessibility the majority of participants in the footbridge and trolley dilemmas made the normatively rational choice (kill one person to save five). Whilst with partial accessibility the typical results were confirmed; in the footbridge dilemma the majority of participants did not make the normatively rational choice (they did not kill one person to save five), whilst in the trolley dilemma the majority of participants did make the normatively rational choice (they did kill one person to save five).

Interestingly, similar to the availability heuristic, in their DbS relative rank model, Stewart et al. (2006) assume that people's judgement and decisions are (in-part) informed by sampling information (e.g., monetary amounts) from memory. However, interestingly, in DbS Stewart and colleagues do not account for the possibility that people's sampling from memory might be influenced by the availability heuristic, and that this could bias the construction of preferences.

### 1.5.2.2 Representativeness

When determining the answer to probabilistic questions such as 'What is the probability that object A belongs to class B? What is the probability that event A originates from process B? What is the probability that process B will generate event A?' (Kahneman et al., 1982, p. 4), people often use the representativeness heuristic. According to the representativeness heuristic, predictions and judgements are informed by considering the degree to which an object (event; e.g., A) resembles a class (category; e.g., B) - how similar event A is to the category B (Ayton, 2005; Kahneman & Tversky, 1972, 1973). Accordingly, if event A is judged to be very similar to (and thus representative of) category B, then the likelihood that event A originated from category B is high. In contrast, if event A is judged to be dissimilar to (and thus not representative of) category B, then the likelihood that event A originated from category B is low.

However, whilst the representativeness heuristic does enable predictions and probability judgements to be made with little cognitive effort, its use can result in biased predictions and judgements as people are insensitive to the quality of evidence (Kahneman, 2012), as well as statistical rules such as sample size (Kahneman & Tversky, 1972; Tversky & Kahneman, 1971), the conjunction rule (Tversky & Kahneman, 1983), and the prior probability of outcomes – the base rate frequency (Kahneman & Tversky, 1973). As an example, consider the following experimental demonstration of insensitivity to the prior probability of outcomes. In one of their experiments, Kahneman and Tversk (1973) told participants that 100 people (30 engineers and 70 lawyers) had completed a personality test and that a short description about each person had been written. Participants were informed that they would be shown five descriptions, and that it was their job to judge the probability (from 0 – 100) that each description belonged to either an engineer or a lawyer. A second group of participants were given identical instructions, but told that the descriptions were based on interviews with 70 engineers and 30 lawyers. An example of a short description is as follows:

'Jack is a 45-year-old man. He is married and has four children. He is generally conservative, careful, and ambitious. He shows no interest in political or social issues and spends most of his free time on his many hobbies which include home carpentry, sailing and mathematical puzzles' (p. 241).

When participants were asked to estimate the probability that Jack was an engineer, the average probability ratings for the five descriptions was 50% for the group with fewer engineers, and 55% for the group with the larger proportion of engineers. Accordingly, participants in both groups ignore the respective base rate (the relative prevalence of engineers and lawyers = 70%/30%). Indeed, subsequent research by Tversky and Kahneman (1983) revealed that neglect of the base rate can lead people to demonstrate conjunction fallacy (a violation of the conjunction rule – the overall probability of two events cannot be larger than each individual event). For instance, when provided with the following description of Linda:

'Linda is 32 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations' (p. 297).

Participants were more likely to judge Linda as a bank teller who is active in the feminist movement, rather than just as a bank teller.

Interestingly, Kahneman and Tversky (1973), found that neglect of the base rate was also demonstrated by another group of participants who were provided with non-informative descriptions of the same five people. The non-informative descriptions did not reveal any information about the possible careers of the people being judged. For this group of participants, the average probability ratings were around 50% (chance level), regardless of the base rate of engineers/lawyers. Only when no information about the five people was provided prior to the judgements, did participants provide responses consistent with the underlying base rate. Based on these results, Kahneman and Tversky concluded that the representativeness neglects base rate information, and therefore biases human judgement. Only when it was not possible to use the representativeness heuristic (i.e., when no information about the people was provided prior to judgement), did participants make judgements consistent with the base rate.

However, in subsequent literature it has been argued that base rate neglect is not homogenous, and that the extent to which base rate information is used is influenced by factors such as task structure, task representation by the participants, and other experimental features (for a review see Koehler, 1996). For instance, people are more sensitive to base rate information when: (i) base rate information is manipulated within-subjects rather than between-subjects (Fischhoff et al., 1979; see Ajzen, 1977); (ii) base rate information is learned through direct experience rather than through description (Lindeman et al., 1988; see Goodie & Fantino, 1999); and, (iii) descriptive information is less diagnostic than when it is more diagnostic (Fischhoff & Bar-Hillel, 1984; Ginosar & Trope, 1980; for a review of all these factors – plus others – see Koehler, 1996). Accordingly, it is fair to say that base rate neglect is not consistent and it is determined by features of the context and task. This conclusion is consistent with research which has examined conjunction fallacy and argued that it might be an artefact of features of the task (see Kahneman & Fredrick, 2002).

#### 1.5.2.3 Anchoring

Anchoring, referred to as ‘the tendency for decision makers to bias their estimates of unknown quantities in the context or direction of a visually and/or contextually salient value’ (Shanks et al., 2020, p. 1), is a robust behavioural effect which has been demonstrated by expert and non-expert judgement and decision-making across a wide variety of domains (for reviews see Furnham & Boo, 2011; Mussweiler & Englich, 2005). For instance, it has been revealed that people's responses to general knowledge questions (see Furnham & Boo, 2011), judgement of house evaluations (Northcraft & Neale, 1987), estimates about the likelihood of nuclear war (Plous, 1989), and legal sentencing judgements (Englich, 2006; Englich & Mussweiler, 2001; Englich et al., 2005) can be influenced by the anchoring effect. Moreover, more recently it has been argued that people's judgements and decisions can also be anchored by incidental values likely to be encountered during daily life (e.g., Critcher & Gilovich, 2008; Dogerlioglu-Demir & Koçaş, 2015; Koçaş & Dogerlioglu-Demir, 2020; although see Shanks et al., 2020).

In the typical two-stage anchoring paradigm, created by Tversky and Kahneman (1974), participants are first provided with an random number (the anchor), and then asked whether the answer to a comparative question is greater than or less than the anchor. Following this, participants are then asked a related question but required to give an absolute answer (see Epley & Gilovich, 2001). For example, Tversky and Kahneman (1974) asked participants to spin a wheel of fortune rigged – unbeknownst to participants - to stop on either 10 (low anchor) or 65 (high anchor). After spinning the wheel, participants had to write the number down and were then asked two questions (Kahneman, 2012, p. 122): (i) 'Is the percentage of African nations among UN members larger or smaller than the number you just wrote?', and then; (ii) 'What is your best guess of the percentage of African nations in the UN?'. The result revealed that the mean estimate was lower (25%) for those who landed on the low anchor (10) and higher (45%) for those who landed on the high anchor (65). To explain this result, Tversky and Kahneman (1974) suggested that the anchoring effect might occur because of insufficient adjustment from the anchor. Specifically, they proposed that when making a judgement under uncertainty people begin with an anchor and then adjust upwards or downwards until a plausible estimate is reached. The estimate is then reviewed, and if deemed satisfactory adjustment is terminated and the answer given. However, Tversky and Kahneman proposed that the adjustment process was insufficient, and therefore people tend to give answers which are too close to the initial value – the anchor (see Shanks et al., 2020).

Although the adjustment proposal made by Tversky and Kahneman is intuitive, it has received little support in the empirical literature. Instead, it has been proposed and empirically demonstrated that anchoring in the typical two-stage paradigm (where the anchor is externally provided - typically, by the experimenter) is explained by the Selective Accessibility Model (e.g., Mussweiler, 2002; Mussweiler & Strack, 1999; Strack & Mussweiler, 1997; see Strack et al., 2016). According to the Selective Accessibility Model, anchoring is the outcome of interplay between two social cognitive mechanisms; (i) hypothesis-consistent testing, and (ii) knowledge accessibility (Mussweiler, 2002). Specifically, according to the model participants solve the comparative task (e.g., that the percentage of African nations among UN members larger or smaller than 65), by searching for evidence/knowledge that their estimate is congruent with the anchor (that the percentage of African nations in the UN is high – probably around 65%). However, as this evidence/knowledge is easily accessible in memory during the subsequent question, people use it to form their absolute judgement, and therefore it tends to be towards the anchor (Mussweiler, 2002).

However, there is empirical evidence that Tversky and Kahneman's (1974) insufficient adjustment proposal can explain anchoring outside of the typical two-stage experimental paradigm. Specifically, Epley and Gilovich (2001) proposed and empirically demonstrated that the anchoring effect can be explained by insufficient adjustment in experimental paradigms which use a self-generated anchor (an anchor generated by the participant) rather than an externally sourced anchor (e.g., an anchor provided by the experimenter). According to this proposal, as self-generated anchors given in response to questions such as 'in what year was George Washington elected president' (Epley & Gilovich, 2001, p. 391) are known to be incorrect, participants will not search for evidence/knowledge which is congruent with the anchor, and therefore their absolute judgement will not be influenced by accessibility to this information. For example, in one of their experiments Epley and Gilovich (2001) asked participants to verbalise their thoughts when answering questions involving either self-generated or externally provided (by the experimenter) anchor values. The results revealed that with self-generated anchors the majority of participants described a process of anchoring and adjustment. In contrast, a minority of participants provided with an externally generated anchor described a process of anchoring and adjustment.

Subsequent experiments by Epley and Gilovich (2006) revealed the psychological process underlying adjustment in response to a self-generated anchor. Specifically, similar to the process suggested by Tversky and Kahneman (1974), people incrementally adjust their estimate towards a range of estimates which are considered plausible, and continue to do so until the first satisfactory estimate is reached. Accordingly, anchoring occurs because the first satisfactory estimate tends to be towards the edge of the range of plausible estimates and towards the anchor. Moreover, research has revealed that this process of adjustment is effortful (Epley & Gilovich, 2006; see also Epley & Gilovich, 2005), and therefore people are more prone to influence from self-generated anchors when their cognition is impaired by cognitive load and alcohol consumption (Epley & Gilovich, 2006), or disrupted by motor movements (Epley & Gilovich, 2001). Moreover, more recently, in their adaptive dynamic anchoring model Kusev et al. (2018) predicted and empirically demonstrated that when processing dynamically presented events (stimuli which are sequential), people’s judgements were anchored to recent events.

Accordingly, like primacy (overweighting of information early in a sequence) and recency (overweighting of information late in a sequence), anchoring is a memory effect which influences human behaviour under particular circumstances (see Hogarth & Einhorn, 1992). In contrast, FAH is more than primacy and anchoring as it is not a general memory effect, and provides a specific process/mechanism which can explain how people make judgement and decisions; via binary comparison on the first contextually available attribute and selection of the choice option with the superior attribute value

### 1.5.3 Adaptive Behaviour: Evolutionary Supported Heuristics

#### 1.5.3.1 Fast and Frugal Heuristics

In contrast to the heuristics and biases program which treats heuristics as mental short-cuts that enable people to operate within their bounded cognitive capabilities, but are inferior to computational processing and bias behaviour, the fast and frugal heuristic paradigm does not accept normative utilitarian standards of rationality. Instead, the fast and frugal heuristics program argues that people possess a ‘toolbox’ of domain specific heuristics which, when used in a suitable environment, can lead to satisficing (good enough) outcomes (see Gigerenzer et al., 1999). Accordingly, the rationality of fast and frugal heuristics is ecological and determined by how well they match with the structure of information in the environment (Gigerenzer, 2002). Thus, fast and frugal heuristics are not good (rational) or bad (irrational) per se, but relative to the environment (Gigerenzer, 2004b). For example, Gigerenzer (2008) argued that a simple rule such as ‘don’t break ranks’ (i.e., conform with your peers) could lead someone to commit atrocities (e.g., the mass murder of Jews in a Polish village during WW2), as well as to perform acts of heroism (e.g., storm the beaches of Normandy). Therefore, to make satisficing inferences, predictions and/or decisions, a person must select from the ‘toolbox’ a heuristic which is suitable given the environment (Gigerenzer & Todd 1999; see Gigerenzer et al., 1999). Furthermore, fast and frugal heuristics enable people to operate within the limits of their cognitive architecture as they exploit evolved capacities (e.g., humans’ excellent recognition memory; Goldstein & Gigerenzer, 1999, 2002), operate quickly (hence fast) and use relatively little information (hence frugal). Accordingly, unlike the heuristics program which only considers bounded rationality in terms of people's limited cognitive capacity, the fast and frugal heuristics program also considers constraints from the environment, and thus aligns with Simon's vision of bounded rationality (Gigerenzer, 2004b, 2010; see also Gigerenzer & Gaissmaier, 2011).

Moreover, besides disagreeing about whether heuristics are rational or irrational, the fast and frugal adaptive heuristics programs also differ on their approach to psychological processing. Specifically, the fast and frugal program differs from the heuristics and biases program as it seeks to offer a process level account of human decision-making in addition to just describing how human agents behave (see Gigerenzer, 1996; Gigerenzer et al., 1999). Accordingly, each fast and frugal heuristic is constructed using a computational model (building blocks) and therefore they are expected to, at a minimum, satisfy principles for searching for alternatives and information, stopping the search, and making a decision (e.g., Gigerenzer & Todd, 1999; Goldstein & Gigerenzer, 2002; see Gigerenzer et al., 1999). Due to this process level approach and the rejection of normative assumptions of rationality, the fast and frugal heuristics program has often found itself in contention with the heuristics and biases program (see Gigerenzer, 1996; Kahneman & Tversky, 1996).

#### 1.5.3.2 Recognition Heuristic

Goldstein and Gigerenzer (1999, 2002) proposed and explored the recognition heuristic where, under certain conditions, people can use their recognition memory to infer which of two objects – where one is recognised and the other is not – has a higher value on a criterion (e.g., population size). Specifically, assuming a positive correlation between recognition and the criterion, the recognition heuristic is stated as 'If one of two objects is recognized and the other is not, then infer that the recognized object has the higher value with respect to the criterion'

(Gigerenzer & Goldstein, 2011, p. 101). For example, if asked which of two German cities (e.g., Berlin or Ulm – the objects) has a larger population (the criterion), and one of the cities is recognised (e.g., Berlin) and the other (e.g., Ulm) is not, then infer that the recognised city has a larger population. Of course, when there is a negative correlation between recognition and the criterion, the recognition heuristic assumes that a person will infer that the non-recognised objected has a higher value with respect to the criterion (Goldstein & Gigerenzer, 2002). Accordingly, it has been proposed that knowledge about the direction of the correlation between recognition and criterion can be either genetically encoded or based on experience (Goldstein & Gigerenzer, 2002). Specifically, in the case of inferences or predictions where the criterion is inaccessible (e.g., when the population of a city is unknown), it is proposed that mediators in the environment might be accessible and also reflect (but not reveal) the criterion (Goldstein & Gigerenzer, 1999, 2002). For instance, the population of a city is likely to be reflected in how frequently the city is mentioned in media (e.g., in the news), and cities which are frequently mentioned in media are more likely to be recognised by people.

As with all heuristics in the adaptive toolbox, the recognition heuristic is only used when it is ecologically rational to do so (e.g., Gigerenzer & Goldstein, 2011). For the recognition heuristic, this is when two conditions are met: (i) when one of the objects – not both – are recognised; and, (ii) when there is a strong correlation (positive or negative) between recognition and the criterion (Goldstein & Gigerenzer, 2002), as this ensures that the predictive accuracy achievable using the recognition heuristic (its recognition validity) is above the level of chance (Gigerenzer & Gaissmeier, 2011; Gigerenzer & Goldstein, 2011; see Pachur et al., 2011). Or in other words, when lack of recognition is systematic rather than random (Goldstein & Gigerenzer, 1999). Accordingly, based upon these assumptions, the recognition heuristic makes three strong predictions: (i) people should only use the recognition heuristic when it is ecologically rational to do so (i.e., when one object but not the other is recognised and there is a strong recognition validity); (ii) people use the recognition heuristic in a non-compensatory fashion (i.e., they ignore contradictory cue information so that their response is in the direction indicated by recognition); and, (iii) the recognition heuristic can produce a less-is-more effect where less information can lead to more accurate responses (Pachur et al., 2011).

So far, experimental evidence supports the first prediction, as in domains where recognition validity is high (i.e., when recognition is a good predictor), a large proportion of people's judgements are congruent with the responses that the recognition heuristic predicts (for extensive reviews see Pachur et al., 2011; Gigerenzer & Goldstein, 2011). For example, Goldstein and Gigerenzer (1999, 2002) reported that when American students were asked to choose which city was largest from pairs of German cities, between 100 – 73% of participants' responses were congruent with those predicted by the recognition heuristic. Likewise, Pohl (2006) performed a similar experiment with Swiss cities and found that 89% of participants inferences were as predicted by the recognition heuristic. Furthermore, assuming high recognition validity, the recognition heuristic is also descriptive of people's choice between stock options (e.g., Borges et al., 1999; Newell & Shanks, 2004; although not in a down market, see Boyd, 2001), and people's forecasts regarding the outcome of elections (Gaissmaier & Marewski, 2011), and sport events (e.g., Herzog & Hertwig, 2011; Pachur & Biele, 2007; Scheibehenne & Bröder, 2007; Serwe & Frings, 2006).

Furthermore, in support of the first prediction and more generally Gigerenzer and colleagues' adaptive toolbox approach, when it is not ecologically rational to use the recognition heuristic – such as when recognition validity is low (i.e., when recognition is not a good predictor) – people use the recognition heuristic less and appropriate alternate strategies more (for extensive reviews see Pachur et al., 2011; Gigerenzer & Goldstein, 2011). For instance, Pohl (2006) presented participants with pairs of Swiss cities and asked them to predict which cities are located further away from the Swiss city of Interlaken. Pohl reported that as name recognition is not significantly correlated with distance from the city of Interlaken, just 54% of inferences were for the recognised city. Similar results were found by Newell and Shanks (2004) in the context of a stock market prediction game in which participants were required to make a series of forced-choice investment decisions between two fictional companies (which had names that were either novel or had been repeated and were recognised). Specifically, Newell and Shanks found that when the company had low recognition validity, the participants chose the recognised company on just 62% of trials (they preferred to purchase and use alternate, more valid, information). However, besides low recognition validity, there are other contextual characteristics which can make the recognition heuristic inappropriate for use (for an extensive review of all characteristics see Pachur et al., 2011). For instance, people do not use the recognition heuristic if they have conclusive knowledge about the criterion. For example, when asked to choose which of two diseases is more frequent, people tend not to choose the recognised disease if they know that it is almost eradicated (Pachur & Hertwig, 2006). Moreover, people do not infer that recognised cities are larger than unrecognised cities if the recognised cities are widely known for a reason other than their size (e.g., people recognise Chernobyl because of the nuclear disaster; Oppenheimer, 2003).

Furthermore, there is evidence to support the second prediction that people use the recognition heuristic in a non-compensatory fashion (using no other cues; for a review see Pachur et al., 2011). For example, in one of their experiments Goldstein and Gigerenzer (2002) presented American participants with pairs of German city names and asked them to infer which city from each pair was larger. Accordingly, participants using the recognition heuristic should infer that recognised cities are larger than unrecognised ones. However, to offer an alternative to the recognition heuristic, participants were taught additional useful information (e.g., that in 78% of cases German cities with major league football teams are larger than German cities without major league football teams). The results revealed that in 92% of trials participants behaved consistent with the recognition heuristic and inferred that recognised cities were larger than unrecognised cities, even when they knew that unrecognised cities had major league football teams and that the recognised cities did not. Thus, congruent with the second prediction, participants largely ignored information which contradicted the recognition heuristic. Moreover, across a series of experiments, Pachur et al. (2008) extended Goldstein and Gigerenzer's experiment and found that a large proportion of participants made inferences consistent with those predicted by the recognition heuristic, even when up to three contradictory cues were provided, and thus when participants had a good reason to ignore recognition. However, a number of experiments have revealed evidence inconsistent with the prediction that the recognition heuristic is used in a non-compensatory fashion, by demonstrating that people's inferences are also influenced by other cues (e.g., Bröder & Eichler, 2006; Newell & Fernandez, 2006; Richter & Späth, 2006; for a review and critique of these studies see Pachur et al., 2008).

With regards to the final prediction, Goldstein and Gigerenzer (1999, 2002) proposed and mathematically demonstrated that in certain conditions when recognition validity is greater than knowledge validity (when the recognition heuristic has greater predictive accuracy than recognising both options), the recognition heuristic can produce a less-is-more effect where less information leads to more accurate responses. However, it is fair to say that the evidence for this prediction is mixed (see Pachur, 2010; Pachur et al., 2011). For instance, Pachur and Biele (2007) asked participants to forecast the outcome of matches for the 2004 European Soccer Championship and found that even when the condition specified by Goldstein and Gigerenzer was met (recognition validity was higher than knowledge validity), on average experts made more accurate forecasts than laypeople.

#### 1.5.3.3 Take The Best Heuristic

When the recognition heuristic cannot be used (e.g., because both objects are recognised), how should a person discriminate between the options? In such an instance, take the best heuristic assumes that human agents possess a list of cues (pieces of information) which are subjectively ranked according to their ecological validity; their relative subjective success at discriminating between the alternatives[6] (Gigerenzer & Goldstein, 1996, 1999). Accordingly, take the best assumes that the human agent will search the list of cues in descending order of their ecological validity, and then stop searching information once they reach a cue which discriminates between the alternatives (e.g., they find a cue which indicates which city is largest). Thus, take the best is assumed to be constructed of the following building blocks (Gigerenzer & Gaissmaier, 2011; see also Gigerenzer & Goldstein, 1999):

1. Search rule: search the cues in order of their subjective validity.

2. Stopping rule: stop searching as soon as a cue discriminates between the alternate options (when one alternative has a positive value on the cue and the other does not).

3. Decision rule: Predict that the alternative with the highest cue value has the higher criterion value.

Despite the simplicity of take the best relative to normative models (it is lexicographic and does not integrate information), the heuristic has demonstrated success at predicting inferences (e.g., Czerlinski et al., 1999; Graefe & Armstrong, 2012; Rieskamp & Hoffrage, 1999). For example, in a simulation Gigerenzer and Goldstein (1996; see also Gigerenzer & Goldstein, 1999) tested the accuracy of the take the best algorithm (combined with the recognition heuristic) when making inferences about the size of 83 real cities defined on 8 cues (e.g., is the city the national capital), each of which were associated with an ecological validity (the relative frequency at which the cue resulted in a correct inference), and a discrimination rate (the relative frequency at which each cue discriminates between the alternatives). Moreover,

[6] Note: the ordering of the cues is informed by the agent's subjective experience and does not necessarily align with their actual predictive validity.

Gigerenzer and Goldstein simulated limited knowledge regarding the cities (if they were recognised) and the ecological validity of the cues (if the values for each cue were known). The results demonstrated that take the best (together with the recognition heuristic) looked up an average of three cues and had an accuracy of 65.8%; offering higher than any other simulated algorithm including the standard linear regression approach (Gigerenzer & Goldstein, 1999). Furthermore, take the best demonstrated a ‘less is more’ effect where it performed better with imperfect information (Gigerenzer & Goldstein, 1996; 1999).

However, like all theoretical proposals, whilst there is evidence that take the best can predict inferences (e.g., Czerlinski et al., 1999; Graefe & Armstrong, 2012; Rieskamp & Hoffrage, 1999), it has also been criticised. For instance, in an experimental test of take the best Newell and Shanks (2003) found ‘a significant proportion of behaviour inconsistent with TTB, especially its stopping rule’ (p. 53). Specifically, they found that participants continued to search for information even after obtaining the cue with the highest ecological validity. In a subsequent study, Newell et al. (2003) found that whilst most participants were frugal, only a minority (33%) of participants behaved consistently with take the best rules (search, start, and stopping). Taken together, these results from Newell and colleagues call into question take the best claim to be a process level theory of decision-making, as there is a lack of evidence that agents consistently use take the best (and follow its rules), even in highly constrained experimental environments which promote its use (Newell & Shanks, 2003).

#### 1.5.3.4 Priority Heuristic

In contrast to the recognition and take the best heuristics, the priority heuristic is concerned with predicting human agents’ preferences between two (or more) risky gamble options which offer two outcomes each, either no possibility of loss (gains only) or no possibility of gain (zero outcomes or losses only), and when there is no dominant option or an option which has an obviously higher expected value[7]. However, like take the best heuristic, the priority heuristic is lexicographic and assumes that cues (attributes) are searched in an order[8] (see the priority rule), and that the first cue which discriminates between the choice options is used as a basis for decisions (Brandstätter et al., 2006). Specifically, to make a choice the priority heuristic proposes that people first screen the options and determine an aspiration level (10% of the highest maximum gain), and then once the aspiration level has been determined, search the cues using the following rules (Brandstätter et al., 2006, p. 413):

1. Priority rule: Consider reasons in the order: minimum gain, probability of minimum gain, maximum gain.

2. Stopping rule: Stop examination if the minimum gains differ by 1/10 (or more) of the maximum gain; otherwise, stop examination of probabilities differ by 1/10 (or more) of the probability scale.

3. Decision rule: choose the gamble with the more attractive gain (probability).

Crucially, Brandstätter and colleagues constructed the priority rule (the order in which the attributes are searched) by consulting prior behavioural research. In particular, they first argued that outcomes have primacy over probabilities; they also referred to published research which revealed that affective (emotional) reactions stem from outcomes and tend to override the impact of probabilities. Following this, Brandstätter et al., subsequently argue that minimum gains are considered prior to maximum gains and support this claim with empirical evidence (e.g., that people tend to be risk-averse in the domain of gain rather than risk-seeking). Moreover, to determine whether people generally consider probability of minimum gain before the maximum gain, Brandstätter and colleagues conducted an experiment in which participants were required to choose between gambles. Specifically, the gambles' minimum outcome was

[7] Brandstätter et al. (2008) assume that if the best choice is obvious then human agents will intuitively know which option to select, and therefore only use the priority heuristic when they cannot reach an easy decision.
[8] In contrast to take the best heuristic when the cues are subjectively ordered according to their ecological validity, the priority heuristic is not dependent on memory as all cue information is contextual.

held constant and therefore participants had to base their decision on either the maximum gains or the probability of minimum gains. Their results revealed that the majority of participants chose gambles with the smaller probability of minimum gain (thus implying that the probability of minimum gain is considered prior to maximum gain).

For an example of the priority heuristic in the domain of gain, consider the following gamble options (Brandstätter et al., 2006):

| **Gamble A** | **Gamble B** |
|---|---|
| 5% chance of winning £2,500 | 10% chance of winning £2,000 |
| 95% chance of winning £550 | 90% chance of winning £500 |

According to the priority heuristic people, upon deciding that it is not easy to choose between the options, would first screen the options to identify the highest possible gain (£2,500), and then set an aspiration level for 10% of the amount (thus £250). Following this, they would first determine if the minimum gains for each gamble differ by more than the aspiration level. As in this case they do not (they differ by just £50), the priority heuristic assumes that people would then search the probability of minimum gain in each gamble, and determine if they differ by more than 1/10. In this example, they only differ by 1/20 (5%), and therefore people would search the maximum gain for each gamble option, and chose the option offering the highest possible gain (gamble A).

Surprisingly, considering that unlike PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) the priority heuristic does not assume any integration of information, Brandstätter et al. (2006) provided an impressive list of phenomena that the priority heuristic successfully predicted during simulations (including the Allais paradox, intransitivity, the certainty effect, and PT's four-fold pattern of risk preferences). However, the priority heuristic has faced critique in experimental contexts. For instance, evidence suggests that outside of the specific choices used by Brandstätter et al. (2006) participants do not typically obey the priority heuristic's fast and frugal search rules (e.g., Glöckner & Betsch, 2008; Rieger & Wang, 2008; Hilbig, 2008; Johnson et al., 2008; for a reply to some of these critiques see Brandstätter et al., 2008). Moreover, research has demonstrated that risky choice preferences that can be better predicted by PT (Glöckner & Betsch, 2008; Rieger & Wang, 2008), or alternate predictive models such as the transfer of attention exchange model (Birnbaum, 2008b; although see Brandstätter et al., 2008).

#### 1.5.3.5 Ethics Heuristic

Classic research on moral philosophy and moral psychology was dominated by the rationalist approach to understanding how people process moral problems (for reviews see Haidt, 2001; Martin, Kusev, Teal, et al., 2021). The rationalist approach, exemplified by Bentham's utilitarianism and Kantian deontology, argues that moral acts are a product of careful reasoning and reflection (e.g., Piaget, 1932; Turiel, 1983). Accordingly, as controlled cognitive processing is a necessity for reasoning and reflection, advocates of the rationalist approach interpreted evidence demonstrating that children's moral reasoning capabilities matured over the course of their development, as support for their claims. For instance, Kohlberg (1969) presented children with hypothetical moral dilemmas (e.g., should Heinz steal a drug to save his dying wife?) and then asked the children to indicate whether the behaviour described in each dilemma is morally wrong or right, and also to justify their reasoning. From his experimental findings, Kohlberg (1973) proposed that as children age, they advance through three cognitive-developmental stages: (i) preconventional level, (ii) conventional level, and (iii) postconventional, autonomous, or principled level. Specifically, at the preconventional level children understand cultural rules and labels (e.g., right and wrong) in terms of their physical consequences but not internal feelings of guilt (they seek to avoid punishment) and behave in accordance with their own self-interest. At the conventional level, children perceive it as valuable to conform to social expectations regardless of obvious consequences, and actively contribute towards the maintenance of social order. Finally, at the postconventional, autonomous, or principled level, children develop their own moral principles and opinions and define their own moral values independently of authority.

Although, in contrast to the rationalist approach, the intuitionist approach – an alternate approach to moral philosophy and moral psychology – postulates that people's moral judgements are the product of automatic, quick, and emotionally driven intuition (Martin, Kusev, Teal, et al., 2021). Specifically, according to Haidt and colleagues (e.g., Haidt, 2001; Haidt et al., 2000) people initially react to moral dilemmas using intuition and then, having made a judgement, employ reasoning to establish a post-decisional justification. For example, Haidt et al. (1993) presented participants with a series of affectively loaded scenarios which invoked feelings of disrespect and distrust, but which were also harmless (e.g., privately cleaning one's toilet with one's own national flag, or cooking and eating one's dog for dinner after it was killed in an accident). As expected by the intuitionist approach (but not the rationalist approach), even though all scenarios made it clear that no-one was harmed, Haidt and colleagues found that participants typically judged the scenarios to be morally wrong, but were unable to provide a valid justification as to why. This effect of moral dumfounding – 'the stubborn and puzzled maintenance of a judgement without supporting reasons' (Haidt et al., 2000, p. 1)[9] – is taken as evidence that intuition precedes careful reasoning and reflection, and has been demonstrated using a variety of moral dilemmas. For instance, Haidt and Hersh (2001) found that self-proclaimed conservative participants tended to condemn homosexuality but often admitted their own state of confusion and inability to justify their condemnation.

[9] Moral dumbfounding is possibly related to the phenomenon of choice-blindness (e.g. Johansson et al., 2005), which occurs when people state a preference between two objects (e.g., female faces), are given false-feedback (in the opposite direction of their initial preferences), and then willingly justify their false preference for the option which they did not choose. Specifically, in the case of both moral dumbfounding and choice-blindness, people attempt to justify their real (in the case of moral dumbfounding) or false (in the case of choice-blindness) preferences using post-hoc explanations which are easily refutable, and which could not form the basis of their preference.

Moreover, besides participants' explicit admission of confusion, moral dumfound is also characterised by anxious/awkward laughter, long-pauses and the use of fillers such as 'um' during justification (presumably due to searching for justification), face-touching (a sign of embarrassment), and dropping of arguments upon realisation that they would not work (Haidt & Hersh, 2001; Haidt et al., 2000; Haidt, 2001). Accordingly, in contrast to Kant's original interpretation of deontology as a rationalist theory, it has been argued that moral-dumbfounding is evidence that people's deontological rules are underlined by automatic processing rather than careful reasoning (see Barque-Duran & Pothos, 2021).

In contrast to the views of Haidt and colleagues who attribute moral intuition to feelings rather than reason, Gigerenzer (2008) proposed that moral intuitions are a product of fast and frugal heuristics. Accordingly, Gigerenzer (2008) argued that moral dumbfounding is a consequence of conflict between the unconscious reasoning underlying intuition and conscious after-the-fact reasoning. To illustrate his point that people's moral behaviour often seems to be influenced by fast and frugal heuristics, Gigerenzer (2008, 2010) explained that in countries where organ donation is opt-in (people need to register to donate) there are far fewer donors that in countries where organ donation is opt-out (people need to register not to donate). Thus, Gigerenzer (2008, 2010) suggested that people's willingness to donate organs appears to be the result of a simple rule 'If there is a default, do nothing about it' (Gigerenzer, 2010, p. 539) rather than careful reasoning and reflection. However, Gigerenzer (2008, 2010) also argued that there are no heuristics exclusive to moral decisions. For example, the default heuristic is more generally known as status quo bias (e.g., Samuelson & Zeckhauser, 1988; Thaler & Sunstein, 2008), and has been demonstrated to influence non-moral decisions (e.g., financial decision-making; see Thaler & Sunstein, 2008). Furthermore, in keeping with the fast and frugal perspective on heuristics, Gigerenzer (2008, 2010) also argued that the heuristics which people employ to navigate moral dilemmas are not good or bad per se, because their outcome is dependent on the environment in which they are used. Therefore, a heuristic could lead to consequences which might be either morally applauded or condemned, and this indicates that people's moral attitudes are not solely implicit (as assumed by the intuitionalist approach). To illustrate this point, Gigerenzer (2008) explained that the use of the simple heuristic 'don't break ranks' (in other words, conform with peers) could explain atrocities committed during WW2 (e.g., the mass murder of Jews in a Polish village) as well as acts of heroism (e.g., willingness to storm the beaches of Normandy). Accordingly, it seems possible that many instances of moral inconsistency can be explained by the consistent application of fast and frugal heuristics without regarding to their ecological rationality (for examples see Gigerenzer, 2010).

## 1.6 The Influence of First Contextual Occurrences on People's Judgements and Decisions

### 1.6.1 Primacy

Arguably, the most consistent finding in research exploring human cognition is that when presented with a sequence of stimuli, people demonstrate a serial position effect known as primacy. Primacy occurs when first encountered stimuli have more impact than subsequently encountered stimuli. For instance, in memory research it is widely reported that human agents have better recall for items presented at the beginning of a sequence relative to items towards the middle of the sequence[10] (e.g., Daniel & Katz, 2018; Deese & Kaufman, 1957; Li, 2010; Murdock, 1962; Rundus & Atkinson, 1970; for a review see Stewart et al., 2004). Accordingly, the primacy effect has been included in variety of memory models (for a review see Azizian & Polich, 2007) including Atkinson and Shiffrin's (1968) multistore model of memory where it

[10] Humans also demonstrate a recency effect where they also have relatively better recall for items towards the end of a sequence when compared to items towards the middle of a sequence. However, as the recency effect is not particularly relevant to the research presented in this thesis, I have omitted it from the discussion.

was argued that successful transfer of information from short-term memory into long-term (permanent) memory is largely determined by rehearsal. Thus, Atkinson and Shiffrin proposed that primacy occurs because people pay more attention to, and have relatively more time to rehearse, early encountered stimuli that later encountered stimuli.

Although, the influence of primacy is not limited to memory and recall, and has also been demonstrated to influence human judgements and decision-making in a variety of other domains. For example, impression formation about individuals (Anderson & Barrios, 1961; Anderson, 1965; Asch, 1946; Sullivan, 2019; for a review see Forgas, 2011) and groups (Steinmetz et al., 2020) is subject to a primacy effect where our judgements of others are disproportionately informed by early information. Moreover, there is evidence that primacy influences choice preferences for sequentially presented consumer goods (Biswas et al., 2010; Carney & Banaji, 2012; Mantonakis et al., 2009; for a review see Philp & Mantonakis, 2020). For example, Mantonakis et al. (2009) asked participants to sample a series of wines (unbeknownst to participants, all samples were the same wine) and then to state which one was their favourite. The results revealed that the first sample of wine was always preferred to subsequent samples of wine.

Moreover, primacy effects also appear to influence human judgement and decision-making when options are presented simultaneously. For instance, studies have demonstrated that the order in which candidates' names are listed on election ballots can influence voters' choices, with candidates listed first often receiving a relatively greater share of votes (e.g., Chen et al., 2014; Koppell & Steen, 2004; Lutz, 2010; Miller & Krosnick, 1998; van Erkel & Thijssen, 2016; for an extensive review see Blom-Hansen et al., 2016). One possible explanation for this effect, proposed by Miller and Krosnick (1998; see also Koppell & Steen, 2004; van Erkel & Thijssen, 2016), is that in circumstances when a voter lacks information about candidates, they might use a heuristic where they choose the first candidate on a ballot as it is easily accessible, and enables choice to be made with little effort. This suggestion is supported by research which has revealed that primacy is most influential during minor elections where gaining information is effortful (they receive less media attention), and thus when voters are less informed (e.g., Brockington, 2003; Chen et al., 2014; Kim et al., 2015; Webber et al., 2014).

### 1.6.2 Predecisional Distortion of Information

When making a judgement or decision, human agents have a tendency to demonstrate predecisional distortion of information (henceforth predecisional distortion) where their evaluation of new information is biased in favour of an existing or emerging preference (e.g., Boyle & Purdon, 2019; Bond et al., 2007; Brownstein et al., 2004; Carlson & Russo, 2001; Carlson et al., 2006; Dekay et al., 2011; Hope et al., 2004; Miller et al., 2013; Russo et al., 1996; Russo et al., 1998; Russo et al., 2000; Wilks, 2002). Accordingly, when evaluating new information, predecisional distortion increases support for whichever option the decision-maker currently prefers (often the option which was favoured by first attribute information; e.g., Carlson et al., 2006).

In experimental studies, predecisional distortion is typically elicited using the stepwise evolution of preference method, as this enables the choice process to be tracked overtime (see Russo, 2014). Using this method, choice options are defined on a series of sequentially presented attributes (typically using 50 to 100-word narrative per attribute), and after the presentation of information for each attribute participants are asked to make two Likert scale judgements. Specifically, participants are asked to (i) rate whether the attribute information favours the first-choice option, the second-choice option, or neither choice option; and (ii) identify which choice option is currently preferred and by how much. For example, using this method, Carlson et al. (2006) elicited and examined the influence of predecisional distortion on consumer choice between products which participants had no existing preference for. For instance, in one of their experiments, Carlson and colleagues asked participants to make a choice between two backpacks (backpack A and backpack B) which were described on six attributes. The attributes had been pre-tested so that four were neutral and did not favour either backpack, whilst two of the attributes were diagnostic and favoured one of the backpacks (one favoured backpack A but not B, and the other favoured backpack B but not A). To install an initial preference for one of the backpacks, the experimenters manipulated the order of the first attribute so that it either favoured backpack A (but not B) or backpack B (but not A). The results revealed that participants typically chose the backpack favoured by information on the first attribute. Moreover, the results also demonstrated that participants' evaluations of subsequent attributes were distorted in favour of the backpack favoured by the first attribute.

However, predecisional distortion is not exclusive to non-risky choice and has been demonstrated to influence choices in a variety of risky scenarios (for a review see Dekay et al., 2011), including tasks with risky gambles (Bond et al., 2007; Dekay et al., 2011, 2012; Miller et al., 2013). For instance, using the stepwise evolution of preference method, in one experiment which required choice between pairs of three-outcome gambles, Dekay et al. (2011) found that participants were more likely to choose the gamble favoured by the first attribute than when it was not favoured by the first attribute. Overall, the results of their experiment revealed that participants' evaluations of attribute information (probabilities and monetary payoffs) were distorted to favour of the preferred gamble (favoured by the first attribute), and therefore mediated the influence of participants' initial preferences on their final choice.

Accordingly, predecisional distortion has been demonstrated to influence preferences for both risky and non-risky choice options, and is regarded as a robust phenomenon (Miller et al., 2013). However, one common feature of studies which investigate predecisional distortion – specifically those which use the stepwise evolution of preference method – is that attribute information is gathered sequentially over-time (Russo, 2018). The sequential presentation of information is crucial to eliciting predecisional distortion, as it gives participants opportunity to revise their preferences after considering each new piece of information, and it is this process of revision which drives the distortion of subsequent attribute information (Russo, 2014, 2018). Accordingly, whilst predecisional distortion is robust, it is eliminated through 'simultaneous instead of sequential presentation of alternatives' (Russo, 2014, p. 91), as this reduces the possibility of revising preferences after the presentation of each attribute (Russo, 2018). Additionally, Russo (2018) also speculated that people may find it less effortful to process all information at once, than to revise preferences after processing each individual attribute. Moreover, Carlson et al. (2006) found that disrupting attribute-based processing by presenting attribute information for choice options simultaneously on separate pages also eliminated predecisional distortion.

### 1.6.3 First-Run Effect

When making judgements about the frequency of sequentially encountered stimuli (e.g., auditory stimuli), Kusev et al. (2011; see also Kusev, Tsaneva-Atanasova, et al., 2012) demonstrated that human judgements are influenced by properties of the sequence. Specifically, Kusev and colleagues found that participants were influenced by a first-run effect which caused them to overestimate the frequency of a category when it was the first repeated category in a sequence. For instance, in one experiment, Kusev et al. (2011) presented participants with two sequences which contained an equal number of geometric shapes (circles or triangles). In one condition, the first-run was of circles, whilst in the second condition the first-run was of triangles. The results demonstrated that when the first-run was triangles participants overestimated the frequency of triangles and underestimated the frequency of circles. In contrast, when the first-run was circles participants overestimated the frequency of circles and underestimated the frequency of triangles.

Moreover, in a separate experiment, Kusev and colleagues demonstrated a disassociation between participants' judgements of item frequency and recall for the item. Specifically, participants' judgements about the frequency of stimuli (cities or animals) were influenced by the first-run effect, but not by participants' recall. This result is not consistent with prior research indicating that judgements of frequency are based on recall from memory. For instance, the availability heuristic (Tversky & Kahneman, 1973, 1974) and availability process model (Hastie & Park, 1986) both suggest that frequency judgements should be informed by the ease at which instances of the item can be recalled from memory.

Taken together, Kusev et al. (2011) and Kusev, Tsaneva-Atanasova, et al. (2012) argued that the first-run effect is a simple cognitive heuristic which enables human agents to make frequency judgements within the bounds of human cognition. Accordingly, rather than sample from memory, human agents base their inferences regarding the frequency of an item in a category on features of the sequence (Kusev et al., 2011). Specifically, the item which is first repeated in the sequence is judged to be more frequent regardless of its objective frequency.

### 1.6.4 Anchoring on The First Information

Anchoring is 'the tendency for decision makers to bias their estimates of unknown quantities in the context or direction of a visually and/or contextually salient value' (Shanks et al., 2020, p. 1), and has been demonstrated to influence people's behaviour across a variety of domains (for reviews see Furnham & Boo, 2011; Mussweiler & Englich, 2005). For instance, Tversky and Kahneman (1974) famously demonstrated that participants' judgements regarding the percentage of African nations in the UN were influenced by a wheel of fortune. Specifically, participants' mean estimate was lower (25%) when the wheel landed on a lower number (10), and higher (45%) when it landed on a higher number (65). However, after extensive debate, it seems that the anchoring effect can be explained by two different theories. The first, Tversky and Kahneman's (1974) anchoring proposal explains the anchoring effect in the context of self-generated anchors (anchors generated by a participant; Epley & Gilovich, 2001). The second theory, the Selective Accessibility Model explains the anchoring effect in the context of externally provided anchors (anchors generated by someone/something else; (e.g., Mussweiler, 2002; Mussweiler & Strack, 1999; Strack & Mussweiler, 1997; see Strack et al., 2016).

According to Tversky and Kahneman's (1974) anchoring proposal, when making a judgement under uncertainty people begin with an anchor and then adjust upwards or downwards until a plausible response is reached. The estimate is then reviewed, and adjustment is terminated if the estimate is deemed to be plausible. In contrast, the Selective Accessibility Model (e.g., Mussweiler, 2002; Mussweiler & Strack, 1999; Strack & Mussweiler, 1997; see Strack et al., 2016), proposes that anchoring is the outcome of two cognitive mechanisms: (i) hypothesis-consistent testing, and (ii) knowledge accessibility (Mussweiler, 2002). Thus, people solve comparative tasks by searching for evidence/knowledge that their estimate is congruent with the anchor. Although, as this evidence/knowledge is easily accessible in memory during the subsequent question, people use it to form their absolute judgement, and therefore it tends to be towards the anchor (Mussweiler, 2002).

Although, crucially, whilst Tversky and Kahneman's adjustment proposal and the Selective Accessibility Model assume different psychological processing, they both predict that the first piece of information (the anchor) is particularly salient and has a disproportionally strong influence on people's behaviour. Accordingly, it is fair to say that overall, the anchoring effect can be interpreted as a further example that first information has a special influence on human cognition.

### 1.6.5 First is Best Effect

In a relatively recent experimental article involving sequentially presented stimuli, Carney and Banaji (2012) demonstrated a first is best effect where, under certain conditions, participants preferred and chose the option presented first. For instance, in one of their experiments Carney and Banaji asked participants to make a choice between two different types of bubble gum which were placed sequentially on a clipboard. Moreover, the participants were either required to make their decision immediately or given time to deliberate. The results revealed that in conditions which required an immediate decision participants chose the bubble gum presented first more than the bubble gum presented second (62% and 38% respectively). In contrast, participants in the deliberative choice condition were equally likely to choose each type of bubble gum (51% for the bubble gum presented first and 49% for the bubble gum presented second). Accordingly, participants' preferences were influenced by the order in which options were presented when they made immediate but not deliberative choices. Thus, the results from Carney and Banaji suggest that at an automatic level of cognition (i.e., System 1) first options are psychologically unique and likely help human agents to operate within the bounds of their rationality.

## 1.7 Desirability

In their DbS relative rank model, Stewart et al. (2006) proposed that the subjective worth of an attribute value (e.g., an amount of money) is represented by its relative rank within the attribute (e.g., money) when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory or the context). Accordingly, human decision-making is based on relative ranks, which are constructed using three domain general cognitive tools: (i) sampling from experience; (ii) binary ordinal comparison; and (iii) frequency accumulation – tallies the number of favourable comparisons for each attribute value (relative rank is the proportion of favourable comparisons; Stewart et al., 2006; Stewart, 2009; see also Stewart & Simpson, 2008). For example, according to DbS you would evaluate the attractiveness of the £20 by comparing it against a sample of amounts from experience (e.g., £2, £7, £15, £30, and £4). In the context of this sample, £20 would be ranked as 3/5 as it favourably compares against £15 (2/5) and £20 (3/5), but not £30 (4/5) and £40 (5/5). Therefore, as £20 has a rank (3/5) at the middle of the sample it would not be regarded as particularly attractive or unattractive. Accordingly, DbS predicts that the distribution of values which people sample from context and/or memory determine their evaluation of attribute values (their judgements of subjective value), and subsequently their judgements and decisions (e.g., see Stewart, 2009; Stewart & Simpson, 2008; Stewart et al., 2006; Stewart et al., 2015; Ungemach et al., 2011; Walasek & Stewart, 2015, 2019).

For example, Ungemach et al. (2011) demonstrated that recently sampled prices influenced participants' choice preferences. Specifically, participants' choices for a safe (55% chance of winning £0.50) or risky (15% chance of winning £1.50) gambles were constructed in relation to sampled monetary amounts which were either within (£0.74 and £1.07) or below and above (£0.19 and £3.80) the range of the gambles' prizes (see Figure 4). Accordingly, participants chose the risk gamble more when the sampled amounts were within the range of the gambles' prizes than when the sampled amounts were below and above the range of the gambles' prizes. This pattern of preferences was predicted in advance by Ungemach and colleagues using DbS because when sampled prices were inside the range of the gambles' prizes there was a large relative rank difference between the safe and risky gambles prizes, which made the risky gamble appear much more attractive (rank 0=£0.50; rank 1=£0.74; rank 2=£1.07, and rank 3=£1.50; a relative rank difference of 3/3). However, when sampled prices were below and above the range of the gambles' prizes, the relative rank difference between the safe and risky gambles' prizes was small (rank 0=£0.19; rank 1=£0.50; rank 2=£1.50, and rank 3=£3.80; a relative rank difference of 1/3), and therefore the risky gamble prize did not seem particularly more attractive than the safe gamble prize. Although, one possibility is that with a small relative rank difference between the gambles' prizes (i.e., with sample prices below and above the prizes), participants may have based their choice on the probability attribute, which favoured the safe gamble.

However, consistent with evidence that people can use a variety of psychological processing mechanisms (e.g., Kusev & van Schaik, 2011; Payne, Bettman, Coupey, & Johnson, 1992), I argue that the small monetary prizes (£0.50 and £1.50) used by Ungemach et al. (2011) were negligible and did not trigger participants' choice preferences. Therefore, lacking any particular preference to reach a decision, the participants were prompted to sample from experience. Accordingly, I propose that increasing the desirability of the risky gamble (e.g., by offering a larger monetary prize) will increase participants' preferences for the risky gamble regardless of their sampling experience. As an example, I suggest that with a choice between a safe gamble (55% chance of winning £0.50) and a risky gamble (0.15% chance of winning £150) participants will choose the risky gamble, more than with a choice between a safe gamble (55% chance of winning £0.50) and a risky gamble (15% chance of winning £1.50), regardless of the distribution of sampled values. Thus, I also propose that people will only sample from experience when they chose between gambles with negligible monetary prizes.

My desirability proposal – explored in Experiment 1 of this thesis – cannot currently be accounted for by PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), and DbS which predicts that human risk preferences are informed only by relative ranking (and thus influenced solely by the distribution of sampled values), and not by absolute values (Stewart et al., 2006). Moreover, like EUT (von Neumann & Morgenstern, 1947). DbS is a general theory of judgement and decision-making which predicts that all judgements and decisions are made using the same psychological process (relative ranking) and cognitive tools (sampling, binary ordinal comparison, and frequency accumulation). Accordingly, any theory which proposes that people's psychological processing varies depending on context and task-related factors (as I am doing here) goes against the core idea that DbS is the general 'catch all' theory which can explain all human judgements and decisions regardless of domain.

## 1.8 The First Attribute Heuristic

### 1.8.1 The First Attribute Heuristic: A Binary Comparison on The First Contextually Available Attribute

Furthermore, in this thesis I identify and explore the novel psychological mechanism, first attribute heuristic (FAH), where participants' risky and non-risky preferences (judgements and decisions) are determined using a single cognitive tool, and binary comparison. Specifically, with FAH people's preferences are determined by binary comparison on the first contextually available attribute (in this thesis, always the attribute in the top left position[11]), and they prefer the option with the dominant value on the first contextually available attribute relatively more than the option with the inferior value on the first contextually available attribute. Whilst my FAH proposal is novel, my assumption that people often depend on binary comparison is consistent with psychophysics research investigating relative judgement, as well as findings from a broad variety of judgement and decision-making theories which either implicitly or explicitly assume that binary comparison influences people's behaviour.

For instance, with regard to decision-making research, theories including reason-based choice (Shafir et al., 1993), elimination by aspects (Tversky, 1972a, 1972b), the attraction effect (Huber et al., 1982), and Tversky's (1969) account for intransitivity of preferences are dependent on people being able to make binary comparisons between contextually available information. However, people can also make binary comparisons with information not contextually available. Specifically, Kusev and colleagues' judgement relative to patterns

[11] Or just the first position, when only one choice option is available (e.g., in SE conditions of Experiments 6 and 7).

model (Kusev et al., 2011; Kusev, Tsaneva-Atanasova, et al., 2012), other relative judgement research (e.g., Stewart et al., 2003; Stewart et al., 2005) and theories including DbS (Stewart et al., 2006) require participants to make binary comparisons between novel stimulus and preceding (non-contextual) stimuli from their memory. Similarly, the peak end rule (Redelmeier & Kahneman, 1996; Kahneman et al., 1993) and the focusing illusion (e.g., Kahneman et al., 2006; Schkade & Kahneman, 1998) also assume binary comparison between non-contextual information; one's memories of salient past experiences (peak end rule), or one's current state and an imagined state (focusing illusion). Accordingly, as each of these theories directly or indirectly provide evidence that people's behaviour is influenced by binary comparison – the main assumption of FAH – I will now explore each of them, starting with reason-based choice.

According to reason-based choice (Shafir, 1993; Shafir et al., 1993) when making difficult choices between alternatives (e.g., holiday destinations), people focus on identifying reasons to support their choice, and then use these reasons as the basis for choice. As a consequence of this approach, in contrast to the assumptions of normative theories of decision-making (e.g., von Neumann & Morgenstern, 1947), the framing of a question strongly influences people's decisions (Shafir et al., 1993). Specifically, when people are asked to choose an option, they focus on reasons to choose an option, and when they are asked to reject an option, they focus on reasons to reject an option. Therefore, when one option has more positive and negative features and the other option fewer positive and negative features, it is possible for the majority to choose and reject the same option, depending on how the choice question is framed (accept or reject; Shafir et al., 1993). For example, Shafir (1993; see also Shafir et al., 1993) asked participants to imagine that they were on the jury of an only-child sole-custody case following a nasty divorce and that they, based on the information provided to them (shown in Table 4), had to make a decision about which parent should be given sole-custody. However, in one condition participants were to decide which parent they would award sole-custody of the child (award condition), whilst in the second condition participants were asked which parent they would deny sole-custody of the child (deny condition).

**Table 4**

*Observations Given to Participants in Shafir's (1993) Child-Custody Experiment*

| Parent A | Parent B |
|---|---|
| Average income<br>Average health<br>Average working hours<br>Reasonable rapport with the child<br>Relatively stable social life | Above average income<br>Very close relationship with the child<br>Extremely active social life<br>Lots of work-related travel<br>Minor health problems |

*Note.* Adapted from "Choosing versus rejecting: Why some options are both better and worse than others" by E. Shafir. 1993, *Memory & Cognition,21*(4), p. 549.

The results revealed that even though participants were given identical information, in the award condition 64% of participants chose to award custody to parent B and 36% of participants chose to award custody to parent A. Likewise, in the deny condition, 55% of participants chose to deny custody to parent B and 45% of participants chose to deny custody to parent A. This pattern of results was predicted by reason-based choice, because as parent A has no particularly positive or negative features there is no obvious reason to (or not to) reward them custody of the child. In contrast, there are good reasons why parent B should be awarded custody of the child (i.e., higher income and a closer relationship with the child), and also why they should not be awarded custody of the child (i.e., more active social life, more work-related travel, and more health problems). Therefore, in both tasks participants could easily justify their decision to choose or reject parent B, but not parent A. However, this explanation of the results also implies that participants compared the parents using binary comparison. Specifically, to determine that parent B has more positive/negative features than parent A, presumably participants had to compare both parents within their common attributes (i.e., on income, relationship with the child, social life and health). Accordingly, as parent A is average on each of the attributes which are common to both parents, they acted as a benchmark against which parent B was compared, and then classified as either positive or negative. Thus, as the outcome of the binary comparisons on common attributes provide participants with reason for acceptance (award) or rejection (deny) of custody, reason-based choice is not possible without binary comparison.

Like reason-based choice, Tversky's (1972a; 1972b) theory of elimination by aspects offers a non-normative approach to decision-making. Specifically, elimination by aspects is a theory of successive eliminations, which assumes that the choice-options people encounter are composed of aspects (attributes). Accordingly, to make a choice, elimination by aspects proposes that individual aspects are randomly selected with a probability proportional to their importance, choice-options which lack the selected aspect are eliminated, and that this process of elimination is repeated until only a single choice-option remains (Tversky, 1972a). For example, when looking to purchase a house, the first aspect that a person might select is a maximum price of £100,000 and therefore, any houses which cost more than £100,000 will be eliminated. Then, given the remaining houses, the person will select a second aspect, let's say minimum of three bedrooms, and any houses with fewer than three bedrooms will be eliminated. This process will then be repeated with new aspects, until only a single house remains which will then be chosen. Therefore, like reason-based choice, elimination by aspects is dependent on multiple binary comparisons at each stage of elimination as these enable the decision-maker to compare each choice-option against the selected aspect, and eliminate them accordingly. For instance, with regard to the house example, a decision-maker would only know that the price of a house exceeds the aspect of maximum price of £100,000 and should be eliminated, if they compare the price of each house against the value of £100,000 and categories it as being under or above the specified maximum price. Moreover, like in reason-based choice, the binary comparisons are within not between attributes, a criterion also assumed by FAH.

Furthermore, like elimination by aspects and reason-based choice, the attraction effect can also be explained by binary comparisons. In contrast to the rational choice axiom of regularity (see Huber et al., 2014), in their attraction effect Huber et al. (1982) demonstrated that expanding a choice set can increase the proportion of choices for an existing choice option. Specifically, Huber et al. (1982) predicted that during choice between two options (e.g., A and B) defined on two attributes requiring a trade-off (each option is superior on one attribute), the introduction of a third asymmetrically dominated option (dominated by one option – B, but not the other – A), will increase preference for the most similar option (B). Accordingly, in their experiment Huber and colleagues asked participants to choose between either three (with a decoy – asymmetrically dominated option) or two (without a decoy) choice options (one a target and one a competitor). As predicted, the results revealed that the inclusion of an asymmetrically dominated decoy option increased the proportion of participants who chose the target option relative to when the decoy was not present. Since Huber and colleagues' initial demonstration of the attraction effect, it has been argued that it can be explained by models/theories which assume that people use binary comparison. For example, Köhler (2007) proposed that people's choices are determined by a series of binary comparisons where, assuming that a person has to choose one of three alternatives, they begin by comparing two of the options, reject the option which is not preferred during the comparison, then compare the remaining options and favour the option which is preferred.

Moreover, Tversky's (1969) account for people's tendency to violate the normative axiom of transitivity is also dependent on people being able to make binary comparison between options. Specifically, to explain his transitivity finding, Tversky proposed that participants evaluated the applicants within each of the dimensions (intellectual ability, emotional stability, and social faculty) using a sequence of binary comparisons, but only when there was a large difference between the applicants on a dimension (otherwise the dimension is ignored). Thus, as the applicants differed very little on the intellectual ability dimension it was ignored, and participants instead compared the applicants on the emotional stability and social facility dimensions. On both of these dimensions the applicant with the best score was always A > B, B > C, C > D, D > E, E > F, F > G, H > I, I > J, and thus the applicants were preferred in this order. Although, when participants were then asked to make a comparison between applicants when there was a large difference on the intellectual ability dimension (i.e., comparison between applicants A and J), the intellectual ability dimension was used and thus J > A. Accordingly, like FAH, Tversky's account for intransitivity of preferences is dependent on people's ability to make binary comparisons between options within a single dimension/attribute.

However, the assumption that people can make binary comparisons is also a central component to judgement and decision-making theories which assume that people can make comparisons with non-contextually available information (i.e., recent memories, or imagined future states). For instance, research by Kusev et al. (2011; Kusev, Tsaneva-Atanasova, et al., 2012) demonstrated that people make judgements about the frequency of sequentially encountered stimuli using the first-run effect heuristic, where they overestimate the frequency of the category when it contains the first repetition in a sequence. For example, if a sequence contains two categories of geometric shapes (circle and square) and the first category to be repeated in the sequence is square, then people judge the square to be more frequent than the circle regardless of whether this is actually the case (Kusev et al., 2011). Accordingly, binary comparison between contextual available information (the novel stimulus) and non-contextual available information (memory of the immediately preceding stimulus) is a necessary component of the first-run effect heuristic as this is how participants identify when a category of stimuli has been repeated. Specifically, they must compare each stimulus in the series with the immediately preceding stimulus, and determine if there is a match. If there is a match between the stimuli, then they judge that category to be most frequent.

Although, the first-run effect is not the only theory of judgement which indicates that people can make binary comparison between information which is not available in the context. For instance, the peak end rule demonstrates that people's retrospective evaluations of unpleasant experiences are determined by their memories of their discomfort at the worst and final moments of an experience, regardless of the length of the experience (e.g., Redelmeier & Kahneman, 1996; Kahneman et al., 1993; Varey & Kahneman, 1992). For example, Kahneman et al. (1993) required participants to complete two trials across which they self-reported their moment-by-moment level of discomfort. In the first trial participants placed one hand into water with a temperature of 14 °C (a moderately painful temperature) for 60 seconds. In the second trial the participants also placed one hand into water with a temperature of 14 °C for 60 seconds, however they then had to keep their hand submerged in the water for an additional 30 seconds whilst the water temperature was gradually raised to 15°C (a slightly higher, but still uncomfortable temperature). After completing both trials, participants were asked which trial they would prefer to repeat and, in contrast to expectations of rational choice, a majority chose the longer trial (which was objectively more uncomfortable than the short trial due to its increased length). Moreover, Kahneman and colleagues found that participants' retrospective evaluations about the unpleasant experiences were predicted by averaging their self-reported discomfort at the worst and final moments of the experiences (likely due to the salience of these moments in memory). These results indicate that to generate their judgements regarding the unpleasant trials, participants made a binary comparison between non-contextual information; their memories of discomfort at the worst and final moments of an unpleasant experience. Accordingly, as the majority of participants had a fonder memory of the second trial than the first trial (due to the warmer temperature at the end of the second trial), they generally stated that they would prefer to repeat the second trial.

In addition to the peak end rule, people's judgements are also susceptible to influence from a focusing illusion (e.g., Kahneman et al., 2006; Schakade & Kahneman, 1998). Specifically, when making a judgement about their well-being, a person who focuses too much on a specific category (e.g., their income) is prone to exaggerating the impact that a change in the category (e.g., by winning the lottery) will have on their life-satisfaction (Kahneman et al., 2006). Although, in reality 'nothing that you focus on will make as much difference as you think' (Schakade & Kahneman, 1998, p. 345). Accordingly, whilst – due to the superior climate in California – people often judge that Californians are more satisfied with their life than Midwesterners, in reality, the overall life-satisfaction of Californians and Midwesterners is similar (Schakade & Kahneman, 1998). Therefore, this example demonstrates that participants' judgements about their overall life-satisfaction are largely determined by binary comparison within a specific category (i.e., the weather) between their current state (e.g., I live in the Midwest and am reasonably satisfied) and an alternate imagined state (e.g., I would be more satisfied in California as the climate is warmer). Thus, like with judgements relative to patterns and the peak end rule, the focusing illusion requires binary comparison with information which is not contextually available.

Furthermore, theories of relative judgement also provide substantial evidence that people's judgements are relative and determined by comparing novel stimuli with comparable past stimuli from memory (stimuli which belong to the same category). For example, in his adaptation level theory Helson (1947, 1948) proposed that people's psychophysical judgements regarding the intensity of new stimuli are determined by comparison with an adaptation level; a reference point which represents the weighted mean of all past stimuli which belong to the same category (Luhmann & Intelisano, 2018). For instance, consider this example from Heim et al. (2020) when a person leaves a dark room and moves into sunlight, they will initially feel blinded by the light until they adapt to the new light intensity, which will become their new adaptation level. Then, having become habituated to the new light intensity, when the person moves away from the sunlight and back into the same dark room which they previously left, they will judge that the level of light intensity is no longer adequate enough for them to see, until gradually re-adapt to the lower luminosity, which becomes the new adaptation level. Therefore, to make sense of new stimuli (to judge their intensity), adaptation level theory assumes that people make binary comparisons between new stimuli and the adaptation level. In a similar vein, Parducci's (1965; see also Parducci, 2011) Range-Frequency Theory also implies that people are able to make binary comparisons between novel stimuli and stimuli which have been previously encountered. Specifically, in Range-Frequency Theory people judge novel stimuli according to how they relate to the minimum and maximum distribution (range principle) and frequency (frequency principle) of previously encountered stimuli (Aldrovandi et al., 2015; Luhmann & Intelisano, 2018).

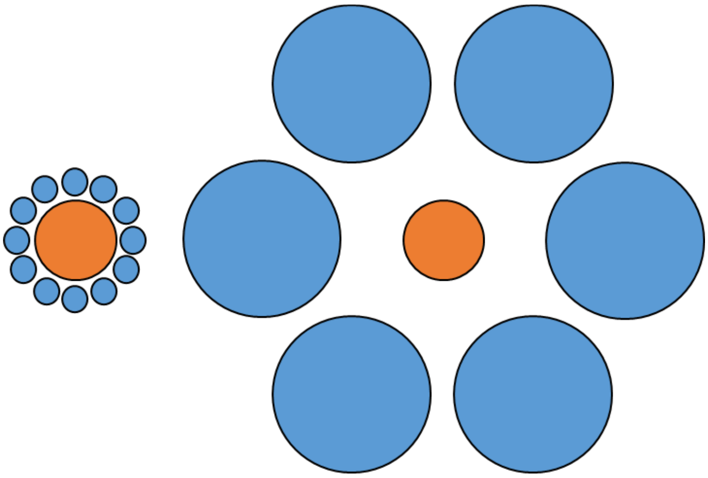
The idea that people's judgements regarding the magnitude of stimuli are informed by prior experiences has had a lasting impact on research investigation psychophysical judgements. Specifically, contemporary research has provided additional evidence that people's psychophysical judgements are relative to context and recent memory, and therefore sequence effects (e.g., Chater & Vlaev, 2011; Kusev et al., 2011; Kusev, Tsaneva-Atanasova, et al., 2012; Lockhead, 1992, 2004; Stewart et al., 2003, 2005; see also Garner, 1954). For example, Stewart et al. (2005) argued that people do not possess/use long term representations of absolute values to inform their judgements regarding stimuli magnitudes. Instead, Stewart and colleagues suggest that people can only evaluate a novel stimulus by comparing it with immediately preceding stimuli which are similar and available in short-term memory. Subsequently, in their DbS relative rank model – a theory of judgement and risky choice –

Stewart et al. (2006) proposed that people's evaluations about an attribute's value (e.g., an amount of money) are represented solely by its relative rank within the attribute (e.g., money) when compared binary against comparable attribute values (e.g., other amounts of money) sampled from experience (memory or the immediate context). Specifically, Stewart and colleagues assume that relative ranks are constructed using three domain-general cognitive tools: (i) sampling from experience; (ii) binary ordinal comparison; and (iii) frequency accumulation (Stewart et al., 2006; Stewart, 2009; see also Stewart & Simpson, 2008).

In light of the discussed literature, it is fair to say that there is substantial evidence from both judgement and decision-making and psychophysical research that people's judgements and decisions are often informed by binary comparisons between contextually available and non-contextually available information, usually within a single category/attribute. However, binary comparisons, even in their simplest form (using only contextually available information) are susceptible to bias and can lead to erroneous judgements and decisions. To demonstrate this point at a general level, I will now briefly introduce the famous Ebbinghaus illusion (see Figure 5), and explain how it can be regarded as the outcome of a series of binary comparisons. Now, look at Figure 5 and consider the size of the orange circles. Do you perceive: (i) the orange circle on the left to be larger? (ii) the orange circle on the right to be larger? Or, (iii) both orange circles to be equal in size?

**Figure 5**

*Ebbinghaus Illusion*



*Note.* Adapted from “Is the Ebbinghaus illusion a size contrast illusion?” by D. Todorović and L. Jovanović. 2018, *Acta Psychologica, 185*, p. 181.

Typically, when presented with this illusion people perceive the orange circle on the left to be larger than the orange circle on the right, even though they are equal in size. Accordingly, much research has been conducted to identify the reason for this psychological effect, and there are two leading explanations; (i) size contrast, and (ii) contour interaction (see Todorović & Jovanović, 2018; see also Jaeger & Klahs, 2015). According to the size contrast explanation, people’s judgements about the size of the orange circles are made relative to the size of the surrounding blue circles (Massaro & Anderson, 1971). Specifically, the orange circle on the left appears larger than the one on the right because it is surrounded by small blue circles, whilst the orange circle on the right appears smaller than the one on the left because it is surrounded by large blue circles. However, I believe that the size contrast explanation is dependent on a series of binary comparisons. Specifically, consider a person who begins by making a binary comparison between the orange circle on the right and the blue circles which surround it. Presumably, their comparison will indicate that in contrast to the blue circles, the orange circle is much smaller. Then, having determined that the right orange circle is relatively small, they make a binary comparison between the orange circle on the left and the surrounding blue circles, and deduce that the orange circle is much larger than the blue circles. Finally, having erroneously judged that the orange circle on the left must be larger than the orange circle on the right (because it is larger than the blue circles), a binary comparison is made between the 'large' orange circle on the left and the 'small' orange circle on the right, and it is established during the direct comparison that the circle on the left is indeed larger than the one on the right. Thus, the person erroneously concludes the outcome of the third binary comparison (that the orange circle on the left is larger) supports their previously established hypothesis (from the two indirect binary comparisons) that the circle on the left is larger than the one on the right.

Unlike the size contrast explanation, the contour interaction explanation does not consider the size of the surrounding blue circle, but instead posits that apparent differences in the size of the orange circles is due to interactions between visual contours (for a review see Takao et al., 2019). Therefore, according to this explanation, the size of the orange circle is overestimated when the blue circles are in close proximity (as on the left of the figure), and underestimated when the blue circles are further away (as on the right of the figure). However, like the size contrast explanation, I believe that that contour interaction explanation is dependent on people using binary comparisons to judge the size of the orange circles. Specifically, I consider it plausible that people make a binary comparison between the orange circle on the right and the surrounding blue circles, and due to the relatively large gap between them, erroneously perceive that the orange circle must be far away in the distance and thus small. Then, when they make a binary comparison between the orange circle on the left and the surrounding blue circles, due to the small gap between them, they erroneously perceive that the orange circle is located much closer and must therefore be larger. Accordingly, in the final binary comparison they compare the orange circle on the left (which they perceive to be near) with the orange circle on the right (which they perceive to be far-away in the distance), and therefore judge the left orange circle to be larger than the right orange circle. Thus, for both the size contrast and contour interaction explanations, I believe it is plausible that people's judgements are largely a product of three binary comparisons which use contextually available information. This results in biased perception due to errors in the third comparison, which are driven by errors in the first two comparisons.

Before moving on, I would clarify that whilst the aforementioned contextual effects in judgement, decision-making and psychophysics have explanations which either implicitly or explicitly assume that binary comparisons influence behaviour, the binary comparisons are not the only component of such explanations. Accordingly, the purpose of this section was to provide a range of examples that binary comparisons contribute towards the explanation of many psychological phenomena. To this end, it is difficult to envision how the previously discussed contextual effects could be explained without the implicit or explicit assumption that people are able to make binary comparisons between contextual information, memories, and prior experiences. This is particularly relevant to the FAH and desirability proposals because they both assume (FAH explicitly and desirability implicitly) that people are able to make binary comparisons between attribute values which are contextually available, and that these comparisons are what determine preferences.

### 1.8.2 The First Attribute Heuristic: Risky Decision-Making

In contrast to the predictions of prominent normative (EUT; von Neumann & Morgenstern, 1947) and descriptive (PT; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) theories of risky judgement and decision-making, there is a plethora of empirical evidence which indicates that people's preferences are not stable, but instead constructed 'on the fly' (Kusev, van Schaik & Aldrovandi, 2012; Kusev et al., 2020), and strongly influenced by context and task (e.g., Kusev & van Schaik, 2011; Kusev et al., 2009; Kusev et al., 2011; Payne, 1982; Slovic, 1995; Vlaev et al., 2010). For instance, a decision about whether to insure a phone worth £400 for a cost of £40 when there is a 10% risk of loss should be regarded as identical to paying £40 to avoid playing a gamble where there is a 10% chance of losing £400. However, in reality people's decisions about purchasing insurance products are influenced by information accessible in their memories (e.g., salient memories about theft), whilst gamble decisions are not (Kusev et al., 2009).

Accordingly, rather than depending solely on computational processing, people can make judgements and decisions using a variety of psychological mechanisms (Payne, Bettman, Coupey, & Johnson, 1992; see Kusev & van Schaik, 2011), which enable them to navigate their bounded cognitive capacity and exploit the structure of information in the environment (Simon, 1955, 1956). Specifically, Simon argued that to overcome their evolved cognitive constraints and to take advantage of information in the environment, people frequently substitute effortful computational processing with heuristics that produce satisficing (good enough) rather than optimal outcomes (see Gigerenzer et al., 1999; Gigerenzer & Gaissmaier, 2011). Therefore, as heuristics are non-optimal, they can bias human judgements and decisions (e.g., for a review see Tversky & Kahneman, 1974). Inspired by Simon's work, advocates of the fast and frugal research paradigm (see Gigerenzer et al., 1999) argue that people possess a 'toolbox' of domain specific heuristics which exploit evolved cognitive capabilities (e.g., humans' excellent recognition memory; Goldstein and Gigerenzer, 1999, 2002), and the structure of information in the environment. Accordingly, when heuristics from the toolbox are selected appropriately (i.e., they are well matched with the task and context), they enable people to make judgements and decisions which are ecologically rational (accurate, fast and frugal; Gigerenzer, 2002). Thus, according to this perspective, fast and frugal heuristics are not good (rational) or bad (irrational) per se as their performance is relative to the environment (Gigerenzer, 2002, 2004b); the more suited to the environment a particular heuristic is, the better it will perform.

As people's psychological processing is adaptive rather than stable (i.e., they do not consistently use a single mechanism), their preferences tend to be unstable across elicitation methods (Pedroni et al., 2017). This has implications for research exploring human judgement and decision-making as it suggests that the success of any theoretical proposal is largely determined by the elicitation method used to test and validate its claims. For example, PT's (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992) four-fold pattern of risk preferences (Figure 3) was validated using the certainty equivalent (CE) method, in which participants had to make a series of choices between an option with a probabilistic outcome, and an option with a certain outcome (Tversky & Kahneman, 1992). However, in a recent experiment Kusev et al. (2020) demonstrated that PT's four-fold pattern is an artefact of the elicitation method. Specifically, Kusev and colleagues were only able to replicate the four-fold pattern of risk preferences when participants' responses were biased by logarithmic (uneven) spacing of certain options around the expected value of the probabilistic options (a common feature of experiments which use the CE method, including those by Kahneman and Tversky). In contrast, when Kusev and colleagues used certain options which were linearly (evenly) spaced around the expected value of the probabilistic options, participants' responses were not biased and they demonstrated a consistently rational two-fold pattern of risk preferences (risk-aversion in the domain of gain, and risk-seeking in the domain of loss). Thus, a relatively subtle contextual change (spacing of sure options around the expected value of probabilistic options) drastically influenced participants' preferences so that they were either influenced by probability range (with logarithmic spacing), or not influenced by probability range (with linear spacing).

Overall, contemporary research has revealed that in contrast to the traditional economic thought, human preferences are not stable, consistent, and determined by computational processing, but instead constructed 'on the fly' using a variety of psychological mechanisms which are context and task dependent. It is within the context of these developments that I identify and explore the novel FAH. According to FAH participants' preferences are determined by binary comparison on the first contextually available attribute, and they prefer the option (e.g., a gamble) with the dominant value on the first contextually available attribute relatively more than the option with the inferior value on the first contextually available attribute. As an example, consider a risky choice between gamble A and gamble B (chance of winning an amount of money):

| | |
|---|---|
| A. 55% | £100 |
| B. 15% | £300 |

In this example, as gamble A has the dominant value (55%) and gamble B the inferior value (15%) on the first contextually available attribute (probability), FAH predicts that gamble A will be preferred relatively more than gamble B. Now consider the same gambles again, but with the attributes reversed so that money is the first contextually available attribute:

| | |
|---|---|
| A. £100 | 55% |
| B. £300 | 15% |

Now, as the first contextually available attribute is money and gamble B has a dominant value (£300) and gamble A an inferior value (£100) on the attribute money, FAH predicts that gamble B will be preferred relatively more than gamble A. Accordingly, even though the content of both gambles is identical (the choice is the same), with FAH I predict a relative change in participants' preferences from gamble A in the first example to gamble B in the second example. Thus, the FAH itself is not good (rational) or bad (irrational), as it produces outcomes which are relative to the environment (the order of the first contextually available attribute determines preferences).

Like in the example above, in research investigating risky judgement and decision-making, people's risk preferences are typically elicited using monetary gambles (Pedroni et al., 2017), in which all probabilistic information (monetary outcomes and their probabilities) is numerically (or occasionally visually) stated (Hertwig & Erev, 2009; Hertwig et al., 2004). These types of gambles are popular among researchers exploring risk as they capture essential characteristics of the real world (mainly, probabilistic outcomes), whilst also allowing for control and manipulation of experimental variables (Lopes, 1983). Accordingly, as probabilistically defined gambles are a staple of experimental research exploring risk, it is unsurprising that they have been used in the validation of significant normative, descriptive (e.g., PT; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) and experience-based (e.g., DbS; Stewart et al., 2006) theories of judgement and decision-making.

For instance, Tversky and Kahneman (1992) validated their four-fold pattern of risk preferences using the CE method, which is 'arguably one of the most widely used and robust experimental methods in behavioural science for measuring decision makers' risk preferences' (Kusev et al., 2020, p. 585). In the CE method, across a series of trials, participants make decisions between gambles with numerically stated probabilistic information. Specifically, in each of Tversky and Kahneman's trials participants made seven choices between a risky option (e.g., 25% chance to win $150 and 75% chance to win $50) which was coupled with each of seven sure options (offering a sure amount of money), that offered outcomes spanning the extreme outcomes of the risky option. Accordingly, the CE (the amount of money that a participant will accept over playing a risky option) is computed using the sure options; it is the midpoint between the lowest accepted value and the highest rejected value. Accordingly, if the CE value was above the EV of the risky option then this indicates risk-seeking preferences, whilst a CE value below the EV of the risky option indicates risk-averse preferences (see Kusev et al., 2020).

More recently, in the domain of risk, the predictions of DbS (Stewart et al., 2006) – a theory which poses significant challenges for EUT, SEU and PT – has also been validated using experiments which required participants to make choices between gambles with numerically stated probabilistic information (i.e., gambles which are described). Specifically, in DbS experiments it is expected that participants' prior sampling experiences (e.g., prior choice options) influence their preferences during current choices (e.g., Stewart et al., 2015; Walasek et al., 2015, 2019). For instance, Ungemach et al. (2011) presented participants with price-product pairs (pictures of products with a price attached) and then asked them to make a choice between a safe gamble (55% chance of winning £0.50) and a risky gamble (15% chance of winning £1.50).

Given that gambles with numerically described probabilistic information are an indispensable component of experimental studies exploring risk preferences (Lopes, 1983), and it is known that human preferences and context are task sensitive (e.g., Kusev & van Schaik, 2011; Kusev et al., 2020; Slovic, 1995), it would be reasonable for one to assume that there are agreed upon conventions. However, this is not the case, as across risky judgement and decision-making literature is evident that simple gambles with numerically presented probabilistic information can be presented/formatted in many different ways. Accordingly, as FAH predicts that the order in which attribute information is presented significantly influences people's risk preferences, it poses a methodological and theoretical problem for experimental studies which have not controlled – and thus cannot account – for its influence. For example, by counterbalancing the first contextually available attribute, and ensuring a trade-off between the probability and outcome attributes. This includes some CE studies by Tversky and Kahneman (1992) and some of the studies which have been used to validate DbS (e.g., Stewart et al., 2015; Ungemach et al., 2011)[12].

[12] I use the term 'some' in this sentence to limit the scope of my claim to only studies which use gambles exclusively in the domain of risk, as I have yet to examine FAH in the context of mixed gambles, or the domain of loss.

However, FAH makes two additional contributions to risky judgement and decision-making research which goes beyond posing methodological and theoretical challenges for existing research. Specifically, FAH has two features which make it particularly interesting to researchers exploring risk; it makes general predictions which are not domain specific, and it is simpler that the majority of existing theories. Accordingly, I will now discuss each of these features in turn.

Firstly, it is important to appreciate that all good theories are general; 'a virtue of a good theory is that it is general; theories that predict a wide range of events have obvious merit' (Kusev et al., 2009). Accordingly, to make general predictions, prominent normative (e.g., von Neumann & Morgenstern, 1947), descriptive (e.g., Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), and experience-based (e.g., Stewart et al., 2006) theories of risky judgement and decision-making propose that people use domain-general cognitive mechanisms/psychological processing. For instance, both EUT (von Neumann & Morgenstern, 1947) and PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) assume that people's risky preferences are informed by computational processing, are context and task independent, and are thus stable and consistent. Likewise, in their DbS relative rank model Stewart et al. (2006) propose that regardless of the task, people's judgements and decisions are always determined by relative ranks which are constructed using three domain-general cognitive tools. Specifically: (i) sampling from experience; (ii) binary ordinal comparison; and (iii) frequency accumulation (Stewart et al., 2006; Stewart, 2009; see also Stewart & Simpson, 2008). Thus, people use the same cognitive tools to judge the subjective value of gamble outcomes (e.g., Ungemach et al., 2011) as they do to judge the riskiness of their alcohol consumption (Wood et al., 2012) and the benefits of exercise (Maltby et al., 2012).

In congruence with the aforementioned theories, FAH is general; it assumes the use of a domain-general cognitive tool (binary comparison) and therefore makes predictions which are not domain specific. Specifically, according to FAH people compare options binary on the first contextually available attribute and prefer the option with the dominant value on the first contextually available attribute relatively more than the option with the inferior value on the first contextually available attribute. Accordingly, as I empirically demonstrate in this thesis (Experiments 3 – 7), FAH is able to predict a significant amount of variance in people's preferences in both risky and non-risky tasks, and for both decisions and willingness to pay (WTP) judgements.

Moreover, in addition to the expectation that a good theory should make general predictions which are not domain specific, a general guideline in science is that 'the simplest model that explains the data' should be preferred (Martignon & Hoffrage, 1999, p. 119). It is with regard to simplicity that FAH makes its second major contribution to judgement and decision-making research. Specifically, as I assume that people's preferences can be predicted using a single domain-general cognitive tool (binary comparison) on the first contextually available attribute, FAH is simpler than the prominent risky judgement and decision-making theories. For instance, normative (von Neumann & Morgenstern, 1947) and descriptive (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) theories of risky judgement and decision-making are dependent on computational processing, which is too complex for people to perform given their bounded cognitive processing capacity (Simon, 1955; 1956; see Gigerenzer et al., 1999). Moreover, whilst the cognitive demands of DbS are certainly lower than those made by computational models, DbS is still more complex that FAH as it uses three domain-general cognitive tools (rather than just one), one of which involves sampling from memory which is presumably effortful, and could be biased (e.g., serial position effects; Stewart et al., 2004, or false memory; see Loftus, 1975).

Furthermore, I argue that even the fast and frugal heuristics – which are famed for their simplicity – often make greater demands regarding human psychological processing then I do with FAH. For instance, take the best heuristic assumes that: (i) people possess a list of cues which are subjectively ranked according to their ecological validity (their relative subjective success at discriminating between alternatives); (ii) people search the cues in order of their ecological validity, until a clue that discriminates between the alternatives is found (lexicographic search); and, (iii) when a discriminating cue is found, people stop the search and predict that the alternative with the highest cue value has the higher criterion value (Gigerenzer & Goldstein, 1996; 1999). Accordingly, take the best heuristic, like DbS appears to be heavily dependent on human memory, which is prone to error and can be difficult to access. In contrast, the priority heuristic – the only fast and frugal heuristic which deals exclusively with risk – which is also lexicographic, is not as dependent on memory as all cue information is contextual (Brandstätter et al., 2006). However, the priority heuristic is still more complex than FAH as it requires people to set an aspiration level of 1/10, which implies that each decision made using the priority heuristic requires at least a small amount of psychological computation, whereas FAH requires none.

Overall, FAH makes three significant contributions to risky judgement and decision-making research. Specifically, it is a theory which makes general non-domain specific predictions, and it is arguably simpler that the majority of existing judgement and decision-making theories as it assumes the use of a single domain-general cognitive tool. Moreover, FAH poses significant methodological (and also theoretical) challenges to theories/models which were validated using gambles with numerically stated probabilistic information (i.e., decisions from description) where FAH was not controlled for. Furthermore, FAH fits well with a plethora of experimental research which has demonstrated that people use psychological mechanisms and processing contingent on context and task. Moreover, FAH is supported by research which argues that people frequently substitute computational processing for simple heuristics.

### 1.8.3 The First Attribute Heuristic: Non-Risky Judgements

In the previous section I discussed how FAH can influence participants' choice preferences in the domain of risk. However, as I assume that FAH uses a single domain general cognitive tool (binary comparison), its influence is not restricted to choice and risk. Accordingly, in this thesis (Experiments 5 – 7) I also argue and experimentally demonstrate that FAH can influence people's WTP judgements in non-risky domains.

Within non-risky domains there is extensive empirical evidence that people's preferences are influenced by 'firsts', and thus good reason to suspect that their preferences might be influenced by binary comparison on the first contextually available attribute. For example, people's impression of other groups (Steinmetz et al., 2020) and individuals (e.g., Asch, 1946; Sullivan, 2019; for a review see Forgas, 2011) are disproportionately informed by early information. Moreover, people tend to prefer consumer goods which are presented to them first (e.g., Carney & Banaji, 2012; Mantonakis et al., 2009), and are more likely to vote for someone if their name appears first on a ballot (for an extensive review see Blom-Hansen et al., 2016). Furthermore, people's judgements can be anchored to initially presented information (e.g., Tversky & Kahneman, 1974), and informed by the first repetition of stimuli in a sequence (Kusev et al., 2011; Kusev, Tsaneva-Atanasova, et al., 2012). Accordingly, some authors (Carney & Banaji, 2012) have argued that 'first' have a privileged influence on human cognition. This argument is consistent with memory research which indicates that people have better recall for items presented at the beginning of a sequence relative to items towards the middle of the sequence (e.g., Deese & Kaufman, 1957; Murdock, 1962; Li, 2010; for a review see Stewart et al., 2004).

People also have a tendency to demonstrate predecisional distortion of information (or predecisional distortion) where they distort their evaluation of new information in favour of an existing or emerging preference (e.g., Carlson & Russo, 2001; Russo et al., 1996, 1998), which can be for the option favoured by the first attribute (Carlson et al., 2006). For example, Carlson et al. (2006) asked participants to make a choice between two backpacks (backpack A and backpack B) described on six attributes; four neutral attributes which did not favour either backpack, and two attributes which favoured one of the backpacks (one favoured backpack A but not B, and the other favoured backpack B but not A). To instil an initial preference for one of the backpacks, the experimenters manipulated the order of the first attribute so that it either favoured backpack A (but not B) or backpack B (but not A). The results revealed that participants typically chose the backpack favoured by information on the first attribute and distorted their evaluation of information in favour of the backpack favoured by the first attribute. Accordingly, given this evidence, one may be tempted to argue that FAH is explained by predecisional distortion in which the first contextually available attribute establishes a preference, and then the evaluation of the second attribute is distorted in the direction of the preference. However, this cannot be the case when attribute information is simultaneously presented (as in all experiments in this thesis), as sequential presentation of attribute information is necessary to elicit predecisional distortion (Russo, 2014, 2018). Specifically, it is the sequential presentation of information that gives people opportunity to revise their preferences after considering each new piece of information; it is this process of revision which drives the distortion of subsequent attribute information (Russo, 2014, 2018).

To explore the influence of FAH on people's judgements in a non-risky domain, I selected the experimental paradigm which Hsee (1996) used to empirically validate his evaluability theory (see Hsee, 1996, 1996, 2000) for two reasons. Firstly, Hsee (1996) used tasks which are structurally similar to the gambles which I use to explore FAH in my risk experiments (Experiments 3 & 4). Specifically, in Hsee's paradigm participants use WTP to state their preference between two options (e.g., two job candidates) which are defined on two attributes, that require a trade-off (e.g., each job candidate is superior on only one attribute; for an example see Table 3). The second reason why I selected Hsee's paradigm is because it was designed by

Hsee to explore joint-separate evaluation preference reversals (JE-SE preference reversals). This is a topic which has been widely explored in non-risky judgement and decision-making, and thus a research area in which the importance of FAH can be cemented. Accordingly, I will now introduce JE-SE preference reversals and explain how Hsee's evaluation method can explain them.

JE-SE preference reversals were initially revealed by Bazerman et al. (1992) in a series of experiments which focused on choice between absolute and relative outcomes (Bazerman et al., 1999). Specifically, participants read a scenario which described a dispute between two homeowners (themselves and a neighbour) about either how sales revenue or tax liability for a shared plot of land should be split. After reading the scenario, participants were required to choose how the sales revenue/tax liability should be settled with the neighbour. For instance, consider the example used in Bazerman et al. (1999) which concerns splitting sales revenue:

$600 for self and $800 for neighbour
$500 for self and $500 for neighbour

Bazerman et al. (1992) found that when the options were evaluated together (joint evaluation) the vast majority of participants preferred the option which maximises their revenue ($600 for self and $800 for neighbour). However, when the options were evaluated in isolation (separate evaluation) the majority of participants preferred the option which split the sales revenue equally between both parties ($500 for self and $500 for neighbour).

Since Bazerman and colleagues' initial demonstration of JE-SE preference reversals, a number of theories have been proposed to account for them (for a review see Bazerman et al., 1999). For instance, Bazerman et al. (1998) proposed that at least some JE-SE preference reversals could be explained by their want/should proposition according to which human agents feel tension between what they want to do and what they believe that should do, and that they are more likely to do what they want during SE and what they should in JE. Moreover, Ritov and Kahneman (1997) used Norm Theory (Kahneman & Miller, 1986) to argue that joint-separate evaluation preference reversals occur because of a contrast between within category and across category assessments (see Bazerman et al., 1999). However, despite these proposals, Hsee's evaluability hypothesis (see Hsee, 1996, 1998, 2000; Hsee et al., 1999) is the leading explanation for JE-SE preference reversals (Sher & McKenzie, 2014).

According to Hsee's evaluability theory, JE-SE preference reversals occur because some attributes are easier to evaluate in isolation than others (Hsee, 1996; for a list of factors which influence evaluability see Hsee & Zhang, 2010). Specifically, attributes which are easy-to-evaluate independently can be understood in isolation, whilst attributes which are hard-to-evaluate independently require comparison to interpret, and thus cannot be understood in isolation. Accordingly, in his evaluability theory Hsee (1996; Hsee et al., 1999) proposes that in separate evaluation people's preferences are determined by easy-to-evaluate rather than hard-to-evaluate attributes, whilst in joint evaluation people's preferences are determined by both easy to and hard to evaluate attributes. Accordingly, as hard-to-evaluate attributes have relatively more influence in joint evaluation than in separate evaluation, and easy-to-evaluate attributes have relatively more influence in separate evaluate than in joint evaluation, Hsee (1996) predicts a preference reversal from the option superior on the hard-to-evaluate attribute during JE to the option superior on the easy-to-evaluate attribute during SE (Hsee, 1996). For example, consider the music dictionaries in Table 5:

**Table 5**

*Music Dictionary Information*

| | Dictionary A | Dictionary B |
|---|---|---|
| Number of entries | 10,000 | 20,000 |
| Any defects? | No, it's like new | Yes, the cover it torn |

*Note.* Adapted from "The Evaluability Hypothesis: An Explanation for Preference Reversals between Joint and Separate Evaluations of Alternatives" by C. Hsee. 1996, *Organizational Behaviour and Human Decision Processes, 67*(3), p. 248.

According to Hsee's evaluability theory, participants who are presented with information about both dictionaries simultaneously (joint evaluation) should pay relatively more for dictionary B than participants who are presented with information about only one of the dictionaries (separate evaluation). This is because, in separate evaluation the number of entries attribute is hard-to-evaluate and therefore participants' WTP judgements are mostly informed by the easy-to-evaluate any defects attribute, on which dictionary A (no, it's like new) dominates dictionary B (yes, the cover it torn). In contrast, in joint evaluation both attributes are easy-to-evaluate as they can be compared binary and it is clear than 20,000 entries are better than 10,000 entries. Accordingly, as participates can use both attributes to determine their WTP, when compared to the separate evaluations condition there will be a relative increase in WTP for dictionary B (a superior number of entries – 20,000) but not dictionary A (an inferior number of entries – 10,000). Therefore, if the increase in WTP for dictionary B is big enough in joint evaluation a preference reversal should occur.

However, it is important to recognise that for preference reversals to occur it is necessary that 'the option superior on the hard-to-evaluate attribute must be preferred in joint-evaluation; otherwise there would be no room for a preference reversal' (Hsee, 1996, p. 250). Therefore, to induce JE-SE preference reversals, in the majority of Hsee's (1996) experiments the hard-to-evaluate attribute was also the most important attribute (Hsee, 2000). Building upon the premise that people's preferences can be influenced by both evaluability and attribute importance, González-Vallejo and Moran (2001) suggested that the influence of importance and evaluability on preferences differs across joint and separate evaluation modes. This is because people use different evaluation procedures: comparative procedure in joint evaluation and an absolute procedure in separate evaluation. Accordingly, González-Vallejo and Moran proposed that in joint evaluation, preferences are informed predominantly by attribute importance. Therefore they predicted that people would have a greater tendency to select the option superior on the most important attribute regardless of its evaluability. In contrast, in separate evaluation González-Vallejo and Moran proposed that preferences are informed by combining the available attributes, but suggested that the relative weight of each attribute is influenced by its importance and evaluability. Thus, overall, González-Vallejo and Moran predicted that JE-SE preferences reversals occur when a hard-to-evaluate attribute is more important that an easy-to-evaluate attribute. In congruence with these predictions, their experimental results replicated Hsee's JE-SE preference reversals, but revealed that a comparative procedure (joint evaluation) is influenced largely by attribute importance. Whilst a procedure with separate evaluation is also influenced by absolute importance, but also other factors such as evaluability.

However, as is the case with many experiments which have explored human risky preferences, in their experiments neither Hsee (1996) nor González-Vallejo and Moran (2001) controlled for influence from FAH by counterbalancing the order in which the contextually available attributes were presented. Accordingly, in addition to evaluability and attribute importance, it is possible that FAH could explain why preferences differ across joint and separate evaluation modes. Specifically, in joint evaluation (where binary comparison on the first contextually available attribute is possible) people's preferences will be influenced by FAH, whilst in separate evaluation (where binary comparison on the first contextually available attribute is not possible) people's preferences cannot be influenced by FAH. For instance, considering the example in Table 3, in joint evaluation FAH predicts that when GPA is the first contextually available attribute, then Candidate A will be preferred relatively more than Candidate B, whilst the reverse will be true when experience with KY is the contextually available attribute. Although, in separate evaluation, as people cannot use FAH to determine their preferences, they must use alternate psychological mechanisms.

## 1.9. Behavioural Experimental Methods

### 1.9.1 The Experimental Approach Employed in This Dissertation

As in any other scientific subject, the success of theories/models and their predictions in behavioural science and psychology is determined solely by experimental evidence (employed experimental methods and experimental results). Accordingly, established empirical evidence is the reason to accept or reject theoretical proposals or models with mathematical formulisations. Moreover, developed scientific experimental methods and their experimental designs are theories in themselves as they could determine and inform the assumed parameters in the theoretical proposals/models, and deliver results and predictions (the empirical evidence). Hence, the experimental methods and their experimental designs, materials, procedures, and results are the scientific tools to establish or reject assumptions about processes and their consequences.

### 1.9.2 Justification for Using Panel Services for Participant Recruitment

Prior to mass adoption of broadband technologies which enable people to access the world-wide-web, psychology researchers would recruit participants for their elaborate laboratory experiments from the undergraduate student population at their respective institutions (often in return for course credit). In contrast, since the late 1990's there has been a general shift towards performing laboratory experiments through the internet (Birnbaum & Birnbaum, 2000), using participants recruited from online data panel services such as Amazon's Mechanical Turk or PureProfile. Indeed, it is argued that it contrast to psychologists' traditional method of recruiting participants (convenience sampling from student populations), online data panel services offer a number of unique advantages: (i) the population of on-line data panels is more representative of the general population (e.g., Berinsky et al., 2012); (ii) data panels make participant recruitment more affordable and do not compromise data quality (e.g., Buhrmester et al., 2011); and, (iii) recruiting participants from data panels can reduce biases which are found in traditional samples (e.g., Gosling et al., 2004). Accordingly, all experiments in this dissertation use participants recruited via data panels (PureProfile).

### 1.9.3 Aims and Objectives of the Research

In this thesis, the research aims to empirically demonstrate that people's judgement and decision-making behaviour (risky and non-risky preferences) can be influenced by a novel psychological mechanism (FAH) and behavioural effect (desirability). Crucially, these theoretical contributions (FAH and desirability) are not accounted for by the most prominent theories of behavioural science (EUT, PT, DbS and evaluability theory). Specifically, providing evidence (theoretical, methodological and empirical) for the influence of FAH and desirability will support the proposal that people's preferences are constructed 'on the fly'. Accordingly, to achieve this aim, each experiment (1–7) has unique objectives:

The objective of Experiment 1 is to demonstrate that in contrast to the predictions of Stewart et al.'s (2006) DbS relative rank model, people's risk preferences are not always constructed in relation to relative ranks (sampled values from memory) and can be influenced by desirability (i.e., absolute values).

In Experiment 2 the objectives are to: (i) eliminate money comparisons (comparisons on the money attribute) by asking participants to choose between gambles with either both non-desirable monetary prizes or both desirable monetary prizes; and, (ii) explore the possibility that probability comparisons (comparisons on the probability attribute) can be influenced by vertical (enhanced) or horizontal (disrupted) gamble presentation.

In Experiment 3 the objectives are to: (i) empirically demonstrate that FAH influences participants' risk preferences during choice between risky gambles; and (ii) to establish whether the influence of presentation (horizontal or vertical) established in Experiment 2, can be eliminated when attribute values are equally easy to compare across both types of presentation.

The objective in Experiment 4 is to empirically demonstrate that FAH influences people's risk preferences in a repeated measures design where participants have to make a series of choice between risky gambles, and where the probability attribute is not associated with risk-aversion, and the money attribute is not associated with risk-seeking (as they are in Experiment 3).

In Experiment 5 the objectives are to: (i) empirically explore whether FAH can influence participants' WTP judgements in a non-risky task (JE only); and (ii) to examine the influence of attribute importance on participants' WTP judgements.

The objectives in Experiment 6 are to: (i) examine the influence of FAH on participants' WTP judgements in JE and SE; (ii) explore the influence of evaluation difficulty on participants' WTP judgements; and, (iii) investigate the influence of attribute importance on participants' WTP judgements.

In Experiment 7, the objectives are to: (i) determine whether FAH influences participants' WTP judgements when the first contextually available attribute is task-irrelevant and without opportunity for binary numerical comparisons; and (ii) whether with an ethical first contextually available attribute, participants' WTP judgements will be influenced by FAH in SE.

### 1.10 Summary of Chapter 1 and Outline of Chapters 2–6

In this chapter, I have introduced and discussed the multidisciplinary theoretical background of risky and non-risky judgement and decision-making research, and also stated my contribution to these fields; desirability (a behavioural effect) and FAH (a psychological mechanism). Accordingly, in Experiments 1 and 2 I explore the influence of desirability on preference for safe and risky gambles by manipulating the desirability of the gambles prizes. Moreover, I explore the influence of desirability against the DbS's (Stewart et al., 2006) predictions, particularly those made by Ungemach et al. (2011). In Experiments 3-7 I explore the influence of FAH on people's preferences. In particular, Experiments 3 and 4 examine the influence of FAH on risky choices, and Experiments 5-7 on non-risky WTP judgements.

Chapter 2 of this thesis contains Experiments 1 and 2, which explore the influence of desirability and sampling experience (relative ranking) on participants' risky choice preferences between safe and risky gambles. Specifically, Experiment 1 manipulated: (i) type of decision-making task (gambles with non-desirable monetary prizes or gambles with a non-desirable monetary prize and a desirable monetary prize); and, (ii) type of sampling experience (below and above the gambles' prizes or within the range of the gambles' prizes). The second experiment in the chapter (Experiment 2) further investigated the influence of sampling experience and desirability on risk preferences, but with different gambles (gambles with non-desirable monetary prizes or gambles with desirable monetary prizes). Experiment 2 also introduced a novel manipulation to the presentation of gambles (horizontal or vertical).

Chapter 3 of this thesis is composed of Experiments 3 and 4, which explore the influence of FAH on participants' risk preferences with choice between safe and risky gambles. Accordingly, Experiment 3 manipulated two variables: (i) first contextually available attribute (probability or money) and (ii) first attribute presentation (horizontal or vertical). Similar to in Experiment 3, Experiment 4 also explored the influence of FAH on participants' risk preferences. In particular, with gambles where a dominant value on the probability attribute is not associated with a safe gamble, and a dominant value on the money attribute is not associated with a risky gamble.

Given that the Experiments 3 and 4 always examined the influence of FAH on risky choice preferences, the two experiments (5 and 6) in chapter 4 explore the influence of FAH on participants' WTP judgements. In particular, Experiment 5 examines the influence of FAH and attribute importance on participants' WTP salary for two job candidates. Accordingly, Experiment 5 manipulated the first contextually available attribute (BSc degree result or Experience with KY), and also tasked participants to decide which attribute they considered to be most important. In Experiment 6 I examine the influence of FAH on participants' WTP purchase value judgements for TVs, using Hsee's (1996) experiment method, and examined FAH against Hsee's evaluability theory predictions and González-Vallejo and Moran's (2001) attribute importance proposal and predictions. Therefore, in addition to manipulating the first contextually available attribute (brightness or warranty), Experiment 6 also manipulated evaluation mode (JE or SE).

In chapter 5 (the final experimental chapter), Experiment 7 further explores the influence of FAH on participants' WTP salary judgements. However, as Experiments 5 and 6 used first contextually available attributes which were task relevant, and binary comparisons on numerical information, Experiment 7 explores whether FAH is limited to binary contextual numerical comparisons on a task-relevant attribute, Moreover, to explore whether FAH can influence preferences in JE and SE and to supress influence from the task-relevant first contextually available attribute, Experiment 7 uses an ethical first contextually available attribute.

In chapter 6, the final chapter of this thesis, I provide an overview of behavioural theories which are bounded by desirability and FAH. Moreover, I discuss the influence of desirability on the consistency of people's judgement and decision-making preferences, and also the role of FAH on the construction of preferences. Within Chapter 6, I also highlight the methodological, theoretical and practical contributions and implications of this thesis. Finally, I offer some limitations of my experimental research, identify opportunities for additional research, and discuss research which could demonstrate the influence of desirability and FAH in applied settings.

# Chapter 2

# Sampling Experience, Desirability, and Risky Decision-Making

## 2.1 Overview of Chapter 2

Chapter 2 is composed of two Experiments (Experiments 1 and 2) which closely follow the design and procedure of Ungemach et al.'s (2011) DbS experiment, and seek to explore a boundary of DbS; the possibility that with a non-negligible gamble prize, peoples' risk preferences can be triggered (and influenced) by absolute values, rather than sampling experience which is used when risk preferences are not triggered. According to Stewart et al.'s (2006) DbS relative rank model, people's judgements and decisions about available options are not determined by their absolute values. Instead, the subjective value of an option (e.g., a gamble) is represented by its relative rank within an attribute (e.g., money), when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory and/or context).

In Experiment 1, to examine the proposed boundary to DbS, I explore the influence of *type of decision-making task* (gambles with non-desirable monetary prizes or gambles with a non-desirable monetary prize and a desirable monetary prize) and *type of sampling experience* (below and above the gambles' prizes or within the range of the gambles' prizes), on participants' *risk preference*; a binary choice between a safe gamble (which offered a high probability of winning a smaller monetary prize), and a risky gamble (which offered a low probability of winning a larger monetary prize). Accordingly, the results from Experiment 1 revealed that participants who chose between gambles with non-desirable prizes were influenced by sampling experience, as predicted by Ungemach et al. (2011) and more broadly DbS (Stewart et al., 2006). However, with choice between a safe gamble with a non-desirable monetary prize and a risky gamble with a desirable monetary prize there was no influence from sampling experience (or relative ranking) on participants' risk preferences. Instead, participants chose the risky gamble regardless of how sampling experience was distributed, and therefore caused a shift in preference from the safe gamble (with non-desirable gambles' prizes) to the risky gamble (with a desirable gamble prize). Overall, in Experiment 1 the results suggest that DbS did not successfully predict respondents' risk-preferences.

In Experiment 2, I explore the influence of *type of decision-making task* (gambles with non-desirable monetary prizes or gambles with desirable monetary prizes), and *type of sampling experience* (below and above the gambles' prizes or within the range of the gambles' prizes), and *presentation of the gambles* (horizontal or vertical), on participants' *risk preference*; a binary choice between a safe gamble (which offered a high probability of winning a smaller monetary prize), and a risky gamble (which offered a low probability of winning a larger monetary prize). Specifically, Experiment 2 explores whether when offered two gambles both with either non-desirable or desirable monetary prizes, participants' risk preferences would be informed by comparison between the gambles on the probability attribute. Furthermore, Experiment 2 also explores whether comparison on the probability attribute could be enhanced or disrupted by visual contextual presentation (horizontal or vertical) of the safe and risky gambles. Accordingly, the results revealed that in contrast to the predictions of Ungemach et al. (2011) and more broadly DbS (Stewart et al., 2006), participants' risk preferences were not influenced by sampling experience and relative ranking. Moreover, as I predict, the results also revealed that participants preferred the safe gamble (high probability of winning a smaller monetary prize) when offered gambles with both non-desirable and desirable monetary prizes. Furthermore, as I predicted in Experiment 2, this effect is further enhanced by vertical presentation of the gambles.

## 2.2 Experiment 1: The Influence of Absolute Values on Risky Choices

### 2.2.1 Introduction

In contrast to prominent normative (EUT; von Neumann & Morgenstern, 1947) and descriptive (PT; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) theories of risky judgement and decision-making which assume preference stability, behavioural science research has revealed that people's preferences are influenced by content, context, and experience (e.g., Brandstätter et al., 2006; Hertwig et al., 2004; Kusev & van Schaik, 2011; Kusev et al., 2009; Kusev et al., 2020). Accordingly, in keeping with this evidence, contemporary theories of judgement and decision-making propose that people's preferences are constructed 'on the fly' (e.g., Kusev et al., 2020; Pedroni et al., 2017).

For instance, in their DbS relative rank model, Stewart et al. (2006) argue that people's judgements and decisions about available options are not determined by their absolute values. Instead, the subjective value of an option (e.g., a gamble) is represented by its relative rank within an attribute (e.g., money), when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory and/or context). Specifically, relative ranks, which are constructed using three domain general cognitive tools: (i) sampling from experience; (ii) binary ordinal comparison; and (iii) frequency accumulation (Stewart et al., 2006; Stewart, 2009; Stewart & Simpson, 2008). Accordingly, DbS predicts that the distribution of sampled values from memory and/or context determines people's preferences (e.g., Stewart et al., 2006; Stewart et al., 2015; Ungemach et al., 2011; Walasek & Stewart, 2015, 2019).

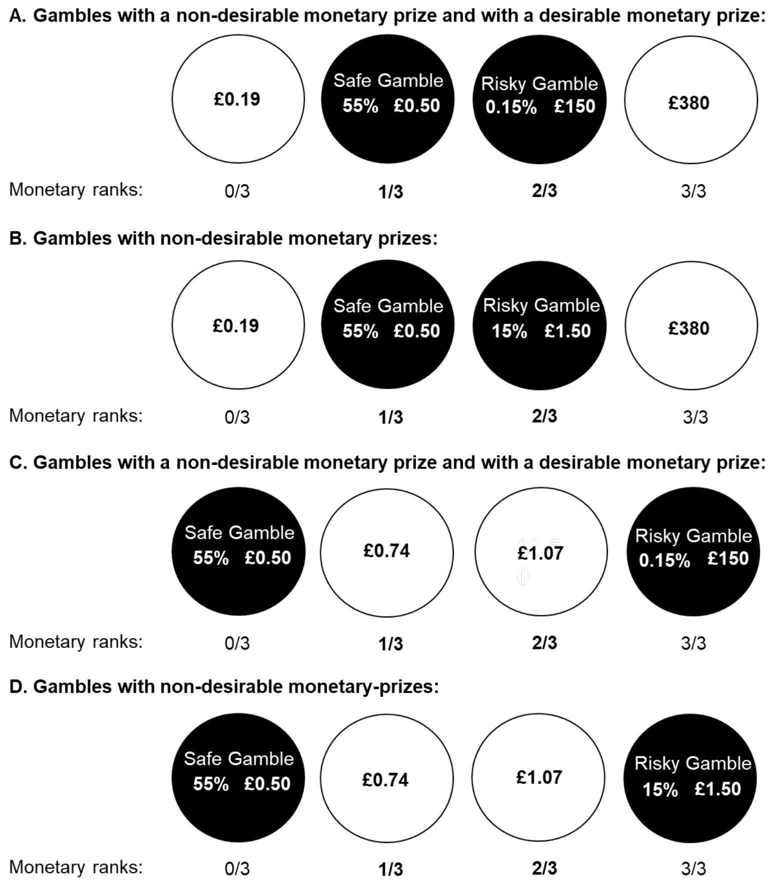
As an example, imagine that you just won £200 on a lottery; how do you feel? To make this judgement, DbS predicts that you will compare the £200 against a sample of amounts (e.g., previous lottery wins) from experience (£210, £250, £300). Accordingly, given this sample, DbS predicts you will feel disappointed as £200 has the worst relative rank (0/3) because it is not favourable in any of the comparisons. In contrast, £210, £250 and £300 rank as 1/3, 3/3, and 3/3 respectively, and are therefore more favourable. However, as DbS researchers argue that people's judgement and decision-making preferences are not influenced by absolute values, DbS predicts that you would be equally disappointed with your £200 lottery win if your prior lottery wins were £2,100, £2,500, and £3,000 (or even £2,100,000, £2,500,000, and £3,000,000), as the relationship between the relative ranks would be identical.

A recent decision-making study by Ungemach et al. (2011) demonstrated that recently sampled prices influenced participants' risk preferences. Specifically, participants' choices between a safe gamble offering a smaller prize (£0.50) combined with a high probability of winning (55%), and a risky gamble offering a larger prize (£1.50) combined with a low probability of winning (15%), were constructed in relation to whether recently sampled monetary amounts (price-product pairs) were within (£0.74 and £1.07) or below and above (£0.19 and £3.80) the range of the gambles prizes. The results revealed that participants chose the risky gamble more when sampled amounts were within the range of the gambles prizes, than where the sampled amounts were below and above the gambles prizes. This pattern of preferences is consistent with DbS ranking principle and predictions (Stewart et al., 2006; Ungemach et al., 2011) because when sampled amounts were inside the range of the gambles' prizes the risky gamble was dominant in all comparisons, whilst the safe gamble was dominant on no comparisons (rank 0=£0.50; rank 1=£0.74; rank 2=£1.07, and rank 3=£1.50). Accordingly, due to the large relative rank difference between the safe and risky gambles, the risky gamble was regarded as more attractive than the safe gamble. However, when sampled amounts were below and above the gambles' prizes, the relative rank difference between the safe and risky gambles' prizes was small (rank 0=£0.19; rank 1=£0.50; rank 2=£1.50, and rank 3=£3.80), and therefore participants chose the risky gambles less because it was not perceived to be particularly more attractive than the safe gamble. Although, one possibility is that with a small relative rank difference between the gambles' prizes (i.e., with sample prices below and above the prizes), participants may have based their choice on the probability attribute, which favoured the safe gamble.

However, informed by evidence that people's judgements and decisions can be determined by a variety of psychological processes and effects (e.g., see Gigerenzer et al., 1999; Kusev & van Schaik, 2011; Payne, Bettman, Coupey & Johnson, 1992), I argue that the desirability of the gambles' prizes can also influence participants' risk preferences. Specifically, I argue that the small monetary prizes (£0.50 and £1.50) used by Ungemach et al. (2011) were negligible and non-desirable, and therefore did not trigger participants' immediate choice preferences. Moreover, given that participants' choice preferences were not triggered by the non-desirable monetary amounts, it is plausible that to make a decision between the gambles participants were prompted to sample from their experience. Accordingly, in this Experiment I explore the influence of sampling and desirability on participants' risky choice preferences, using the DbS method of Ungemach et al. (2011). Specifically, I propose that increasing the desirability of the risky gamble (e.g., by offering a larger monetary prize) will increase participants' preference for the risky gamble, regardless of their sampling experience. As an example, I propose a relative shift in participants' preferences from the safe gamble with choice between a safe (55% chance of winning £0.50) and risky (15% chance of winning £1.50) gambles with non-desirable prizes, to preference for the risky gamble with choice between a safe gamble with a non-desirable monetary prize (55% chance of winning £0.50) and a risky gamble with a desirable monetary prize (0.15% chance of winning £150); see Figure 6. Furthermore, I also propose that people will only sample from experience when they choose between gambles with negligible monetary prizes, as their non-desirable monetary prizes will not trigger a preference and will therefore prompt sampling from experience.

**Figure 6**

*Gambles Prizes' Relative Ranks Among Sampled Values*




Crucially, this experiment closely followed the method and procedure used by Ungemach et al. (2011). Specifically, participants either sampled price-product pairs within the range of the gambles' prizes or below and above the gambles' prizes. Furthermore, all attribute values (money and probability) held the same relative rank positions as the gamble attributes used by Ungemach and colleagues; participants sampled monetary amounts either below and above the gambles' prizes, or within the range of the gambles' prizes. Accordingly, given that absolute values are not supposed to influenced participants' choices, Ungemach et al. (2011) and more broadly DbS (Stewart et al., 2006), would predict that participants' preferences should be determined solely by their sampling experience, and there should be no influence from desirability. Thus, regardless of the desirability of the risky gamble's prize, participants should choose the risky gamble more when their sampling experience is within the range of the gambles' prizes, than when their sampling experience is below and above the gambles' prizes. In contrast, I ague that participants will choose the risky gamble more when it has a desirable prize, regardless of the distribution of their sampling experience (below and above/within the range of the gambles prizes. Furthermore, I also argue that participants' preferences will only be influenced by sampling experience when they choose between gambles with non-desirable prizes.

### 2.2.2 Preliminary Exploration of The Associations Between Desirability and Choice

In a preliminary study, 103 participants, with a mean age of 56 ($SD$=10.83) of whom 59 were female and 44 were male, were recruited via an online data panel service and asked to make a choice between the safe and risky gambles used in the study by Ungemach and colleagues (see panels B and D in Figure 6):

*55% chance of winning £0.50* (safe) or *15% chance of winning £1.50* (risky)

Following the choice, participants made judgements regarding the desirability of both gambles (presented one at a time) using a ten-point Likert scale ranging from *non-desirable* to *desirable*. Although both gambles were not judged as desirable (very small monetary prizes) by the participants ($M$=3.79 and $M$=4.86), there was a statistically significant difference between desirability of safe ($M$=4.86; $SD$=2.22) and risky ($M$=3.79; $SD$=2.39) gambles, $t(102)$ =4.00, $p<.001$. This difference in participants' judgements of desirability of the gambles is not anticipated by DbS. Moreover, the results revealed that the odds ratio (*OR EXP[B]*=.75, *CI*[.95] = [.564; .986], $p$=.040) for choosing the risky gamble was .75 times smaller when the desirability of the safe gamble was raised by one unit. However, the *OR* (*EXP[B]*=1.40, *CI*[.95] = [1.082; 1.803], $p$=.010) for choosing the risky gamble was 1.40 times larger when the desirability of the risky gamble was raised by one unit.

### 2.2.3 Method

**2.2.3.1 Participants**

In Experiment 1, and online data panel service was used to recruit participants, who were paid £1 for their participation It is a standard methodological practice in psychological and behavioural research to use fixed payment incentive for participation in studies. Accordingly, all studies in this dissertation project used fixed incentive payments as a reward for participation time. Moreover, there is evidence which suggests that behavioural/psychological results discovered using variable/performance based rewards are replicable with fixed reward incentives (and vice versa). However, it is good empirical practice to challenge experimental methods and theoretical predictions, and therefore future research could explore whether the pattern of results in this dissertation will be influenced by type of reward incentive. A window of 14 days was set for data collection, and by the end of this window 1005[13] participants had successfully completed the tasks. The mean age of participants was 52 years (*SD* = 14.29), and 546 (53.6%) of the participants were female. The experiment received approval from Huddersfield Business School's research ethics committee. Moreover, all participants who took part in the study were treated in accordance with the British Psychological Society's code of ethics and conduct, and the American Psychological Association's ethical principles.

For statistical testing, a significance level of .05 was used. A retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size f = .40 by convention (Cohen, 1988) of the independent-measures effects of *type of decision-making task* and *type of sampling experience* and their interaction. According to Cohen, a large effect size, will achieve a statistical power of at least .95. Accordingly, post-hoc power analysis

[13] The sample size for Experiment 1 is much larger than for all subsequent experiments. This is motivated by the large sample size used by Ungemach et al. (2011). Moreover, achieving good statistical power with the employed experimental design in Experiment 1 does not require a large sample size. Accordingly, future research would not benefit from employing a large sample size for the method in Experiment 1.

demonstrated that the sample size (N = 1005) produced a power of 1 which exceeded the target of .95.

### 2.2.3.2 Experimental Design

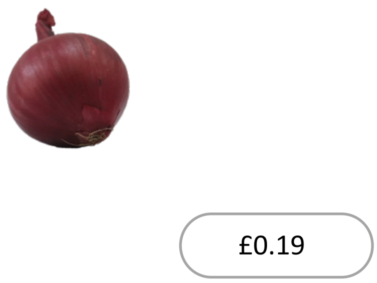
Experiment 1 used a 2 x 2 independent measures design with the following independent variables: type of decision-making task (gambles with non-desirable monetary prizes or gambles with a non-desirable monetary prize and a desirable monetary prize) and type of sampling experience (below and above the gambles' prizes or within the range of the gambles' prizes). As in Ungemach et al. (2011), the dependent variable was participants' risk preference; a binary choice between a safe gamble (which offered a high probability of winning a smaller monetary prize), and a risky gamble (which offered a low probability of winning a larger monetary prize).

### 2.2.3.3 Materials and Procedure

At the beginning of the experiment, participants were asked to sample two price-product pairs (see Figure 7 for an example), because as hypothesised by Ungemach et al. (2011) recently sampled amounts should influence participants' subsequent risk preferences. Specifically, participants either sampled price-product pairs within the range of the gambles' prizes (£0.74 and £1.07) or below and above the gambles' prizes (£0.19 and £380). Following the design of Ungemach and colleagues, participants were required to judge the value of the first-price product pair on a five-point Likert scale (*extremely poor value – extremely good value*) and subsequently to indicate whether they would buy the product (yes, I would buy the product/no, I would not buy the product). Then the participants were shown the second price-product pair and were required to judge its value and indicate whether they would purchase the product. Moreover, to avoid possible biases from product or price associations, there were four products randomly associated with each price. Moreover, the market values associated with each product were taken from large UK retailers.

**Figure 7**

*Example Price-Product Pair*




After the price-product pair tasks, participants were required to make a choice between two horizontally presented gambles consistent with Ungemach et al.'s (2011) method. Specifically, one gamble was safe and offered a high probability of winning a smaller amount, and the second gamble was risky and offered a low probability of winning a larger amount. Accordingly, participants in the conditions using gambles with non-desirable monetary prizes were required to make a choice between gambles offering 55% chance of winning £0.50 (safe) and 15% chance of winning £1.50 (risky). In contrast, participants in the conditions using gambles with a non-desirable monetary prize and a desirable monetary prize were required to choose between gambles offering 55% chance of winning £0.50 (safe) and 0.15% chance of winning £150 (risky).

### 2.2.4 Results and Discussion

The objective of Experiment 1 is to demonstrate that in contrast to the predictions of Stewart et al.'s (2006) DbS relative rank model, people's risk preferences are not always constructed in relation to relative ranks (sampled values from memory) and can be influenced by desirability (i.e., absolute values). In order to test the hypothesis underpinning this study, that risky behaviour is influenced by monetary desirability (and not sampling experience), a logistic regression model was used with predictors type of decision-making task (gambles with non-desirable monetary prizes or gambles with a non-desirable monetary prize and a desirable monetary prize), type of sampling experience (within the range of the gambles' prizes or below and above the gambles prizes), and the outcome variable participants' risk preferences (safe or risky). The results revealed that the regression model was a significant fit to the data $\chi^2(3)$= 51.17, *p*<.001. This logistic regression model demonstrated that all predictors were statistically significant; type of sampling experience (odds ratio, *OR EXP[B]*=.52, *CI*[.95] = [.359; .748], *p*<.001), decision-making task (*OR EXP[B]*=1.70, *CI*[.95] = [1.192; 2.417], *p*=.003), as well as the two-way interaction type of sampling experience by decision-making task (*OR EXP[B]*=1.72, *CI*[.95] = [1.036; 2.867], *p*=.036) made statistically significant contributions to the prediction (see Figure 8). However, as the interaction effect was significant, follow-up regression models were conducted and reported in the following sections.

#### 2.2.4.1 Predicting Risky Behaviour by Type of Decision-Making Task

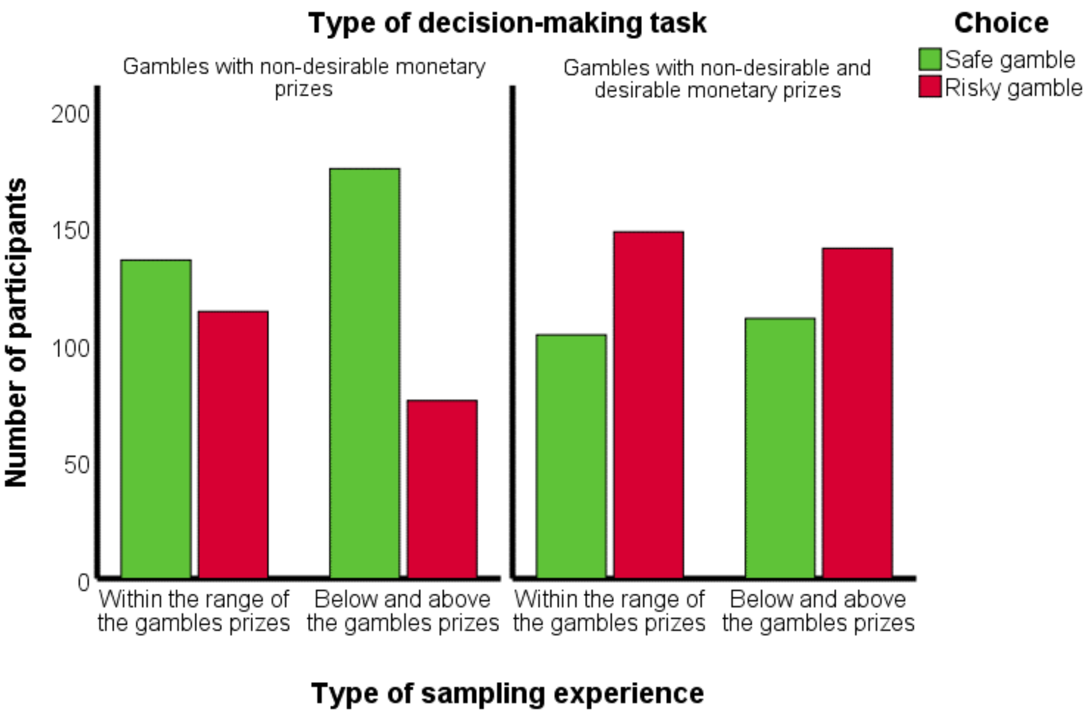
Follow-up logistic regression models (for each of the two decision-making tasks) were used with a predictor type of sampling experience, and outcome variable participants' risk preferences.

##### 2.2.4.1.1 Gambles With Non-Desirable Monetary Prizes

The regression model was statistically significant $\chi^2(1)$= 12.55, *p*<.001. Specifically, the results revealed that sampling experience was a significant predictor, negatively associated with respondents' risky choices, *OR EXP(B)*=.52, *CI*(.95) = (.359; .748), *p*<.001. The OR for the risky choice (choosing the risky gamble) was .52 times smaller when the sampling experience was below and above the gambles' prizes than when the sampling experience was within the range of the gambles' prizes (see Figure 8). Accordingly, this result is consistent with the prediction of Ungemach et al. (2011), and more broadly DbS (Stewart et al., 2006), as they found that choice preferences were constructed in relation to recently sampled monetary amounts (price-product pairs). Specifically, when participants sampled monetary amounts below (£0.19) and above (£380) the gambles' prizes (£0.50 and £1.50), they were less likely to choose the risky gamble (15% chance of winning £1.50), than when they sampled monetary amounts within the range (£0.74 and £1.07) of the gambles' prizes. This is because the gambles' prizes had a relatively small rank difference with sampling experience below and above the monetary prizes – rank 1 and rank 2 (rank 0=£0.19; rank 1=£0.50; rank 2=£1.50, and rank 3=£380), and a relatively large rank difference with sampling experience within the range of the monetary prizes – rank 0 and 3 (rank 0=£0.50; rank 1=£0.74; rank 2=£1.07, and rank 3=£1.50). Therefore, participants were less likely to choose the risky gamble when the rank difference was relatively small, than when the rank difference was relatively large. Accordingly, the relatively large rank difference between the gambles' prizes (caused by sampling experience within the range of the gambles prizes) induced participants' preferences for the risky gamble. However, this pattern of results did not hold when there was a gamble with a desirable monetary prize (see the results in the next section).

**Figure 8**

*Frequencies of Safe and Risky Choices as a Function of Type of Sampling Experience and Type of Decision-Making Task*




**2.2.4.1.2 Gambles With A Non-Desirable Monetary Prize and A Desirable Monetary Prize**

The regression model was not statistically significant $\chi^2(1)$= .40, *p*=.528. Moreover, the sampling experience was not a significant predictor of respondents' risky choices, *OR EXP(B)*=.89, *CI*(.95) = (.627; 1.271), *p*=.528. In other words, the DbS predictor (type of sampling experience) had no effect on participants' risky choices when the gambles were with a non-desirable monetary prize and a desirable monetary prize (see Figure 8). This result is novel, and not previously anticipated by decision-making researchers. DbS is a general theory of decision-making which predicts that choices should only be influenced by sampling experience (and relative ranking), and not by absolute values and their magnitudes (Stewart et al., 2006).

**2.2.4.2 Predicting Risky Behaviour by Type of Sampling Experience**

Follow-up logistic regression models (for each of the two sampling experiences) were used with a predictor type of decision-making task, and outcome variable respondents' risk preferences.

### 2.2.4.2.1 Sampling Experience Within The Range of The Gambles' Prizes

The regression model was statistically significant $\chi^2(1)= 8.70$, $p=.003$. The results indicated that type of decision-making task was a significant predictor, positively associated with participants' choices *OR EXP(B)*=1.70, *CI*(.95) = (1.192; 2.417), $p=.003$. The OR for the risky choice (choosing the risky gamble) was 1.70 times larger when the decision-making task used gambles with a non-desirable monetary prize (safe gamble) and a desirable monetary prize (risky gamble) than when the decision-making task used safe and risky gambles with non-desirable monetary prizes (see Figure 8). This significant result is not anticipated by DbS, which predicts that only sampling experience and relative ranks influence risk preferences (Stewart et al., 2006).

### 2.2.4.2.2 Sampling Experience Below and Above The Gambles' Prizes

The regression model was statistically significant $\chi^2(1)= 34.21$, $p<.001$. Specifically, the results revealed that type of decision-making task was a statistically significant predictor, positively associated with respondents' risky choices *OR EXP(B)*=2.93, *CI*(.95) = (2.027; 4.220), $p<.001$. The OR for the risky choice was 2.93 times larger when the decision-making task used gambles with a non-desirable prize (safe gamble) and a desirable monetary prize (risky gamble) than when the decision-making task used safe and risky gambles with non-desirable monetary prizes (see Figure 8). As before and in contrast to DbS predictions, this result is not expected by DbS (Stewart et al., 2006). Moreover, this result indicates a pattern of risk preferences in the opposite direction of DbS predictions (Ungemach et al., 2011).

### 2.2.4.2.3 Predicting Risky Behaviour With Non-Manipulated Factors

The non-manipulated factors included the age and gender of participants, the respondents' judgements (for both price-product pairs) and purchase decisions, as well as decision-making time. Similar to Ungemach et al. (2011), none of the non-manipulated factors influenced significantly respondents' risk-preferences (see Table 6).

**Table 6**

*Inferential Statistics for the Coefficients in the Logistic Regression Model with the Additional Non-Experimental Factors*

| Coefficient | Wald | Exp(B) | 95% CI for Exp(B) | | *P* |
|---|---|---|---|---|---|
| | | | *LL* | *UL* | |
| Gender | 1.945 | 1.203 | .928 | 1.560 | .163 |
| Age | 2.089 | .993 | .985 | 1.002 | .148 |
| Price-product Pair One Judgement | .179 | .967 | .830 | 1.128 | .673 |
| Price-product Pair One Purchase Decision | .291 | 1.082 | .811 | 1.444 | .590 |
| Price-product Pair Two Judgement | 1.891 | 1.124 | .952 | 1.327 | .169 |
| Price-product Pair Two Purchase Decision | .135 | 1.060 | .778 | 1.443 | .714 |
| Decision-Making Time | 1.167 | 1.000 | .999 | 1.000 | .280 |

Overall, the results suggest that DbS did not successfully predict respondents' risk-preferences. Instead, participants' risk preferences were influenced by the desirability of the gambles' prizes regardless of whether the sampling experience was within the range of the gambles' prizes or below and above the gambles prizes. This novel finding cannot be accounted for by DbS theory, which predicts that human risk preferences are informed by sampling experience (and relative ranking), not absolute values and their magnitudes (Stewart et al., 2006).

## 2.3 Experiment 2: The Influence of Absolute Values and Presentation of Gambles on Risky Choices

### 2.3.1 Introduction

In contrast to DbS predictions, the results in Experiment 1 revealed a shift in participants' risk preferences based on the desirability of the gambles prizes. Specifically, participants preferred the safe gamble when both gambles were with non-desirable prizes (Safe gamble - 55% chance of winning £0.50 or Risky gamble - 15% chance of winning £1.50) and the risky gamble when the gambles were with a non-desirable (Safe gamble - 55% chance of winning £0.50) and a desirable (Risky gamble - 0.15% chance of winning £150) monetary prize. Accordingly, it is plausible that in Experiment 1 when participants were offered gambles with a non-desirable (£0.50) and desirable prize (£150), the salience of the money attribute increased and prompted participants to make comparisons between gambles on the money attribute (prize comparisons), leading them to choose predominantly the risky gamble (offering a desirable prize - £150). Moreover, it is also plausible that when participants were offered gambles with non-desirable prizes (£0.50 or £1.50) but large differences in probability (55% and 15%), this increased the salience of the money attribute and prompted participants to make comparisons between gambles on the probability attribute (probability comparisons), leading them to choose predominantly the safe gamble (offering a large probability of winning – 55%). This effect is in addition to the effect from experience with non-desirable monetary prizes.

Therefore, in Experiment 2, I explore participants' risk preferences when both gambles are with desirable (safe gamble - 55% chance of winning £100 or risky gamble – 15% chance of winning £300) or non-desirable prizes as in Experiment 1 (safe gamble - 55% chance of winning £0.50 or risky gamble 15% chance of winning £1.50). Specifically, Experiment 2 sought to determine whether participants would still prefer the risky gamble (offering a larger prize - £300) over the safe gamble (offering a smaller prize - £100) when choosing between two gambles with desirable monetary prizes (prize comparisons). Accordingly, in congruence with the results of Experiment 1 (comparison on the probability attribute with gambles offering non-desirable prizes), it is plausible that when participants are offered two gambles with desirable prizes (£100 or £300), their preferences will be determined by comparisons on the probability attribute leading to preference for the safe gamble (large probability – 55%).

Moreover, it is also plausible that the comparison on the probability attribute could be further enhanced (more direct comparisons of the values on the probability attribute) or disrupted (less direct comparisons of the values on the probability attribute) by the visual contextual presentation of the safe and risky gambles (horizontal or vertical). For example, with vertical presentation of the gambles, participants might find it easier to compare within the probability attribute as the attribute values are presented with no other information between them. In contrast, with horizontal presentation of the gambles, participants might find it harder to compare within the probability attribute as the attribute values are presented with information between them. Accordingly, participants may prefer the safe gamble more with vertical presentation than with horizontal presentation.

### 2.3.2 Method

#### 2.3.2.1 Participants

All participants were recruited via an online data panel service and received payment of £1 for their participation. A window of 14 days was set for data collection, and by the end of this window 558 participants had taken part. The mean age of participants was 53 years old (*SD*=13.36), and 259 (46.4%) of the participants were female. The experiment received approval from the School's research ethics committee. All participants who took part in the study were treated in accordance with the British Psychological Society's code of ethics and conduct, and the American Psychological Association's ethical principles.

A significance level of .05 was used for statistical testing. In this experiment, an effect size was not assumed. However, a retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size (f = .40 by convention; Cohen, 1988) of the independent-measures effects of *type of decision-making task*, *type of sampling experience* and *presentation of gambles* and their interaction. A large effect size will achieve a statistical power of at least .95. Post-hoc power analysis demonstrated that the sample size (N = 558) produced a power of 1 which exceeded the target of .95.

### 2.3.2.2 Experimental Design

A 2 x 2 x 2 independent measures design was used, with the following independent variables: (i) type of decision-making task (gambles with non-desirable monetary prizes or gambles with desirable monetary prizes), (ii) type of sampling experience (below and above the gambles prizes, or within the range of the gambles prizes), and (iii) presentation of gambles (horizontal or vertical). As in Ungemach et al. (2011) the dependent variable was participants' risk preference; a binary choice between a safe gamble (which offered a high probability of winning a smaller monetary prize), and a risky gamble (which offered a low probability of winning a larger monetary prize).

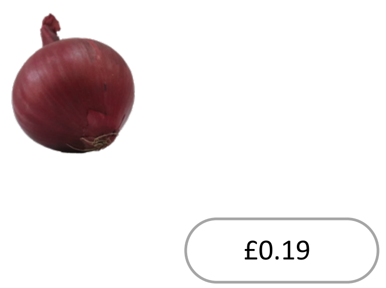
In order to establish whether participants experienced the gambles with non-desirable monetary prizes and the gambles with desirable monetary prizes as different, a manipulation check test was conducted. Once participants had made their binary choice between the safe and risky gambles, they were required to judge the desirability of the non-desirable or desirable gambles on a ten-point Likert scale (0 – *very undesirable* to 9 – *very desirable*). As expected, the results revealed a significant difference between the participants' judgements for the gambles with non-desirable ($M$= 4.40; $SD$= 1.61) and desirable ($M$=5.28; $SD$= 1.53) monetary prizes, $t(556) = -6.66$, $p<.001$. Accordingly, the participants found the gambles with desirable monetary prizes to be significantly more desirable than the gambles with non-desirable monetary prizes.

### 2.3.2.3 Materials and Procedure

At the beginning of the experiment, participants were asked to sample two price-product pairs (see Figure 9 for an example), as Ungemach et al. (2011) hypothesised that recently sampled monetary values should influence subsequent risk preferences. Accordingly, participants in the experience below and above the gambles' prizes conditions sampled the monetary amounts of £0.19 and £380, whilst participants in the experience inside the range of the gambles' prizes either sampled the monetary amounts of £0.74 and £1.07 or £148 and £214[14]. Following the design of Ungemach and colleagues, participants were required to judge the value of the first-price product pair on a five-point Likert scale (*extremely poor value – extremely good value*) and subsequently to indicate whether they would buy the product (yes, I would buy the product/no, I would not buy the product). Then the participants were shown the second price-product pair and were required to judge its value and indicate whether they would purchase the product. Moreover, to avoid possible biases from product or price associations, there were four products randomly associated with each price. Moreover, the market value associated with each product were taken from large UK retailers.

**Figure 9**

*Example Price-Product Pair*




Once both price-product pairs had been presented and their corresponding judgement and willingness to purchase tasks completed, participants had to make a choice between safe and risky gambles as in Experiment 1. Specifically, participants had to choose between a safe

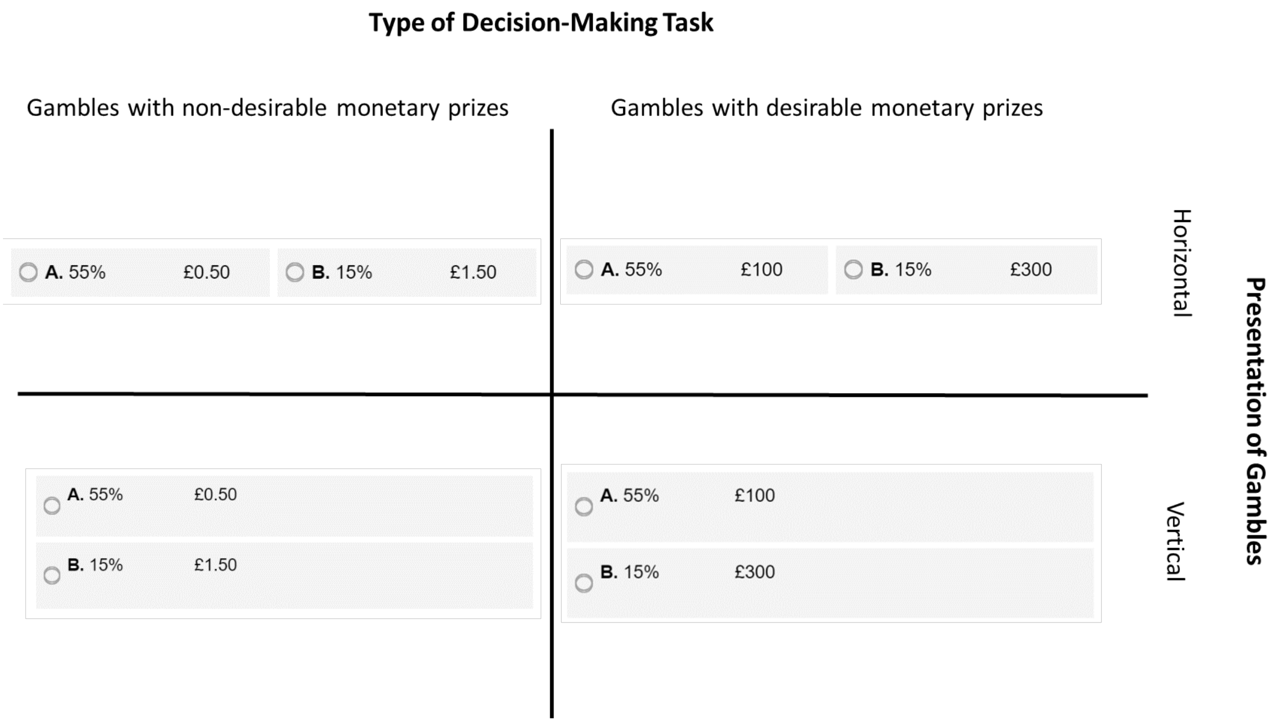
[14] Two sets of prices were used in the experiment to accommodate the subsequent manipulation to type of decision-making task. Specifically, as the gambles used either desirable monetary prizes (£100 and £300) or non-desirable monetary prizes (£0.50 and £1.50), it was not possible to find one set of values which fell between both sets of outcomes.

gamble offering a high probability of winning a smaller amount or a risky gamble offering a low probability of winning a larger amount. Accordingly, participants in the conditions using gambles with non-desirable monetary prizes had to make a choice between 55% chance of winning £0.50 (safe), or 15% chance of winning £1.50 (risky; see Figure 10). In contrast, participants in the conditions using gambles with desirable monetary prizes were required to choose between 55% chance of winning £100 (safe), or 15% chance of winning £300 (risky; see Figure 10). Moreover, the presentation of gambles was manipulated so that the gambles were either presented horizontally side-by-side (similar to Experiment 1) or vertically one above the other (see Figure 10).

**Figure 10**

*Possible Gambles Presentations*

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).




### 2.3.3 Results and Discussion

In Experiment 2 the objectives are to: (i) eliminate money comparisons (comparisons on the money attribute) by asking participants to choose between gambles with either both non-desirable monetary prizes or both desirable monetary prizes; and, (ii) explore the possibility that probability comparisons (comparisons on the probability attribute) can be influenced by vertical (enhanced) or horizontal (disrupted) gamble presentation. Accordingly, a logistic regression model was used with predictors experience (within the range of the gambles prizes, or below and above the gambles prizes), type of decision-making task (gambles with non-desirable monetary prizes, or gambles with desirable monetary prizes), presentation of gambles (horizontal or vertical) and their interactions. The outcome variable was participants' risk preferences (safe or risky). The regression model was a significant fit to the data $\chi^2(7)=36.18$, $p<.001$. Specifically, the results revealed that the only significant predictors that contributed to the model were type of decision-making task (*OR EXP[B]*=.34, *CI*[.95] = [.156; .753], *p*=.008), and presentation of gambles (*OR EXP[B]*=.35, *CI*[.95] = [.159; .767], *p*=.009), which were both negatively associated with participants' risky choices. Accordingly, the OR for the risky choice was .34 times smaller when the decision-making task contained gambles with desirable monetary prizes, than when it contained gambles with non-desirable monetary prizes (see Figure 11). Therefore, desirable monetary prizes decreased participants' preference for the risky gamble. As predicted, when participants were offered two gambles with desirable monetary prizes (£100 or £300), their preferences were determined by comparisons on the probability attribute, leading to preferences for the safe gamble (high probability of winning a smaller monetary prize). Moreover, the OR for the risky gamble option was .35 times smaller when presentation of gambles was vertical than horizontal (see Figure 11). In other words, the odds of participants choosing the risky gamble was smaller with vertically presented gambles, than with horizontally presented gambles. This result was predicted as with vertical presentation of the gambles enhanced the comparison on the probability attribute, which inducted preferences for the safe gamble (high probability of winning a smaller monetary prize). Furthermore, the main predictor of experience, as well as the three two-way interactions and the three-way interaction made non-significant contributions to the model (p>.005; see Table 7).

**Figure 11**

*Frequencies of Safe and Risky Choices as a Function of Presentation of Gambles and Type of Decision-Making Task*

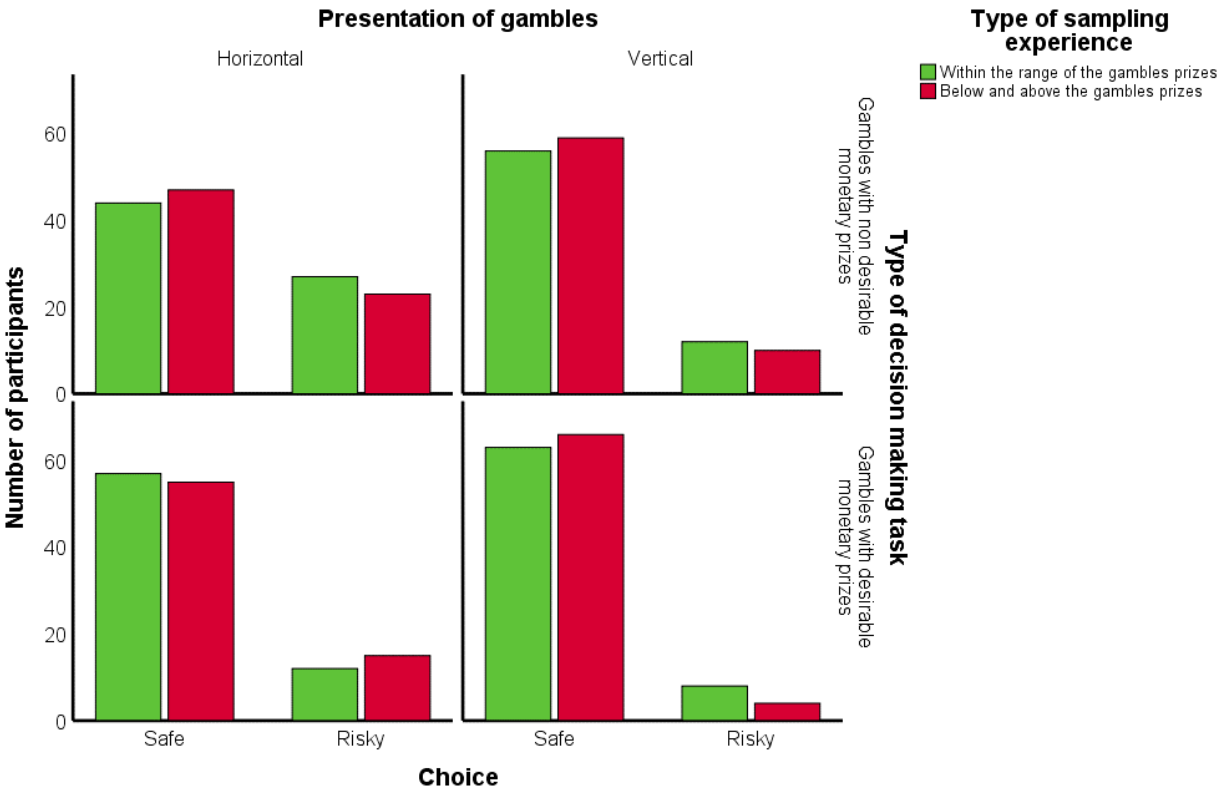



**Table 7**

*Inferential Statistics for the Coefficients in the Logistic Regression Model with the Main Predictor of Experience, Two-Way Interactions, and the Three-Way Interaction*

| Coefficient | Z | P | Exp(B) | Lower | Upper |
|---|---|---|---|---|---|
| Experience | .411 | .521 | .797 | .399 | 1.593 |
| Experience by type of decision-making task | .759 | .384 | 1.624 | .545 | 4.840 |
| Experience by presentation of gambles | .000 | .989 | .992 | .315 | 3.124 |
| Type of decision-making task by presentation of gambles | .742 | .389 | 1.727 | .498 | 5.991 |
| Experience by type of decision-making task by presentation of gambles | 1.050 | .306 | .371 | .056 | 2.470 |

### 2.3.3.1 Predicting Risky Behaviour With Non-Manipulated Factors

The non-manipulated factors included the gender and age of participants, the respondents' judgements and purchase decisions (for both price-product pairs), as well as decision-making time. As with the results in Experiment 1 and consistent with Ungemach et al. (2011), none of the non-manipulated factors predicted participants' risk-preferences (see Table 8).

**Table 8**

*Inferential Statistics for the Coefficients in the Logistic Regression Model with the Additional Non-Experimental Factors*

| Coefficient | Wald | Exp(B) | 95% CI for Exp(B) | | *P* |
|---|---|---|---|---|---|
| | | | *LL* | *UL* | |
| Gender | .109 | 1.075 | .701 | 1.649 | .741 |
| Age | 1.393 | 1.010 | .994 | 1.026 | .238 |
| Price-product Pair One Judgement | .220 | 1.059 | .833 | 1.347 | .639 |
| Price-product Pair One Purchase Decision | 2.505 | 1.553 | .900 | 2.679 | .113 |
| Price-product Pair Two Judgement | .830 | 1.146 | .855 | 1.535 | .362 |
| Price-product Pair Two Purchase Decision | 0.33 | 1.053 | .604 | 1.836 | .855 |
| Decision-Making Time | .370 | 1.003 | .993 | 1.014 | .543 |

In contrast to the predictions of Ungemach et al. (2011) and more broadly DbS (Stewart et al., 2006), the results from Experiment 2 revealed that sampling experience (and relative ranking) did not influence participants' risk preferences. In congruence with the results from Experiment 1 (comparisons on the probability attribute), the results from Experiment 2 revealed that when participants were offered gambles with two non-desirable (£0.50 or £1.50) or two desirable (£100 or £300) monetary prizes they preferred the safe gamble (high probability of winning a smaller monetary prize). This result was predicted, as I argued that preferences would be determined by comparisons on the probability attribute, as there was not a gamble with a desirable monetary prize which could enhance the comparisons on the monetary attribute. Moreover, as predicted, this effect was further enhanced by the vertical presentation of the gambles. Specifically, the results revealed that participants were less likely to choose the risky gamble with vertically presentation than with horizontal presentation as the comparisons on the probability attribute were enhanced, leading to preferences for the safe gamble (high probability of winning a smaller monetary prize).

## 2.4 General Discussion

In their DbS relative rank model Stewart et al. (2006) argue that people's judgements and decisions about available options are not determined by their absolute values. Instead, the subjective value of an available option (e.g., a gamble) is represented by its relative rank within an attribute (e.g., money), when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory and/or context). For example, in one of their studies Ungemach et al. (2011) demonstrated that participants' choices between a safe gamble offering a smaller prize (£0.50) combined with a high probability of winning (55%), and a risky gamble offering a larger prize (£1.50) combined with a low probability of winning (15%), were constructed in relation to whether recently sampled monetary amounts (price-product pairs) were within (£0.74 and £1.07) or below and above (£0.19 and £3.80) the range of the gambles prizes. Specifically, Ungemach and colleagues' results revealed that people chose the risky gamble more when sampled amounts were within the range of the gambles prizes, than where the sampled amounts were below and above the gambles prizes. This is because with sampled values inside the range of the gambles' prizes the relative rank difference between the safe and risky gambles was large (rank 0=£0.50; rank 1=£0.74; rank 2=£1.07, and rank 3=£1.50), and therefore the risky gamble was perceived to be much more attractive than the safe gamble. In contrast, with sampled values below and above the gambles' prizes, the relative rank difference between the safe and risky gambles was small (rank 0=£0.19; rank 1=£0.50; rank 2=£1.50, and rank 3=£3.80), and therefore the risky gamble was not perceived to be particularly more attractive than the safe gamble.

However, in the present Chapter I have argued that people's risk preferences can be influenced by the desirability of gambles' prizes regardless of their sampling experience. Specifically, in Experiment 1 I argued that the negligible and non-desirable gambles' prizes (£0.50 and £1.50) used by Ungemach et al. (2011) did not trigger participants' risk preferences, and therefore prompted them to sample from experience to reach a decision. Accordingly, I proposed that increasing the desirability of the risky gamble (by offering a larger monetary amount - £150) would increase participants' preference for the risky gamble, regardless of sampling experience and therefore shift participants' preferences from the safe gamble (with non-desirable prizes) to the risky gamble (with a desirable prize). Moreover, I also proposed that participants would only sample from experience when choosing between gambles with non-desirable monetary prizes. Consistent with my predictions, the results from Experiment 1 revealed that when choosing between gambles with the non-desirable monetary prizes used by Ungemach and colleagues (£0.50 and £1.50) participants constructed their preferences in relation to recently sampled monetary values, as predicted by Ungemach and colleagues and more broadly DbS (Stewart et al., 2006). Thus, participants who sampled monetary amounts below and above the gambles' prizes (£0.19 and £380) were less likely to choose the risky gamble, than the participants who sampled monetary amounts within the range of the gambles' prizes (£0.74 and £1.07). However, with choice between a safe gamble with a non-desirable monetary prize (£0.50) and a risky gamble with a desirable monetary prize (£150) there was no influence from sampling experience (or relative ranking) on participants' risk preferences, and therefore they chose the risky gamble regardless of how sampling experience was distributed. Overall, the results from Experiment 1 suggested that DbS did not successfully predict participants' risk preferences. Instead, participants' risk preferences were influenced by the desirability of the gambles' prizes regardless of whether sampled amounts were within the range of the gambles prizes, or below and above the gambles prizes. This novel finding cannot be accounted for by DbS theory, which predicts that human risk preferences are informed by sampling experience (and relative ranking), not absolute values and their magnitudes (Stewart et al., 2006).

In Experiment 2 I suggested that the results of Experiment 1 (shift in participants' risk preferences based on gamble desirability) could be explained by the within attribute comparisons. Specifically, when offered gambles with a non-desirable (£0.50) and desirable (£150) monetary prizes, I suggested it is plausible that participants made comparisons between gambles on the monetary attribute (prize comparisons), and chose predominantly the risky gamble. Similarly, when offered gambles with non-desirable prizes (£0.50 or £1.50), I suggested it is plausible that participants made comparisons between gambles on the probability attribute (probability comparisons) and chose predominantly the safe gamble (offering a large probability of winning – 55%). This effect is in addition to the effect from experience with non-desirable monetary prizes. Therefore, Experiment 2 explored participants' risk preferences when both gambles were with desirable (Safe gamble - 55% chance of winning £100 or Risky gamble – 15% chance of winning £300) or non-desirable prizes as in Experiment 1 (Safe gamble - 55% chance of winning £0.50 or Risky gamble 15% chance of winning £1.50). Specifically, Experiment 2 sought to determine whether participants would still prefer the risky gamble (offering a larger prize - £300) over the safe gamble (offering a smaller prize - £100) when choosing between two gambles with desirable monetary prizes (prize comparisons). Accordingly, in congruence with the results of Experiment 1 (comparison on the probability attribute with gambles offering non-desirable prizes), I suggested it plausible that the risk preferences of participants offered two gambles with desirable prizes (£100 or £300) would be determined by comparisons on the probability attribute, leading to a preference for the safe gamble as it had the largest probability of winning (55%). Moreover, I also proposed that as comparisons on the probability attribute could be enhanced (more direct comparisons of the values on the probability attribute) or disrupted (less direct comparisons of the values on the probability attribute) by the visual contextual presentation of the safe and risky gambles (horizontal or vertical), participants may prefer the safe gamble more with vertical presentation than with horizontal presentation.

As with the results from Experiment 1, the results from Experiment 2 revealed that in contrast to the predictions of Ungemach et al. (2011) and more broadly DbS (Stewart et al., 2006), participants' risk preferences were not influenced by sampling experience and relative ranking. Moreover, in congruence with the results from Experiment 1 (comparisons on the probability attribute), the results from Experiment 2 also revealed that participants who were offered gambles with both non-desirable (£0.50 or £1.50) and desirable (£100 or £300) monetary prizes preferred the safe gamble (high probability of winning a smaller monetary prize). I predicted this result in advance, as I argued that when there was not a gamble with a desirable monetary prize which could enhance comparison on the monetary attribute, participants' risk preferences would be determined by comparison on the probability attribute. Moreover, as predicted, this effect was further enhanced by vertical presentation of the gambles. Specifically, participants were less likely to choose the risky gamble with vertically presentation than with horizontal presentation as the comparisons on the probability attribute were enhanced, leading to preferences for the safe gamble (high probability of winning a smaller monetary prize).

However, it is also plausible that participants did not make choices based on binary comparisons on the probability attribute, but rather the first contextually available attribute, which in Experiments 1 and 2 was always probability. Accordingly, the next chapter (Experiments 3 and 4) will explore the possibility that participants make binary comparisons on the first contextually available attribute (FAH) irrespective of whether this attribute is probability or money.

Of course, as with DbS, there will be boundaries to the influence that desirability has on people's risk preferences. Accordingly, to encourage further empirical research, I will now speculatively discuss a potential boundary to desirability. For example, in congruence with the proposal that human preferences are constructed 'on the fly', it is possible that had I used alternate probability and money values, I may have been unsuccessful in eliciting an influence from desirability. In other words, it is reasonable to assume that the influence of desirability is bounded by the specific monetary and probability values which are used in an experiment, and therefore an influence from desirability may not be found in every risky choice experiment. In the same vein, even if influence from desirability is successfully elicited, its specific influence on people's risk preferences is influenced by the specific attribute values used in the choice task (e.g., see Experiment 2). The results in Experiment 1 revealed that desirability influenced participants' preferences in a way which demonstrates violation of not only DbS, but also EUT. For example, in the decision-making task the participants were given the opportunity to choose gambles which maximised their expected utility (the safe gamble). Instead, the participants chose the desirable gamble when it was available, despite its lower expected value. Accordingly, as this is not part of the objectives in the dissertation, future research could explore whether desirability is affectively driven or influenced by individual differences (e.g., personal wealth).

# Chapter 3

# The First Attribute Heuristic and Risky Decision-Making

## 3.1 Overview of Chapter 3

Chapter 3 is composed of two Experiments (Experiments 3 and 4) which seek to empirically demonstrate FAH. Specifically, according to FAH participants' risk preferences are determined by binary comparison on the first contextually available attribute (regardless of whether it is money or probability), and prefer the gamble with the dominant value on the first contextually available attribute relatively more than the gamble with the inferior value on the first contextually available attribute.

In Experiment 3 I explore whether *first contextually available attribute* (probability or money) and *first attribute presentation* (horizontal or vertical) have a significant influence on participants' risk preference; a binary choice between a safe gamble (which offered a high probability of winning a smaller monetary prize), and a risky gamble (which offered a low probability of winning a larger monetary prize). Accordingly, consistent with FAH predictions, the results demonstrated that participants' choices are influenced by binary comparison on the first contextually available attribute. Moreover, the results from Experiment 3 revealed that first attribute presentation did not significantly control for participants' risk preferences where it was equally easy to compare on attributes with horizontal and vertical presentation (no disruption), the first attribute presentation had no significant influence on participants' risky preferences. This further indicates that participants made their decisions within the first contextually available attribute using binary comparisons, as predicted by FAH.

In Experiment 4 I further explore the influence of FAH on participants' risk preference by eliminating a confound in Experiment 3 (that probability was associated with the safe gamble, and that money attribute was associated with the risky gamble), by using a repeated-measures design and gambles which each have two probability and money attributes. Accordingly, Experiment 3 explores the influence of *first contextually available* attribute (probability and money) and *gambles with dominant values within the first contextually available attribute* (safe and risky) on *mean risk preferences*. In congruence with FAH predictions, the results revealed that irrespective of whether probability or money is the first contextually available attribute, participants made binary comparisons on the first contextually available attribute and preferred the gambles with the dominant values within the first contextually available attribute. Moreover, the results also revealed an overall risk-seeking pattern of preferences across all experimental conditions, which is not consistent with PT that predicts overall risk-averse preferences in the domain of gain (Tverksy & Kahneman, 1992).

## 3.2 Experiment 3: The Influence of The First Attribute Heuristic on Simple Binary Risky Choices

### 3.2.1 Introduction

In contrast to DbS predictions (Stewart et al., 2006; Ungemach et al., 2011), the results from Experiment 2 revealed that participants' risk preferences were not influenced by sampling experience (and relative ranking). In congruence with results from Experiment 1 (comparisons on the probability attribute), Experiment 2 demonstrated that when there was not a desirable monetary prize to enhance comparisons on the monetary attribute (both gambles had prizes which were either non-desirable - £0.50 or £1.50, or both desirable - £100 or £300), participants' preferences were determined by comparisons on the probability attribute. Moreover, as predicted, this effect was further enhanced by the vertical presentation of the gambles. Specifically, the results revealed that participants were less likely to choose the risky gamble with vertically presentation than with horizontal presentation as the comparisons on the probability attribute were enhanced, leading to preferences for the safe gamble (high probability of winning a smaller monetary prize).

However, it is plausible that participants were not making choices based on binary comparisons on the probability attribute, but rather on the first contextually available attribute (FAH) which in Experiments 1 and 2 was always probability. Moreover, it is also plausible that the enhanced (with vertical) and disrupted (with horizontal) attribute binary comparisons fuelled the effect of type of presentation. Therefore, in Experiment 3, I will explore the possibility that participants are making binary comparisons on the first contextually available attribute (FAH) irrespective of whether this attribute is probability or money. In addition, all gambles will use horizontal and vertical attribute values that are equally easy to compare (without comparisons being disrupted); it is anticipated that the horizontal or vertical presentation of the attribute values will have no effect on participants' risk preferences and only that the binary comparisons on the first contextually available attribute will influence participants' choices.

Whilst my FAH proposal is novel, extensive experiment research supports the plausibility of the assumptions which I have made. Specifically, there is a plethora of evidence that people's judgements and decisions are informed by binary comparison between options within an attribute (e.g., Helson, 1947, 1948; Huber et al., 1982; Kusev et al., 2011; Schakade & Kahneman, 1998; Shafir, 1993; Stewart et al., 2006; Tversky, 1969, 1972a, 1972b). Likewise, the assumption that people make comparisons on the first contextually available attribute is consistent with research that has demonstrated that 'firsts' have a privileged influence on human cognition (see Carney & Banaji, 2012). More generally, FAH is consistent with research which has demonstrated that people overcome their bounded cognitive ability by using simplifying heuristics which enable judgements and decisions to be made with relative ease (e.g., Gigerenzer & Gaissmaier, 2011; Gigerenzer et al., 1999; Kusev et al., 2011; Tversky & Kahneman, 1974). Furthermore, in keeping with the notion that the rationality of heuristics is ecological (determined by how well they match with the task and context; see Gigerenzer, 2002, 2008; Gigerenzer et al., 1999), I assume that FAH is not good (rational) or bad (irrational) per se, as it produces outcomes which are relative to the environment (the order of the first contextually available attribute determines preferences).

### 3.2.2 Method

#### 3.2.2.1 Participants

In Experiment 3 all participants were recruited via PureProfile, an online data panel service, and received payment of £1 for their participation. A window of 14 days was set for data collection, and by the end of this window 139 participants successfully completed the tasks. The mean age of participants was 56 years old (*SD*=14.15), and 56 (40.3%) of the participants were female. The experiment received approval from Huddersfield Business School's research ethics committee. Moreover, all participants who took part in the study were treated in accordance with the British Psychological Society's code of ethics and conduct, and the American Psychological Association's ethical principles.

In this experiment, a significance level of .05 was used for statistical testing and an effect size was not assumed. However, a retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size (f = .40 by convention; Cohen, 1988) of the independent-measures effects of *first contextually available attribute* and *first attribute presentation* and their interaction. According to Cohen, a large effect size will achieve a statistical power of at least .95. Accordingly, post-hoc power analysis demonstrated that the sample size (N = 139) produced a power of 1 which exceeded the target of .95.

#### 3.2.2.2 Experimental Design

A 2 x 2 independent measures design was used, with the following independent variables: (i) first contextually available attribute (probability or money) and (ii) first attribute presentation (horizontal or vertical). As in Experiment 2, the dependent variable was participants' risk preference; a binary choice between a safe gamble (which offered a high probability of winning a smaller monetary prize), and a risky gamble (which offered a low probability of winning a larger monetary prize).

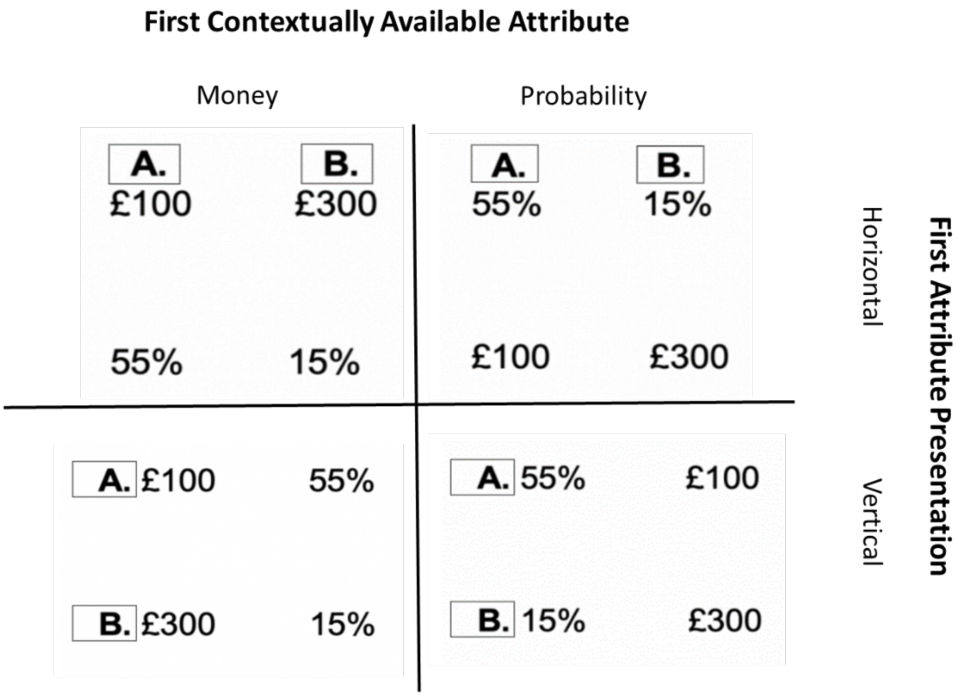
### 3.2.2.3 Materials and Procedure

Participants were required to make a choice between safe and risky gambles, as in Experiment 2. Specifically, participants had to choose between a safe gamble offering a high probability of winning a smaller amount or a risky gamble offering a low probability of winning a larger amount. Accordingly, participants had to make a choice between a safe gamble offering 55% chance of winning £100 and a risky gamble offering 15% chance of winning £300. However, unlike in Experiment 2, the presentation of the gambles was manipulated so that either probability was the first contextually available attribute or money was the first contextually available attribute (see Figure 12). Moreover, the presentation of the first attribute was manipulated too, so that the gambles first attribute was either presented vertically or horizontally. Furthermore, in Experiment 3 all gambles used horizontal or vertical attribute values that were equally easy to compare (without comparisons being disrupted; see Figure 12).

**Figure 12**

*Possible Attribute Presentations*

Choose one of the following two hypothetical options by clicking once on the chosen option (A or B). For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).



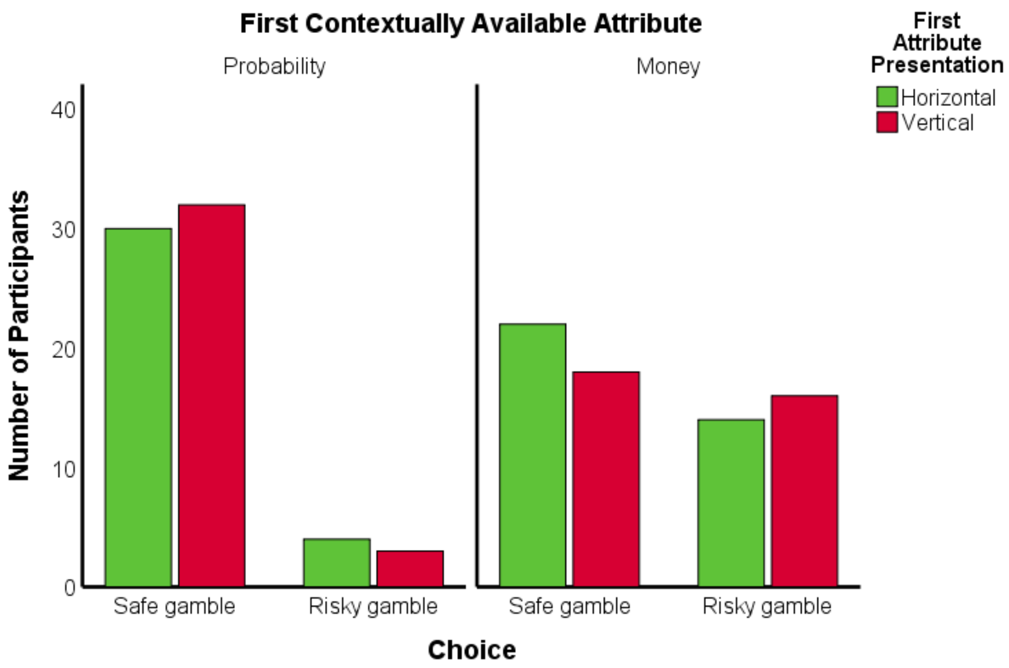

### 3.2.3 Results and Discussion

In Experiment 3 the objectives are to: (i) empirically demonstrate that FAH influences participants' risk preferences during choice between risky gambles; and (ii) to establish whether the influence of presentation (horizontal or vertical) established in Experiment 2, can be eliminated when attribute values are equally easy to compare across both types of presentation. Accordingly, a logistic regression model was used with predictors first contextually available attribute (probability or money), first attribute presentation (horizontal or vertical), and the two-way interaction first contextually available attribute by first attribute presentation. The outcome variable was participants' risk preference (risky or safe). The results revealed that the regression model was statistically significant $\chi^2(3)$=20.85, $p$<.001. Specifically, the first contextually available attribute was the only significant predictor that contributed to the model (*OR EXP[B]*=4.77, *CI*[.95] = [1.381; 16.491], *p*=.013), indicating that the first contextually available attribute was positively associated with participants' risky choices. Accordingly, the OR for choosing the risky gamble was 4.77 times larger when the risky gamble had a dominant monetary value within the first contextually available attribute (money), than when the risky gamble had an inferior probability value within the first contextually available attribute (probability); see Figure 13. In other words, participants chose the risky gamble (low probability of winning a larger monetary prize) relatively more when the first contextually available attribute was money (the risky gamble offered a larger monetary prize), than when the first contextually available attribute was probability (the safe gamble offered a large probability of winning). This result was anticipated, and provides evidence that participants' choices are influenced by binary comparison on the first contextually available attribute.

The second predictor first attribute presentation (*OR EXP[B]*=.70, *CI*[.95] = [.145; 3.406], *p*=.662), as well as the two-way interaction first contextually available attribute by first attribute presentation (*OR EXP[B]*=1.99, *CI*[.95] = [.315; 12.529], *p*=.465), did not significantly contribute to the model. Accordingly, as predicted, when it was equally easy to compare on attributes with horizontal and vertical presentation (no disruption), the first attribute presentation had no significant influence on participants' risky preferences.

**Figure 13**

*Frequencies of Safe and Risky Choices as a Function of First Contextually Available Attribute and First Attribute Presentation*




Collectively, the results from this experiment provided evidence for the FAH where participants' preferences are determined by binary comparison on the first contextually available attribute, and they preferred the gamble with the dominant value on the first contextually available attribute relatively more than the gamble with the inferior value on the first contextually available attribute. Specifically, participants chose the risky gamble (low probability of winning a larger monetary prize) relatively more when the first contextually available attribute was money (the risky gamble offered a larger monetary prize), than when the first contextually available attribute was probability (the safe gamble offered a high probability of winning). Moreover, the results revealed that when the gambles' attribute values were equally easy to compare across horizontal and vertical presentation (no disruption), there was no significant influence on participants' choice preferences from the first attribute presentation. Accordingly, this supports my prediction that participants' preferences are based on binary comparison within the first contextually available attribute and not influenced by the gambles' presentation (vertical or horizontal), but rather by the ease of comparing the attribute values of the gambles. This further indicates that participants made their decisions within the first contextually available attribute using binary comparisons, as predicted by FAH.

## 3.3 Experiment 4: The Influence of The First Attribute Heuristic on Complex Binary Risky Choices

### 3.3.1 Introduction

In Experiment 3 participants' choices were based on the first contextually available attribute 'probability' or 'money'. For example, when the first contextually available attribute, was probability participants' preferences were for the safe gamble (offering a high probability of winning). In contrast, when the first contextually available attribute was money, participants' preferences for the safe gamble decreased; therefore, preference for the risky gamble (offering a larger monetary prize) increased. Accordingly, the probability attribute was always associated with the safe gamble (a dominant value on the probability attribute) and the monetary attribute was always associated with the risky gamble (a dominant value on the monetary attribute). In order to overcome this confound, Experiment 4 employed a new repeated measures independent variable - dominant gamble within the first contextually available attribute (safe and risky). However, in contrast to Experiments 1, 2 and 3, in Experiment 4 each gamble uses two probability values and two monetary values. Therefore, in Experiment 4 both gambles (safe and risky) use probability and money as the first contextually available attribute, and can therefore have dominant values on both probability or money attributes within the first contextually available attribute. Accordingly, irrespective of whether probability or money is the first contextually available attribute, participants will be making binary comparisons on the first contextually available attribute and prefer the gambles with the dominant values within the first contextually available attribute. Hence, according to the FAH proposal, the first independent variable in Experiment 4 (first contextually available attribute – money and probability) should not influence participants' risk preferences.

However, it is anticipated that the risky gambles with dominant values within the first contextually available attribute will induce relatively more risk-seeking preferences than the safe gambles with dominant values within the first contextually available attribute. This is because when the risky gambles have dominant values within the first contextually available attribute, the binary comparisons between the risky (dominant values) and safe (inferior values) gambles on the first contextually available attribute induce participants' risk-seeking preferences. In contrast, when the safe gambles have dominant values within the first contextually available attribute, the binary comparisons between the risky (inferior values) and safe (dominant values) gambles on the first contextually available attribute reduce participants' risk-seeking preferences.

The goal of Experiment 4 is to replicate the findings of Experiment 3 regarding the FAH. Moreover, I will explore whether FAH will account for participants' risk preferences when a repeated measures design is used, and the first contextually available attribute (probability and money) is associated with both safe (dominant values on the probability attribute) and risky (dominant values on the monetary attribute) gambles. These changes in the experimental design will provide further evidence and confirm that participants are making binary comparisons on the first contextually available attribute, regardless of whether the first contextually available attribute is probability or money, or whether the gambles are safe or risky.

### 3.3.2 Method

#### 3.3.2.1 Participants

All participants were recruited via an online data panel service and received payment of £1 for their participation. A window of 14 days was set for data collection, and by the end of this window 161 participants had taken part. The mean age of participants was 50 years old (*SD*=14.62), and 80 (49.7%) of the participants were female. The experiment received approval from the School's research ethics committee. Moreover, all participants who took part in the study were treated in accordance with the British Psychological Society's code of ethics and conduct, and the American Psychological Association's ethical principles.

For statistical testing, a significance level of .05 was used. A retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size (f = .40 by convention; Cohen, 1988) of the repeated measures effects of *first contextually available attribute* and *gambles with dominant values within the first contextually available attribute* and their interaction. According to Cohen, a large effect size will achieve a statistical power of at least .95. Post-hoc power analysis demonstrated that the sample size (N = 161) produced a power of 1 which exceeded the target of .95.

#### 3.3.2.2 Experimental Design

A 2 x 2 repeated measures design was used, with the following independent variables: (i) first contextually available attribute (probability and money) and (ii) gambles with dominant values within the first contextually available attribute (safe and risky). The dependent variable was mean risk preferences (0 = risk-averse, 1 = risk-seeking). In Experiment 4, according to the FAH proposal, the first independent variable (first contextually available attribute) should not influence participants' risk preferences.

#### 3.3.2.3 Materials and Procedure

In Experiment 4 all participants had to make a total of twenty choices between a safe gamble (overall offering a higher probability of winning a smaller amount of money), and a risky gamble (overall offering a lower probability of winning a larger amount of money); see Figure 14. Moreover, each gamble was constructed of two parts, and each part offered a probability of winning a monetary prize. Across four experimental conditions the same five gambles were repeated, but with the first contextually available attribute manipulated so that either the probability (see Figure 14a and 14b) or monetary attribute (see Figure 14c and 14d) was first. Accordingly, the safe and risky gambles used both probability and money as the first contextually available attribute. Therefore, both safe (see Figure 14b and 14d) and risky (see Figure 14a and 14c) gambles had dominant values on both probability or money attributes, within the first contextually available attribute.

In Experiment 4, regardless of whether the first contextually available attribute is probability or money, or whether the gambles are safe or risky, it is anticipated that participants' preferences will be influenced by binary comparisons within the first contextually available attribute. Accordingly, it is predicted by FAH that participants will prefer the gambles with dominant values within the first contextually available attribute relatively more than the gambles with inferior values within the first contextually available attribute.

**Figure 14**

*Gamble Presentation Across Conditions*

| | | | |
|---|---|---|---|
| **14a. First contextually available attribute (probability) and gambles with dominant values within the first contextually available attribute (risky gambles)** | | **14b. First contextually available attribute (probability) and gambles with dominant values within the first contextually available attribute (safe gambles)** | |
| **Gamble choice 1** | | **Gamble choice 1** | |
| Safe Gamble A. | 30% £100 and 65% £50 | Safe Gamble A. | 65% £50 and 30% £100 |
| Risky Gamble B. | 35% £80 and 55% £100 | Risky Gamble B. | 55% £100 and 35% £80 |
| **Gamble choice 2** | | **Gamble choice 2** | |
| Safe Gamble A. | 29% £90 and 64% £40 | Safe Gamble A. | 64% £40 and 29% £90 |
| Risky Gamble B. | 34% £70 and 54% £90 | Risky Gamble B. | 54% £90 and 34% £70 |
| **Gamble choice 3** | | **Gamble choice 3** | |
| Safe Gamble A. | 28% £80 and 63% £30 | Safe Gamble A. | 63% £30 and 28% £80 |
| Risky Gamble B. | 33% £60 and 53% £80 | Risky Gamble B. | 53% £80 and 33% £60 |
| **Gamble choice 4** | | **Gamble choice 4** | |
| Safe Gamble A. | 27% £70 and 62% £20 | Safe Gamble A. | 62% £20 and 27% £70 |
| Risky Gamble B. | 32% £50 and 52% £70 | Risky Gamble B. | 52% £70 and 32% £50 |
| **Gamble choice 5** | | **Gamble choice 5** | |
| Safe Gamble A. | 26% £60 and 61% £10 | Safe Gamble A. | 61% £10 and 26% £60 |
| Risky Gamble B. | 31% £40 and 51% £60 | Risky Gamble B. | 51% £60 and 31% £40 |
| | | | |
| **14c. First contextually available attribute (money) and gambles with dominant values within the first contextually available attribute (risky gambles)** | | **14d. First contextually available attribute (money) and gambles with dominant values within the first contextually available attribute (safe gambles)** | |
| **Gamble choice 1** | | **Gamble choice 1** | |
| Safe Gamble A. | £50 65% and £100 30% | Safe Gamble A. | £100 30% and £50 65% |
| Risky Gamble B. | £100 55% and £80 35% | Risky Gamble B. | £80 35% and £100 55% |
| **Gamble choice 2** | | **Gamble choice 2** | |
| Safe Gamble A. | £40 64% and £90 29% | Safe Gamble A. | £90 29% and £40 64% |
| Risky Gamble B. | £90 54% and £70 34% | Risky Gamble B. | £70 34% and £90 54% |
| **Gamble choice 3** | | **Gamble choice 3** | |
| Safe Gamble A. | £30 63% and £80 28% | Safe Gamble A. | £80 28% and £30 63% |
| Risky Gamble B. | £80 53% and £60 33% | Risky Gamble B. | £60 33% and £80 53% |
| **Gamble choice 4** | | **Gamble choice 4** | |
| Safe Gamble A. | £20 62% and £70 27% | Safe Gamble A. | £70 27% and £20 62% |
| Risky Gamble B. | £70 52% and £50 32% | Risky Gamble B. | £50 32% and £70 52% |
| **Gamble choice 5** | | **Gamble choice 5** | |
| Safe Gamble A. | £10 61% and £60 26% | Safe Gamble A. | £60 26% and £10 61% |
| Risky Gamble B. | £60 51% and £40 31% | Risky Gamble B. | £40 31% and £60 51% |

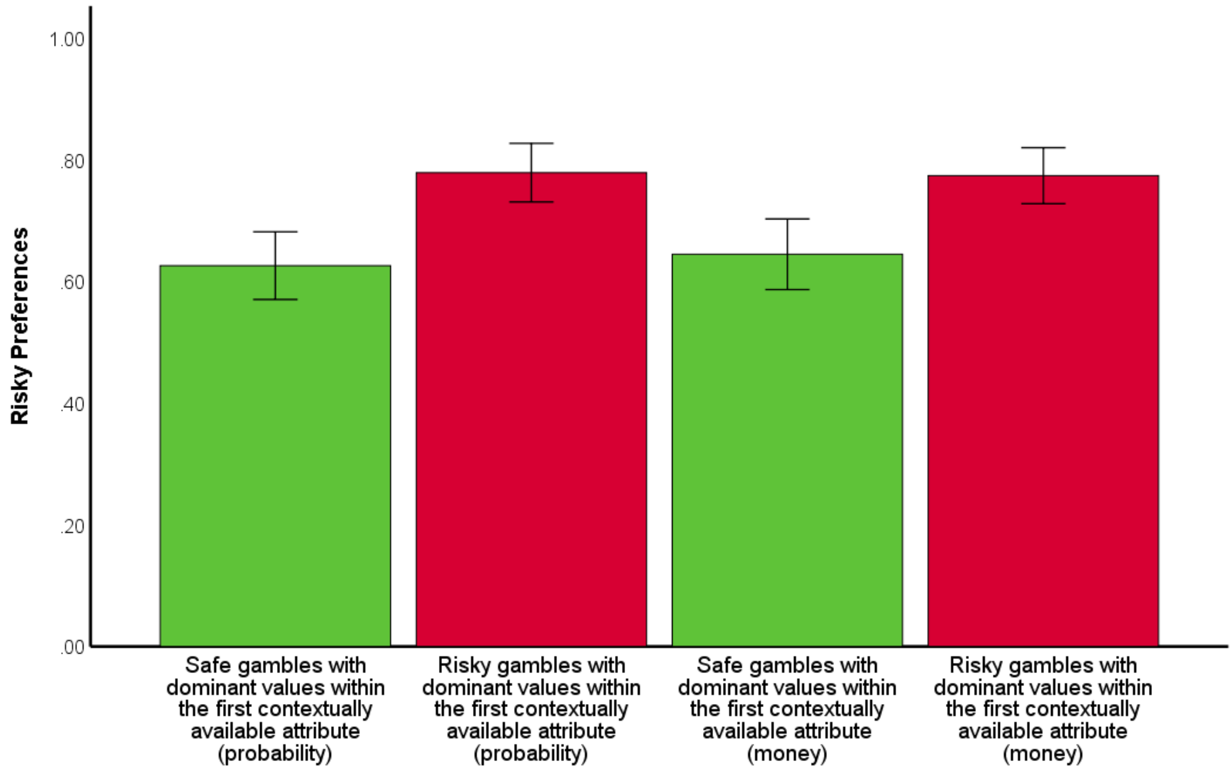
### 3.3.3 Results and Discussion

The objective in Experiment 4 is to empirically demonstrate that FAH influences people's risk preferences in a repeated measures design where participants have to make a series of choice between risky gambles, and where the probability attribute is not associated with risk-aversion and the money attribute is not associated with risk-seeking (as they are in Experiment 3). Accordingly, a 2 x 2 repeated measures ANOVA was conducted with the independent variables first contextually available attribute (probability and money) and gambles with dominant values within the first contextually available attribute (safe and risky), and the outcome variable mean risk preferences. The overall pattern of results revealed that participants' preferences were predominantly risk-seeking across all experimental conditions. Moreover, the results revealed that the first contextually available attribute ($F<1$) as well as the two-way interaction first contextually available attribute by gambles with dominant values within the first contextually available attribute ($F<1$) had not a statistically significant influence on respondents' choice preferences for risk. This result is expected as both first contextually available attributes (probability and money) had safe and risky gambles with dominant values within the first contextually available attribute. Accordingly, irrespective of whether probability or money is the first contextually available attribute, participants made binary comparisons on the first contextually available attribute and preferred the gambles with the dominant values within the first contextually available attribute.

However, the gambles with dominant values within the first contextually available attribute significantly influenced participants' risky preferences, $F(1,160)=33.76$, $p<.001$, with a large effect size $\eta_p^2=.174$. This demonstrates that, as predicted, participants' risk preferences were influenced by the gambles with dominant values (safe and risky) within the first contextually available attribute. Specifically, participants were relatively more risk-seeking in their preferences when the risky gambles had dominant values within the first contextually available attribute ($M=.776$; $SD=.303$) than when safe gambles had dominant values within the first contextually available attribute ($M=.635$; $SD=.365$), see Figure 15. This is because when the risky gambles had dominant values within the first contextually available attribute, the binary comparisons between the risky (dominant values) and safe (inferior values) gambles on the first contextually available attribute induced participants' risk-seeking preferences. In contrast, when the safe gambles had dominant values within the first contextually available attribute, the binary comparisons between the risky (inferior values) and safe (dominant values) gambles on the first contextually available attribute reduced participants' risk-seeking preferences.

**Figure 15**

*Participants' Risky Preferences (mean values; 0 = safe, 1 = risky). Error Bars Represent 95% Confidence Intervals of the Means.*




The results from Experiment 4 replicated the findings of Experiment 3 and extended the empirical evidence for FAH by demonstrating that participants used FAH, even when the design was repeated measures. Accordingly, as predicted the participants were making binary comparisons on the first contextually available attribute and chose the gambles with dominant values within the first contextually available attribute relatively more than the gambles with inferior values within the first contextually available attribute. In particular, in Figure 15 this is represented by the difference in participants' risk preference in conditions where the risky gambles have dominant values within the first contextually available attribute and conditions where the safe gambles have dominant values within the first contextually available attribute. Specifically, in conditions where the risky gambles had dominant values within the first contextually available attribute (the red bars), participants were more risk-seeking (regardless of whether the first contextually attribute was probability of money) than when the safe gambles had dominant values within the first contextually available attribute (the green bars). In contrast, in conditions where the safe gambles had dominant values within the first contextually available attribute (the green bars), participants were more risk-seeking seeking (regardless of whether the first contextually attribute was probability of money) than when the risky gambles had dominant values within the first contextually available attribute (the red bars).

Moreover, in contrast to PT (overall risk-averse preferences in the domain of gain; Tversky & Kahneman, 1992), the results revealed an overall risk-seeking pattern of preferences across all experimental conditions. This result is anticipated by experience-based decision-making researchers (Hertwig et al., 2004; see Hertwig, 2012); however, they employ methods that require experience, sampling and complex cognitive interpretations. In contrast, FAH does not require sampling and benefits from a simple decision-making mechanism.

### 3.4 General Discussion

In Chapter 3, I have argued that participants' preferences are determined by FAH, where they make binary comparisons on the first contextually available attribute and prefer the gamble with the dominant value on the first contextually available attribute relatively more than the gamble with the inferior value on the first contextually available attribute. Specifically, in Experiment 3 I proposed the plausibility of FAH because in Experiments 1 and 2 the first contextually available attribute was always probability. Moreover, in Experiment 3 I also suggested that the effect from presentation of gambles (horizontal or vertical) in Experiment 2 was fuelled by the enhanced (with vertical) and disrupted (with horizontal) attribute binary comparisons. Therefore the effect of gambles presentation was eliminated when the gambles used attribute values that were equally easy across horizontal and vertical presentations.

In congruence with FAH predictions, the results from Experiment 3 revealed that participants' choices between safe (high probability of winning a smaller monetary prize) and risky (low probability of winning a larger monetary prize) gambles were influenced by binary comparison on the first contextually available attribute. Specifically, participants chose the risky gamble (high probability of winning a smaller monetary prize) relatively more when the first contextually available attribute was money (the risky gamble offered a larger monetary prize), than when the first contextually available attribute was probability (the safe gamble offered a large probability of winning). Accordingly, this is evidence for FAH where participants' preferences are determined by binary comparison on the first contextually available attribute, and they preferred the gamble with the dominant value on the first contextually available attribute relatively more, than the gamble with the inferior value on the first contextually available attribute. Moreover, as predicted, the results also revealed that when it was equally easy to compare on attributes with horizontal and vertical presentation (no disruption), the first attribute presentation had no significant influence on participants' risky preferences. This supports my prediction that participants' preferences are based on binary comparison within the first contextually available attribute and not influenced by the gamble presentation (vertical or horizontal), but rather by the ease of comparing the attribute values of the gambles. This further indicates that participants made their decisions within the first contextually available attribute using binary comparisons, as predicted by FAH.

Experiment 4 aimed to further explore the influence of FAH on participants' risky choice preferences by eliminating a confound in Experiment 3. Specifically, in Experiment 3 the probability attribute was always associated with the safe gamble (a dominant value on the probability attribute) and the monetary attribute was always associated with the risky gamble (a dominant value on the monetary attribute). Accordingly, to overcome this confound, Experiment 4 used a repeated measures design and gambles, which were each constructed of two probability values and two monetary values. Therefore, both gambles (safe and risky) used probability and money as the first contextually available attribute, and therefore had dominant values of both probability and money attributes within the first contextually available attribute. Thus, irrespective of whether the first contextually available attribute was probability or money, it was predicted that participants would make binary comparisons on the first contextually available attribute, and prefer gambles with the dominant values within the first contextually available attribute. Hence, according to the FAH proposal, participants' risk preferences should not have been influenced by the first contextual available attribute independent variable. Instead, it was predicted that the risky gambles with dominant values within the first contextually available attribute will induce relatively more risk-seeking preferences than the safe gambles with dominant values within the first contextually available attribute. In contrast, when the safe gambles have dominant values within the first contextually available attribute, the binary comparisons between the risky (inferior values) and safe (dominant values) gambles on the first contextually available attribute reduce participants' risk-seeking preferences.

Consistent with the FAH predictions, the results from Experiment 4 revealed that the first contextually available attribute did not have a statistically significant influence of participants' risk preferences. This result was expected as both first contextually available attributes (probability and money) had safe and risky gambles with dominant values within the first contextually available attribute. Accordingly, irrespective of whether probability or money was the first contextually available attribute, participants made binary comparisons on the first contextually available attribute and preferred the gambles with the dominant values within the first contextually available attribute. However, as predicted, participants' risk preferences were influenced by the gambles with dominant values (safe and risky) within the first contextually available attribute. Specifically, participants were relatively more risk-seeking in their preferences when the risky gambles had dominant values within the first contextually available attribute, than when safe gambles had dominant values within the first contextually available attribute. This is because when the risky gambles had dominant values within the first contextually available attribute, the binary comparisons between the risky (dominant values) and safe (inferior values) gambles on the first contextually available attribute induced participants' risk-seeking preferences. In contrast, when the safe gambles had dominant values within the first contextually available attribute, the binary comparisons between the risky (inferior values) and safe (dominant values) gambles on the first contextually available attribute reduced participants' risk-seeking preferences. Overall, these results replicated those from Experiment 3 and extended the empirical evidence for FAH by demonstrating that participants used FAH even in a repeated measures design. Accordingly, as predicted, participants were making binary comparisons on the first contextually available attribute and chose the gambles with dominant values within the first contextually available attribute relatively more than the gambles with inferior values within the first contextually available attribute.

Moreover, the results from Experiment 4 also revealed an overall risk-seeking pattern of preferences across all experimental conditions, which is not consistent with PT (which predicts overall risk-averse preferences in the domain of gain; Tversky & Kahneman, 1992). Although, as Experiment 4 controlled for various factors (i.e., presentation, desirability, and the association between attributes and gambles), which PT did not, this suggests that the results of PT were an artefact of the method (see also Kusev et al., 2020). Moreover, whilst the overall risk-seeking pattern of preferences is anticipated by researchers exploring decisions from experience (Hertwig et al., 2004; see Hertwig, 2012), they employ methods which require experience, sampling and complex cognitive mechanisms. In contrast, FAH can explain this preference pattern without assuming sampling, and only with a simple heuristic.

# Chapter 4

# The First Attribute Heuristic and Non-Risky Judgements

## 4.1 Overview of Chapter 4

Chapter 4 is composed of two Experiments (Experiments 5 and 6) which seek to empirically demonstrate that people use FAH to determine their WTP preferences in non-risky tasks adapted from Hsee (1996). In Experiment 5, I explore whether *first contextually available attribute* (BSc degree result or experience with KY) and *candidate type* (candidate A and candidate B) influence participants' *WTP salary* for both job candidates in JE. In congruence with FAH predictions, the results revealed that participants' WTP salary judgements were significantly influenced by the first contextually available attribute. Specifically, participants made binary comparisons between the options on the first contextually available attribute, and were willing to pay a higher salary to the candidate dominant in the comparison than to the candidate inferior in the comparison. Moreover, González-Vallejo and Moran's (2001) proposed that in JE participants' preferences are predominantly informed by attribute importance and therefore people have a tendency to prefer the option dominant on the most important attribute. In contrast to González-Vallejo and Moran's proposal, the results from Experiment 5 demonstrated that the effect of participants' decisions of importance on WTP is influenced by the first contextually available attribute (a congruence effect). In particular, participants' WTP for job candidate was only significantly different when the attribute chosen by participants as being most important, is also the first contextually available attribute.

As Experiment 5 is restricted to JE, Experiment 6 uses a different non-risky scenario (WTP for TVs) adapted from Hsee (1996), and also his evaluability experimental method (JE and SE). In his evaluability theory Hsee (1996) proposed that people reverse their preference from JE to SE because in JE preferences are influenced by all attributes, whilst in SE participants' preferences are only influenced by attributes which are easy to evaluate. Accordingly, in Experiment 6 I explore the influence of *first contextually available attribute* and *type of TV* on participants' WTP purchase value judgements. In congruence with FAH predictions, the results revealed that in JE participants compared the TVs binary on the first contextually available attribute, and were willing to pay more for the TV dominant on the first contextually available attribute than for the TV inferior in the first contextually available attribute. Moreover, in congruence with FAH predictions, during SE (when TVs could not be compared) FAH did not influence participants' preferences as binary comparison on the first contextually available attribute was not possible. Furthermore, as in Experiment 5, in JE participants' preferences were influenced by a congruence effect where participants' WTP for TVs is only significantly different when the attribute chosen by participants as being most important, is also the first contextually available attribute. Although, the results from Experiments 6 also revealed a similar congruence effect in SE, albeit without comparison on the first contextually available attribute. Specifically, in SE participants' WTP purchase value judgements were influenced by the attribute chosen as most important, but only when the attribute chosen as most important is also the first contextually available attribute. Finally, in contrast to evaluability theory predictions (Hsee, 1996; see also Hsee et al., 1999), the results from Experiment 6 also revealed that in both JE and SE, participants' decisions of evaluation difficulty (between the attributes) do not significantly influence participants' WTP purchase value judgements.

As a final note to guide future research, given the overall findings of this chapter (and also from Experiment 7), one can speculate (post-hoc) regarding the relationship between FAH, attribute importance and evaluation difficulty. In particular, the results from Experiments 5 and 6 could be interpreted as suggesting that these factors can be ranked in order of their influence (from most influential to least influential) on people's WTP judgements in tasks adapted from Hsee's experimental method: FAH > attribute importance > evaluation difficulty.

## 4.2 Experiment 5: The Influence of The First Attribute Heuristic on WTP Salary Judgements

### 4.2.1 Introduction

In contrast to the assumptions of EUT (von Neumann & Morgenstern, 1947) and PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), the results from Chapter 3 (Experiments 3 and 4) demonstrated that participants' risky choice preferences were determined by FAH, a simple heuristic which assumes the use of a single domain general cognitive tool (binary comparison). Specifically, participants made a binary comparison on the first contextually available attribute, and preferred the gamble with the dominant value on the first contextually available attribute relatively more than the gamble with the inferior value on the first contextually available attribute. For example, with a choice between a safe gamble (55% chance of winning £100) and a risky gamble (15% chance of winning £300), participants chose the risky gamble (high probability of winning a smaller monetary prize) relatively more when the first contextually available attribute was money (the risky gamble offered a larger monetary prize), than when the first contextually available attribute was probability (the safe gamble offered a large probability of winning).

However, in keeping with evidence that people's non-risky judgements (e.g., Helson, 1947, 1948; Kusev et al., 2011; Schakade & Kahneman, 1998) and decisions (e.g., Huber et al., 1982; Shafir, 1993; Tversky, 1969, 1972a, 1972b) are determined using binary comparison, it is plausible that the influence of FAH on people's preferences is not restricted to risky choice. This possibility is especially plausible as 'firsts' have an established influence on human cognition (see Carney & Banaji, 2012), and have been demonstrated to influence human preferences in a variety of non-risky contexts. For example, people's impression of other groups (Steinmetz et al., 2020) and individuals (e.g., Asch, 1946; Sullivan, 2019; for a review see Forgas, 2011) are disproportionately informed by early information. Moreover, people tend to prefer consumer goods which are presented to them first (e.g., Carney & Banaji, 2012;

Mantonakis et al., 2009), and are more likely to vote for a candidate when their name appears first on a ballot (for an extensive review see Blom-Hansen et al., 2016).

Accordingly, in Experiment 5 I will explore the possibility that people may use FAH to determine their preferences (WTP judgements) in a non-risky recruitment task (joint evaluation only), adapted from Hsee (1996). The recruitment task provides an ideal environment to explore FAH in a non-risky domain because, if restricted to joint evaluation (evaluation of both simultaneously presented options), it is structurally similar to the risky gambles in Experiments 1 – 3 (which are known to trigger FAH). Specifically, in Experiment 5 participants have to state their WTP for two hypothetical job candidates (candidates A and B) who are defined on two attributes (BSc degree result and Experience with KY), where candidate A is dominant on the attribute BSc degree result (candidate A = 75%, candidate B = 65%) and candidate B is dominant on the attribute experience with KY (candidate B = 50, candidate A = 40). Therefore, according to FAH predictions participants should compare the candidates binary on the first contextually available attribute (BSc degree result or Experience with KY), and pay relatively more for the candidate dominant on the first contextually available attribute than the job candidate inferior on the first contextually available attribute.

However, in addition to influence from FAH, it is also plausible that participants' WTP judgements will also be influenced by attribute importance (Hsee, 2000; González-Vallejo & Moran, 2001). For instance, González-Vallejo and Moran (2001) proposed that when evaluating options in JE, people use a comparative procedure in which their preferences are predominantly informed by attribute importance, and therefore have a tendency to prefer the option dominant on the most important attribute. Accordingly, using tasks adapted from Hsee (1996) – including the job candidate study – González-Vallejo and Moran (2001) empirically demonstrated that under certain conditions, in JE verbally manipulating the importance of attributes can influence participants' WTP preferences. Specifically, they found that telling participants that GPA was the most important predictor of employee success shifted their preferences from candidate B (dominant on the experience with KY attribute) to candidate A (dominant on the GPA attribute). Thus, in addition to stating their WTP for each candidate, Experiment 5 will also require participants to make a binary choice about which attribute they consider to be most important.

### 4.2.2 Method

#### 4.2.2.1 Participants

For this experiment, respondents were recruited using PureProfile, an online data panel service, and received payment of £1 for their participation. A window of 14 days was set for data collection, and by the end of this window 170 participants had taken part. The mean age of participants was 49 years old (*SD*=14.38), and 92 (54.1%) of the participants were female. The experiment received approval from Huddersfield Business School’s research ethics committee. Furthermore, all participants were treated in accordance with the British Psychological Society’s code of ethics and conduct, and the American Psychological Association’s ethical principles.

For statistical testing, a significance level of .05 was used. I did not assume an effect size. However, a retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size (f = .40 by convention; Cohen, 1988) of the mixed measures effects of *first contextually available attribute* and *candidate type* and their interaction. A large effect size will achieve a statistical power of at least .95. Post-hoc power analysis demonstrated that the sample size (N = 170) produced a power of 1 which exceeded the target of .95.

#### 4.2.2.2 Experimental Design

A 2 x (2) mixed measures design was used, with the following independent variables: (i) first contextually available attribute (BSc degree result or Experience with KY) as a between participants factor, and (ii) candidate type (Candidate A and Candidate B) as a within participants factor. The dependent variable was willingness to pay (WTP) salary.

#### 4.2.2.3 Materials and Procedure

The materials used in this experiment were adapted from Hsee's (1996) job candidate study, and only presented in JE. Accordingly, upon entering the experiment participants were presented with a scenario in which they were asked to imagine that they were looking to hire a programmer to use the language KY, and that they were planning to pay between £20,000 and £40,000 annually; see Figure 16.

**Figure 16**

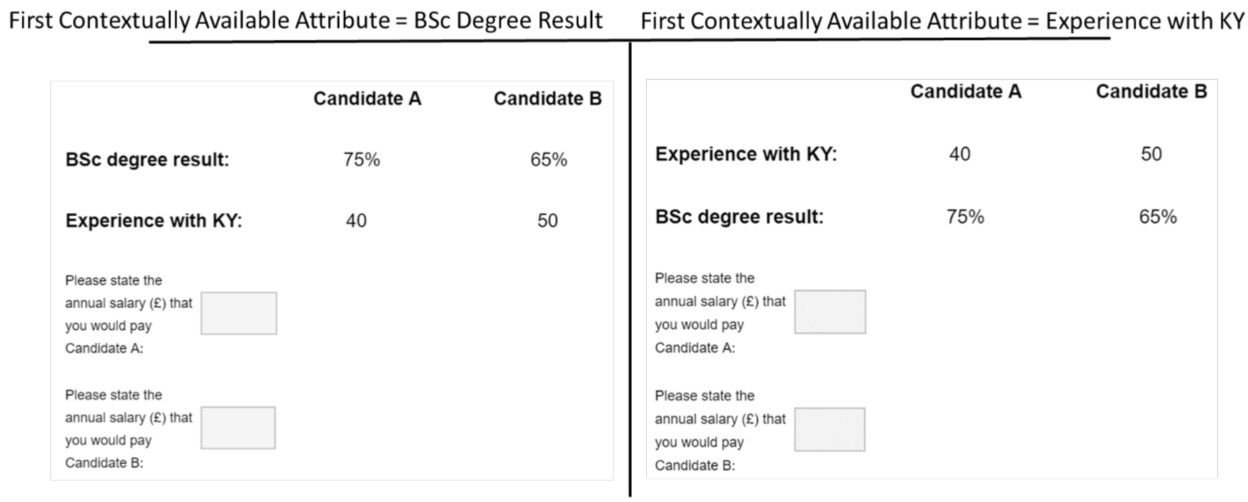
*Scenario*

Imagine that you are the owner of a consulting firm, and that you are looking to hire a new programmer to use a computer language called KY. You plan to pay the new programmer between £20,000 and £40,000 per year. Using the information provided below, please state the annual salary that you would pay each of the candidates. Both candidates have a BSc degree in computer science from the same UK university.

Below the scenario, participants were provided with information about two job candidates (candidate A and candidate B) who were both described on the attributes BSc degree result (used in place of GPA, which is not used in the UK) and experience with KY (following Hsee, 1996; experience with KY is a hard-to-evaluate attribute, hence the intentionally vague description). Within the attribute BSc degree result, candidate A had a dominant value (75%) and candidate B had an inferior value (65%). In contrast, within the attribute experience with KY, candidate B had a dominant value (50) and candidate A had an inferior value (40); see Figure 17. Accordingly, unlike in Hsee's (1996) experiment, the difference between the options attribute values was balanced (10 difference within each attribute - degree and experience) to eliminate any effect from desirability, and the possibility of biasing participants' preference in favour of a dominant option (neither candidate is objectively dominant). Of course, even though the attributes' values were evenly spaced, this does not necessarily mean that participants will regard them as being psychologically equivalent. Moreover, to induce FAH, the order of the attributes was manipulated so that either BSc degree result or experience with KY was the first contextually available attribute; see Figure 17. Below the scenario and information for both job candidates, participants were required to state their WTP salary in GBP for each job candidate; see Figure 17.

**Figure 17**

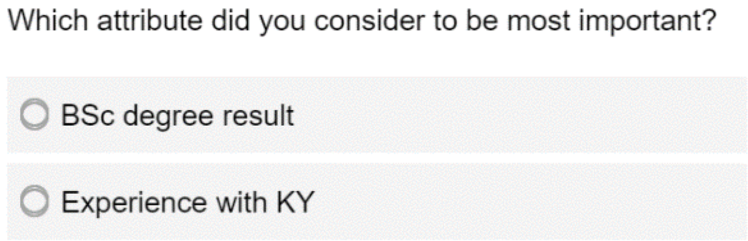
*The First Contextually Available Attribute Manipulation*




After participants had stated their WTP salary judgements for both candidates they were required to make a binary choice about which attribute they considered to be most important (BSc degree result or Experience with KY; see Figure 18).

**Figure 18**

*Decision of Attribute Importance in Experiment 5*




### 4.2.3 Results and Discussion

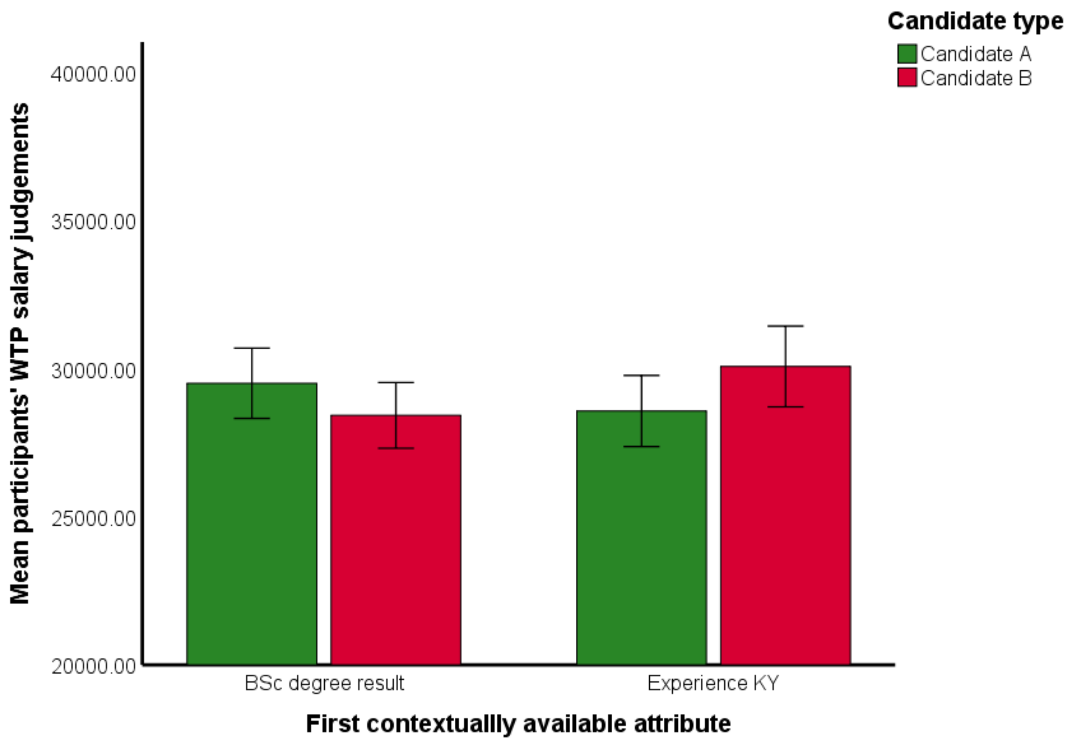
In Experiment 5 the objectives are to: (i) empirically explore whether FAH can influence participants' WTP judgements in a non-risky task (JE only); and (ii) to examine the influence of attribute importance on participants' WTP judgements. Accordingly, the dependent variable is willingness to pay (WTP) salary.

#### 4.2.3.1 Salary: Willingness to Pay

A 2 x (2) mixed measure analysis of variance was conducted with the independent variables first contextually available attribute (BSc degree result or experience with KY), candidate type (candidate A and candidate B) and their two-way interaction (candidate type by first contextually available attribute), and the dependent variable as participants' WTP salary judgements. The results revealed that neither of the main effects (candidate type or first contextually available attribute) had a statistically significant influence on participants' WTP salary, $F$<1. However, the two-way interaction candidate type by first contextually available attribute was statistically significant $F(1,168)=17.08$, $p<.001$, $\eta_p^2=.09$. Accordingly, because of the significant two-way interaction between candidates by first contextually available attribute (see Figure 19), two follow up analyses of variance were conducted.

**Figure 19**

*Participants' Willingness to Pay Salary by First Contextually Available Attribute and Candidate Type. Error Bars Represent 95% CI of the Means*




Follow up analyses of variance by first contextually available attribute as BSc degree result and experience with KY were conducted. When the first contextually available attribute was BSc degree result, participants were willing to pay a higher salary for candidate A (*M*=£29,518.07; *SD*=£5,440.05) than they were for candidate B (*M*=£28,433.73; *SD*=£5,087.51); this difference was statistically significant $F(1,82)=5.71$, $p=0.19$, $\eta_p^2=.07$, see Figure 18. Similarly, the candidate type influenced significantly participants' WTP salary judgements with the first contextually available attribute as KY, $F(1.86)=12.11$, $p=.001$, $\eta_p^2=.12$. Accordingly, the result revealed that when the first contextually available attribute was experience with KY participants' WTP salary was higher for candidate B (*M*=£30,086.21; *SD*=£6,401.40) than candidate A (*M*=£28,580.46; *SD*=£5,637.23); see Figure 19.

Taken together, these results confirmed the FAH reported in Experiments 3 and 4 and demonstrated the FAH in the domain of non-risky WTP judgements during JE. Specifically, the first contextually available attribute influenced participants' WTP salary judgements in accordance with the prediction of FAH. For instance, WTP salary for candidate A was higher than for candidate B when BSc degree result was the first contextually available attribute, and candidate A had a dominant value within BSc degree result (75%) and candidate B had an inferior value within BSc degree result (65%). This result indicates that respondents made a binary comparison between the candidates on the first contextually available attribute (BSc degree result) and subsequently offered a higher salary for the candidate with the dominant value within BSc degree result (candidate A). In contrast, WTP salary was higher for candidate B than for candidate A when experience with KY was the first contextually available attribute, and candidate B had a dominant value within experience with KY (50) and candidate A had an inferior value within experience with KY (40). This indicates that participants made binary comparisons between the candidates on the first contextually available attribute (experience with KY), and favoured the candidate with dominant value within KY experience (candidate B).

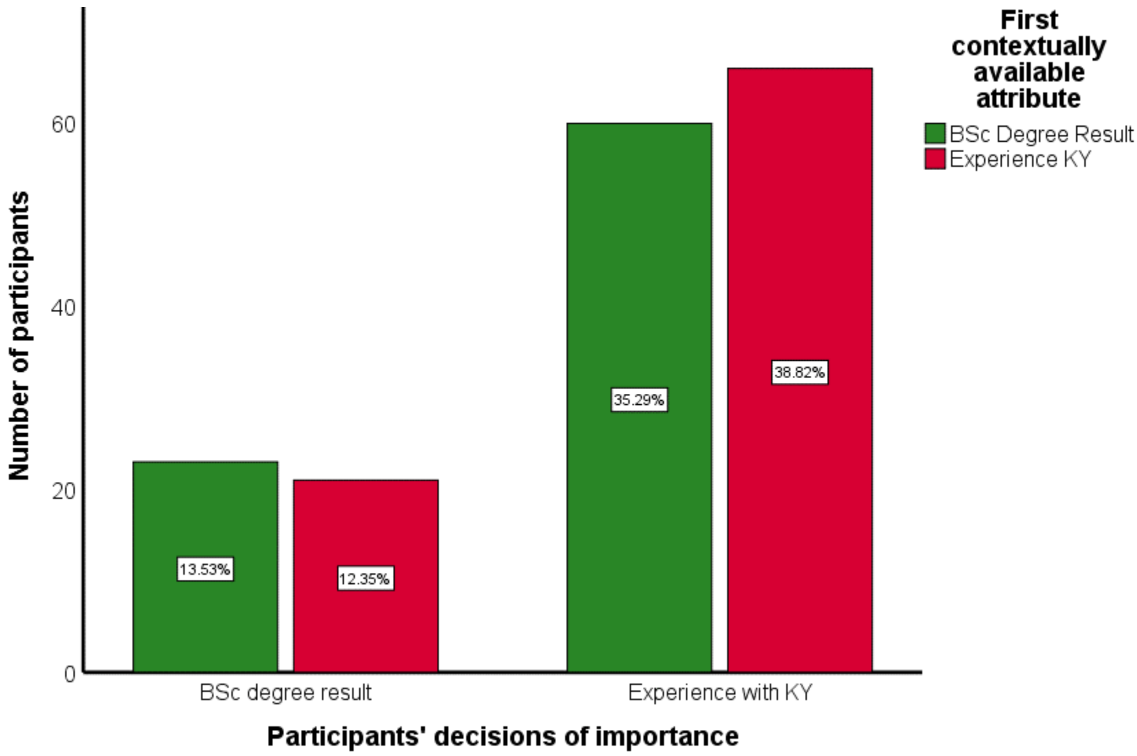
**4.2.3.2 Salary: Willingness to Pay (Including Importance)**

A binary logistic regression was performed with the predictor first contextually available attribute, and the participants' decisions of importance as an outcome variable. The results revealed that the regression model was statistically non-significant $\chi^2(1)$=.28, *p*=.595. Moreover, the first contextually available attribute did not significantly predict participants' decisions of importance between the attributes BSc degree result and experience (*OR EXP[B]*=1.21, *p*=.595, *CI*[.95] = [.606; 2.395]). Furthermore, the results revealed that there was a statistically significant difference between participants' decisions of importance between the attributes BSc degree result (25.88%) and experience with KY (74.11%), $\chi^2(1)$=39.55,

$p$<.001; see Figure 20. This preference for experience with KY was not influenced by the first contextually available attribute and consequently is used as an independent variable in the following analysis of variance with WTP salary judgement.

**Figure 20**

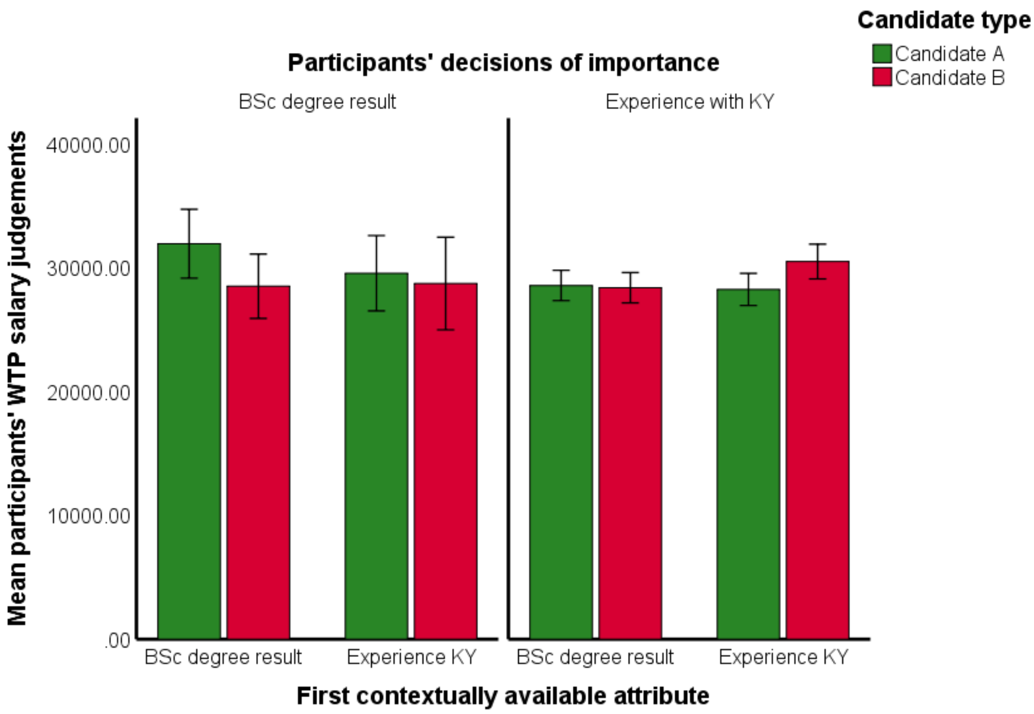
*Participants' Decisions of Importance by First Contextually Available Attribute*




Accordingly, a 2 x 2 x (2) mixed measures analysis of variance was conducted with the independent variables first contextually available attribute (BSc degree result or experience with KY), participants' decisions of importance (BSc degree result or experience with KY), and candidate type (candidate A and candidate B). The dependent variable was participants' WTP salary judgements. The results revealed that none of the main effects first contextually available attribute, $F$<1, participants' decisions of importance, $F$<1, and candidate type, $F(1,166)=2.64$, $p=.106$, $\eta_p^2=.02$, were statistically significant. Likewise, the two-way interaction first contextually available attribute by participants' decisions of importance, $F(1,166)=1.14$, $p=.287$, $\eta_p^2=.01$, and the three-way interaction candidate type by first contextually available attribute by participants' decisions of importance, $F<1$, were non-significant. However, the two remaining two-way interactions, candidate type by first contextually available attribute, $F(1,166)=13.82$, $p<.001$, $\eta_p^2=.08$, and candidate type by participants' decisions of importance, $F(1,166)=21.89$, $p<.001$, $\eta_p^2=.12$, were significant. Accordingly, because of the two significant two-way interactions, follow up analyses of variance were conducted (see Figure 21).

**Figure 21**

*Participants' Willingness to Pay Salary Judgements by First Contextually Available Attribute, Participants' Decisions of Importance and Candidate Type. Error Bars Represent 95% CI of the Means.*




Follow up analyses of variance by the first contextually available attribute as BSc degree result and experience with KY were conducted. When the first contextually available attribute was BSc degree result, there was a significant influence from candidate type on participants' WTP salary judgements, $F(1,81)=14.37$, $p<.001$, $\eta_p^2=.15$, but not from participants' decisions of importance, $F(1,81)=2.20$, $p=.142$, $\eta_p^2=.03$. Moreover, the results revealed that the two-way interaction candidate type by participants' decisions of importance was significant, $F$(1,81)=11.61, $p$=.001, $\eta_p^2$=.13. Moreover, when experience with KY was the first contextually available attribute, the main effects of candidate type, $F$(1,85)=2.18, $p$=.144, $\eta_p^2$=.03, and participants' decisions of importance, $F$<1, did not have statistically significant influence on participants' WTP salary judgements. However, the two-way interaction candidate type by participants' decisions of importance was statistically significant, $F$(1,85)=10.30, $p$=.002, $\eta_p^2$=.11. Accordingly, due to the significant two-way interactions under BSc degree result and experience with KY, a further four follow up one-way analyses of variance (repeated measures) were conducted.

Four follow up analyses of variance were conducted with the independent variable type of candidate (candidate A and candidate B) by first contextually available attribute (BSc degree result or experience with KY) and participants' decision of importance (BSc degree result or experience with KY):

(i) First contextually available attribute (BSc degree result) by participants' decisions of attribute importance (BSc degree result). The results revealed that candidate type significantly influenced participants' WTP salary judgements, $F$(1,22)=13.52, $p$=.001, $\eta^2$=.38. Specifically, participants' WTP salary judgement was higher for candidate A ($M$=31956.52; $SD$=6436.84) than for candidate B ($M$=28521.74; $SD$=6021.80); see Figure 21.

(ii) First contextually available attribute (BSc degree result) by participants' decisions of attribute importance (Experience with KY). The main effect of candidate type was non-significant, $F$<1; see Figure 21.

(iii) First contextually available attribute (Experience with KY) by participants' decisions of attribute importance (BSc degree result). The effect of candidate type was not statistically significant, $F$(1,20)=1.21, $p$=.284, $\eta^2$=.06; see Figure 21.

(iv) First contextually available attribute (Experience with KY) by participants' decisions of attribute importance (Experience with KY). The main effect of candidate type, $F$(1,65)=21.52, $p$<.001, $\eta^2$=.25, had a statistically significant influence on participants' WTP salary judgements. Specifically, participants' WTP was higher for candidate B (*M*=30515.15; *SD*=5717.70) than for candidate A (*M*=28265.15; *SD*=5280.75); see Figure 21.

Accordingly, similar to González-Vallejo and Moran's (2001) proposal, the results revealed that attribute importance influences WTP during JE. However, unlike González-Vallejo and Moran's JE prediction, the results demonstrated that the effect of participants' decisions of importance on WTP is influenced by the first contextually available attribute. Specifically, during JE participants' WTP salary judgements for the candidates, was only significantly different when the most important attribute was also the first contextually available attribute for comparison. For instance, WTP salary for candidate A was higher than for candidate B when BSc degree result was chosen as the most important attribute, but only when the first contextually available attribute for comparison was also BSc degree result (candidate A 75%, candidate B 65%). This indicates congruency between the attribute chosen as important and the first contextually available attribute. Likewise, participants' WTP salary judgement for candidate B was higher than for candidate A when experience with KY was chosen as the most important attribute, but only when the first contextually available attribute for comparison was also experience with KY (candidate A 40, candidate B 50). In contrast, when the attribute chosen as important and the first contextually available attribute for comparison were incongruent (BSc degree result important and experience with KY as the first attribute; experience with KY as important and BSc degree result as the first attribute), there was no significant difference between participants' WTP salary judgements for candidate A and candidate B. This provides evidence that participants made binary comparison on the first contextually available attribute, as with incongruence, the first attribute eliminated the effect of attribute importance on WTP, and with congruence the first attribute induced the effect of attribute importance on participants' WTP salary judgements during JE (see Figure 21).

The results in Experiment 5 confirmed the results of Experiments 3 and 4, and demonstrated the influence of the FAH in non-risky tasks. For example, participants compared binary the job candidates on the first contextually available attribute, and preferred the candidate with the dominant value (BSc degree result or experience with KY) on the first contextually available attribute relatively more than the candidate with the inferior value on the first contextually available attribute. Moreover, the results also revealed a congruence effect where participants' WTP salary judgements were influenced by the attribute which they chose as most important and made binary comparisons on this attribute, but only when the attribute chosen as most important was also the first contextually available attribute. In other words, participants compared the values on the first contextually available attribute only when the first contextually available attribute was also chosen as most important. Therefore, these results provide evidence that binary comparisons were made on the first contextually available attribute.

## 4.3 Experiment 6: The Influence of The First Attribute Heuristic on WTP Purchase Value Judgements

### 4.3.1 Introduction

The results from Experiment 5 confirmed and extended those of Experiments 3 and 4 (Chapter 3) by demonstrating that FAH influenced participants' preferences (WTP judgements) in a non-risky recruitment task, which was adapted from Hsee (1996). Specifically, the results demonstrated that participants compared the job candidates binary on the first contextually available attribute, and preferred the candidate with the dominant value on the first contextually available attribute, relatively more than the candidate with the inferior value on the first contextually available attribute. Furthermore, similar to González-Vallejo and Moran's (2001) proposal, the results revealed that attribute importance influences WTP during JE. Although, unlike González-Vallejo and Moran's JE prediction, the results demonstrated that the effect of participants' decisions of importance on WTP is influenced by the first contextually available attribute. Accordingly, the results also revealed a congruence effect where participants' WTP salary judgements were only significantly different when the attribute chosen as most important was also the first contextually available attribute. Thus, participants compared the candidates on the first contextually available attribute, but only when it was also chosen as most important. However, the experimental method employed in Experiment 5 was restricted to JE. Accordingly, the goal of Experiment 6 is to further explore FAH and the congruence effect within the evaluability experimental method employed by Hsee (1996).

The evaluability experimental method was used by Hsee (1996; see also Hsee, 1998; Hsee et al., 1999) to validate his evaluability theory, the leading theory of JE-SE preference reversals (Sher & McKenzie, 2014). JE-SE preference reversals, first demonstrated by Bazerman et al. (1992), occur when participants' preferences for options reverse depending on whether they are evaluated together (JE) or evaluated in isolation (SE). According to Hsee's evaluability theory, JE-SE preference reversals occur because some attributes are easier to evaluate in isolation than others (see Hsee & Zhang, 2010); attributes which are easy-to-evaluate in isolation can be understood in isolation (without comparison), whilst attributes which are hard-to-evaluate in isolation require comparison to interpret. Accordingly, in evaluability theory Hsee (1996; see also Hsee, 1999) proposes that in SE people's preference are determined by easy-to-evaluate rather than hard-to-evaluate attributes, whilst in JE people's preferences are determined by both easy-to-evaluate and hard-to-evaluate attributes. Therefore, as hard-to-evaluate attributes have relatively more influence on preferences in JE than in SE, and easy-to-evaluate attributes have relatively more influence on preferences in SE than in JE, the evaluability theory predicts a preference reversal from the option dominant on hard-to-evaluate attribute during JE to the option dominant on the easy-to-evaluate attribute in SE. For example, consider the following information about TVs in Table 9, where brightness reflects how bright the picture is and warranty indicates the length of the warranty, in months:

**Table 9**

*TV Information*

| | TV A | TV B |
|---|---|---|
| Warranty | 24 | 34 |
| Brightness | 230cd/m2 | 220cd/m3 |

According to evaluability theory predictions, when the TVs are evaluated in JE both warranty and brightness information can be interpreted and will influence participants' WTP for the TVs. Accordingly, TV A (dominant on the hard-to-evaluate attribute brightness) will appear more favourable in JE than in SE. In contrast, in SE (TVs presented and evaluated independently) as the warranty attribute is easy-to-evaluate in isolation (e.g., people know how long 24 months is) but the brightness attribute is hard-to-evaluate in isolation (e.g., people do not know how good 230cd/m2 is), participants' WTP will be determined by the warranty attribute, and therefore TV B (dominant on the easy-to-evaluate attribute warranty) will appear relatively more favourable than during JE. Therefore, if the shift in preference is large enough between JE and SE it can lead to preference reversals from the option superior on the hard-to-evaluate attribute during JE to the option superior on the easy-to-evaluate attribute during SE.

However, in Hsee's (1996) evaluability method the hard-to-evaluate attribute was usually also the most important attribute (Hsee, 2000) because 'the option superior on the hard-to-evaluate attribute must be preferred in joint evaluation; otherwise, there would be no room for a PR' (Hsee, 1996, p. 250). Building on the premise that people's preference can be influenced by both evaluability and importance, González-Vallejo and Moran (2001) propose that JE-SE preference reversals occur because the influence of these factors differs across evaluation modes. Specifically, González-Vallejo and Moran argue that in JE people use a comparative procedure in which their preferences are informed predominantly by attribute importance, and therefore people have a general tendency to select the option dominant on the most important attribute regardless of its evaluability. In contrast, González-Vallejo and Moran propose that in SE people use an absolute procedure in which their preferences are informed by combining available attributes, which have a relative weight determined by their evaluability and importance. Accordingly, González-Vallejo and Moran predict that JE-SE preference reversals occur when a hard-to-evaluate attribute is more important that an easy-to-evaluate attribute. Moreover, González-Vallejo and Moran also predict that JE (comparative procedure) is influenced largely by attribute importance, whilst SE (absolute procedure) is also influenced by attribute importance, but also other factors such as evaluability.

### 4.3.2 Method

#### 4.3.2.1 Participants

In Experiment 6, all participants were recruited via an online data panel service and received payment of £1 for their participation. A window of 14 days was set for data collection, and by the end of this window 188 participants had successfully completed the tasks. The mean age of participants was 47 years old (*SD*=14.68), and 96 (51.1%) of the participants were female. The experiment received approval from the School's research ethics committee. All participants who took part in the study were treated in accordance with the British Psychological Society's code of ethics and conduct, and the American Psychological Association's ethical principles.

A significance level of .05 was used for statistical testing. In this experiment, an effect size was not assumed. However, a retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size (f = .40 by convention; Cohen, 1988) of the repeated and independent measures effects. A large effect size will achieve a statistical power of at least .95. Post-hoc power analysis demonstrated that the sample size (N = 188) produced a power of .99 which exceeded the target of .95.

#### 4.3.2.2 Experimental Variables

In this experiment the following independent variables were manipulated: (i) first contextually available attribute, and (ii) type of TV. The analyses are conducted and reported within joint and separate evaluation modes. The dependent variable was participants' WTP purchase value judgements.

#### 4.3.2.3 Materials and Procedure

The materials for the current experiment were adapted from Hsee's (1996) TV study, and presented in both JE and SE. Upon entering the experiment participants were presented with a scenario in which they were asked to assume that they were looking to purchase a basic 24" colour television described on the brightness[15] and warranty attributes, and told that most such TVs cost around £200 (see Figure 22). Furthermore, to manipulate evaluability, participants were told that warranty rating reflects the length of the warranty in months, and that brightness reflects the brightness of the TV (see Figure 22). Accordingly, consistent with the assumptions of Hsee (1996; see also Hsee & Zhang, 2010), as participants were given information about the meaning of the warranty attribute it was presumably easy-to-evaluate in isolation. In contrast, as no specific information about the meaning of the brightness attribute was provided, it was assumed that brightness would be the hard-to-evaluate in isolation attribute.

[15] The brightness attribute was adapted from the term clarity used by Hsee (1996), as clarity is influenced by many attributes and therefore its inclusion as a single attribute would have risked confusing participants.

**Figure 22**

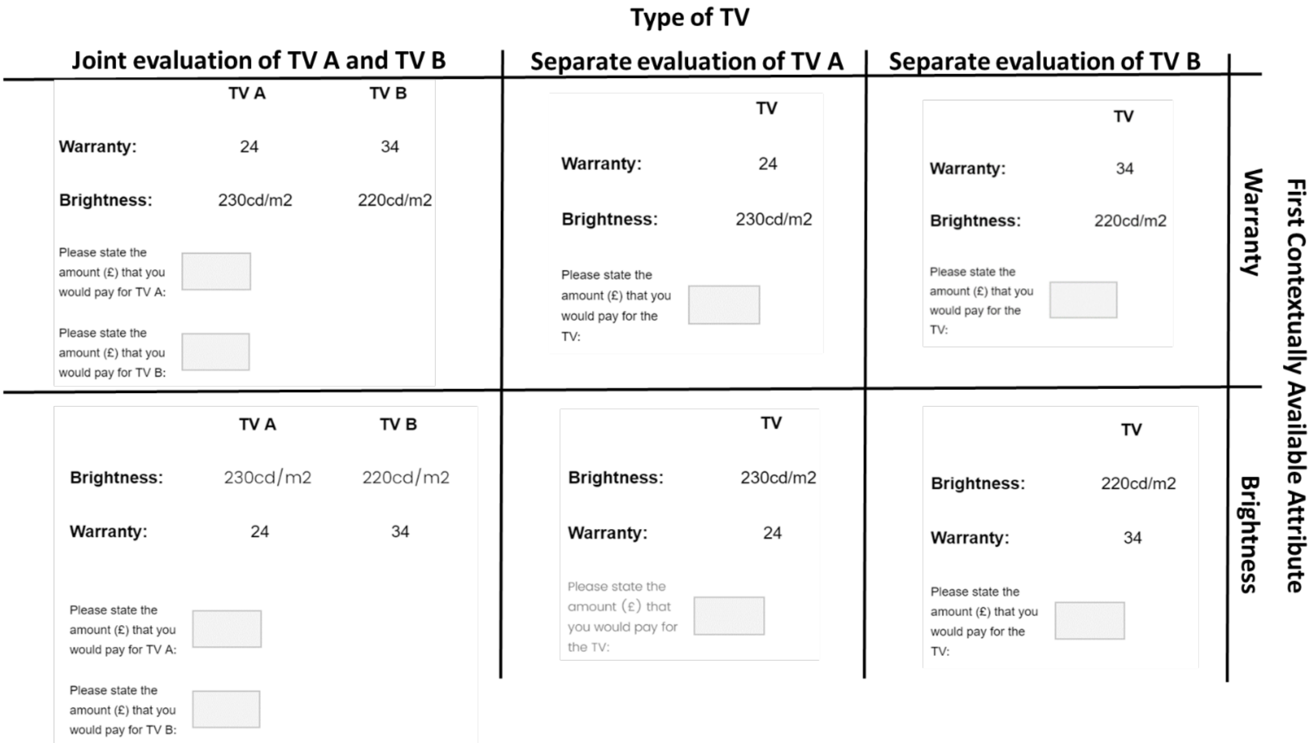
*TV Scenario*

| Joint-evaluation (JE) scenario | Separate-evaluation (SE) scenario |
| --- | --- |
| Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for each of the TVs. | Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for the TV. |

Below the scenario, participants were provided with attribute information. As the experiment included Hsee's (1996) evaluation mode (JE or SE) manipulation (Type of TV), participants were either provided with attribute information about TV A during separate evaluation A, TV B during separate evaluation B, or both TVs A and B during joint evaluation (see Figure 23). However, regardless of the evaluation mode, each TV was defined on two attributes, brightness and warranty. Within the attribute brightness, TV A had a dominant value (230cd/m2) and TV B had an inferior value (220cd/m2). In contrast, within the attribute warranty, TV B had a dominant value (in months - 34) and TV A had an inferior value (24); see Figure 23. As in Experiment 5, the difference between the TVs on each attribute was balanced (10 difference within each attribute - brightness and warranty) to eliminate any effect from desirability, and the possibility of biasing participants' preference in favour of a dominant option (neither TV is objectively dominant). Of course, even though the attributes' values were evenly spaced, this does not necessarily mean that participants will regard them as being psychologically equivalent. Moreover, as in Experiment 5, the order of the first contextually available attribute was manipulated so that in half of the conditions warranty was the first contextually available attribute, whilst in the remaining conditions warranty was the first contextually available attribute; see Figure 23. Once participants had seen the scenario and been presented with information about the TV(s), they were required to state their WTP (purchase value judgement) for the TV(s); see Figure 23.

**Figure 23**

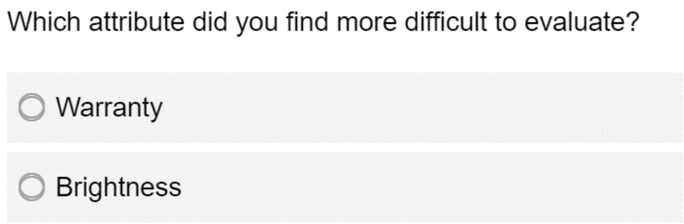
*First Contextually Available Attribute Manipulation Across Type of TV*




After participants had stated their WTP purchase values judgement(s) for all TVs that there were presented with (either both TVs, or one of the TVs), they were required to make two binary choices. In the first, they were required to choose which attribute (warranty or brightness) they found more difficult to evaluate (see Figure 24). In the second choice, participants were required to choose which attribute (warranty or brightness) they considered to be most important (see Figure 25).

**Figure 24**

*Decision of Evaluation Difficulty in Experiment 6*

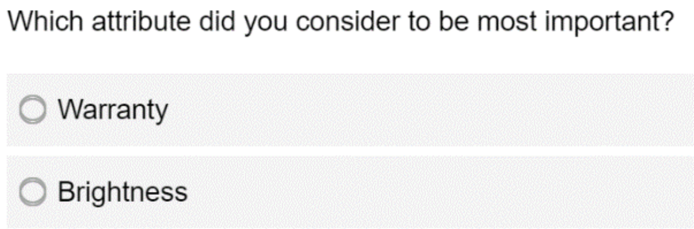

Which attribute did you find more difficult to evaluate?

Warranty

Brightness

**Figure 25**

*Decision of Attribute Importance in Experiment 6*


Which attribute did you consider to be most important?

Warranty

Brightness

### 4.3.3 Results and Discussion

The objectives in Experiment 6 are to: (i) examine the influence of FAH on participants' WTP judgements in JE and SE; (ii) explore the influence of evaluation difficult on participants' WTP judgements; and, (iii) investigate the influence of attribute importance on participants' WTP judgements. Accordingly, as there was a manipulation of evaluation mode (type of TV), the results of the experiment were analysed within the conditions of joint and separate evaluations. Moreover, the dependent variable is WTP purchase value judgements.

#### 4.3.3.1 Joint evaluation of TV A and TV B

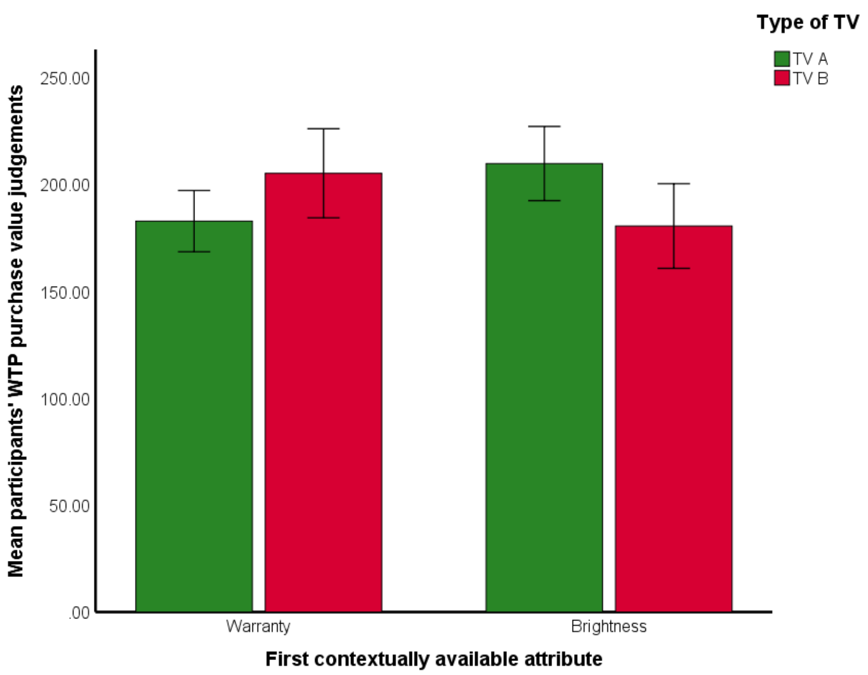
A 2 x (2) mixed measures design was used, with the following independent variables: (i) first contextually available attribute (brightness or warranty) as a between participants factor, and (ii) type of TV (TV A and TV B) as a within participants factor. The dependent variable was participants' WTP purchase value judgements.

##### 4.3.3.1.1 Purchase: Willingness to Pay

A 2 x (2) mixed measures analysis of variance was conducted with the independent variables first contextually available attribute (warranty of brightness), and type of TV (TV A and TV B). The dependent variable was participants' WTP purchase value judgements. The results demonstrated that neither of the main effects (type of TV or first contextually available attribute) had a significant influence on participants' WTP, *F*<1. However, the two-way interaction type of TV by first contextually available attribute did have a statistically significant influence on participants' WTP, $F(1,59)=9.77$, $p=.003$, $\eta_p^2=.14$. Accordingly, as there was a significant two-way interaction between type of TV and first contextually available attribute (see Figure 26), two follow up analyses of variance were performed.

**Figure 26**

*Participants' Willingness to Pay Purchase Value Judgements by First Contextually Available Attribute and* Type of TV. *Error Bars Represent 95% CI of the Means*




Follow up analyses by the first contextually available attribute (warranty and brightness) were conducted. When the first contextually available attribute was warranty, participants were willing to pay a higher price for TV B (*M*=£205.24; *SD*=£58.72) than they were for TV A (*M*=£182.85; *SD*=£40.43). This difference was statistically significant, $F(1,32)=4.49$, $p=.042$,

$\eta_p^2$=.12, see Figure 26. Likewise, type of TV significantly influenced participants' WTP purchase judgements with the first contextually available attribute brightness, $F(1,27)=5.14$, $p=.032$, $\eta_p^2$=.16, see Figure 26. However, in contrast to the results when the first contextually available attribute was warranty, when the first contextually available attribute was brightness, WTP was higher for TV A (*M*=£209.79; *SD*=£44.78) than for TV B (*M*=£180.57; *SD*=£51.07).

The results confirmed the FAH findings from Experiments 3, 4 and 5 by demonstrating that binary comparison on the first contextually available attribute influenced non-risky WTP judgements during JE. This experiment also extended the application of FAH to a consumer behaviour task (with WTP). Specifically, participants compared the TVs binary on the first contextually available attribute, and preferred the TV with the dominant value (brightness or warranty) on the first contextually available attribute relatively more than the TV with the inferior value on the first contextually available attribute. For instance, WTP was higher for TV B when warranty was the first contextually available attribute, and TV B had a dominant value (warranty of 34 months) and TV A had an inferior value (a warranty of 24 months) on the first contextually available attribute. In contrast, WTP was higher for TV A when brightness was the first contextually available attribute, and TV A had a dominant value (higher brightness - 230cd/m2) and TV B an inferior value (220c/m2) on the first contextually available attribute.

#### 4.3.3.1.2 Purchase: Willingness to Pay (Including Evaluation Difficulty)

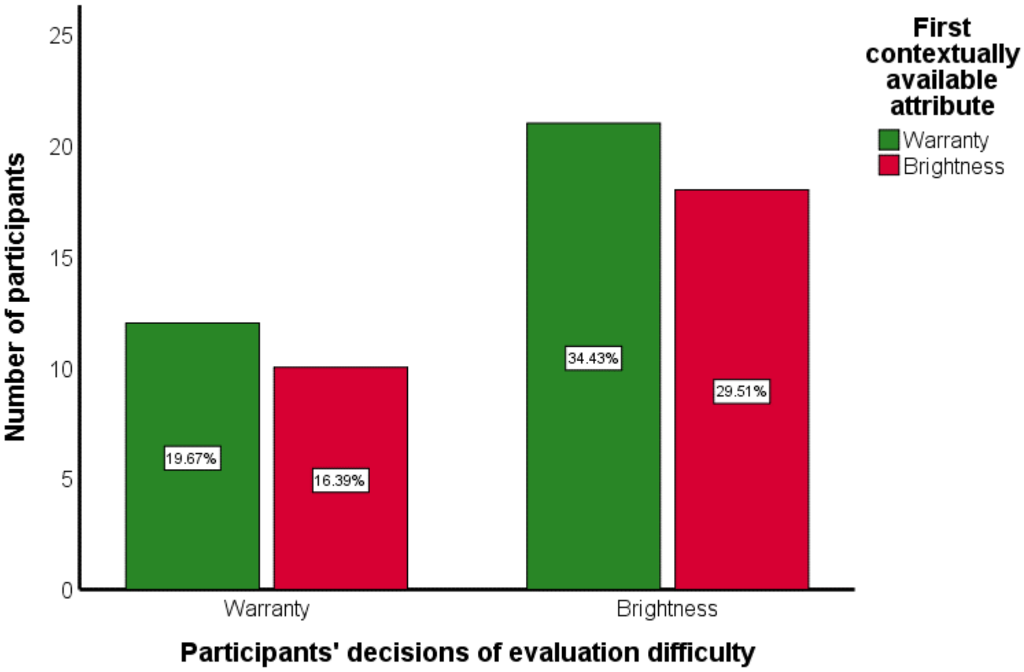
The following analysis explored whether the first contextually available attribute predicts participants' decisions of evaluation difficulty, and statistically tested the difference between choices made for warranty and brightness as being most difficult to evaluate.

A binary logistic regression was conducted with the predictor first contextually available attribute, and participants' decisions of evaluation difficulty as the outcome variable (warranty or brightness). The results revealed that the regression model was statistically non-significant,

$\chi^2(1)=.003$ $p=.958$. Furthermore, the first contextually available attribute did not significantly predict participants' decisions of evaluation difficulty between warranty and brightness (*OR EXP[B]*=1.03, $p=.958$, *CI*[.95] = [.360; 2.937]). However, the results revealed a significant difference between participants' decisions of evaluation difficulty for warranty (36.06%) and brightness (63.94%), $\chi^2$ (1)=4.74. $p=.030$; see Figure 27.

**Figure 27**

*Participants' Decisions of Evaluation Difficulty by First Contextually Available Attribute.*




As the results revealed that the first contextually available attribute is not associated with participants' decisions regarding evaluation difficulty, as well as with their decisions that brightness is the more difficult to evaluate attribute, in the following analysis participants' decisions of evaluation difficulty was included as an independent variable. Accordingly, a 2 x 2 x (2) mixed measures analysis of variance was conducted with the independent variables first contextually available attribute (warranty or brightness), participants' decisions of evaluation difficulty (warranty or brightness), and type of TV (TV A and TV B). The dependent variable was participants' WTP purchase judgements.

The results revealed that none of the main effects were statistically significant, $F$<1. Moreover, the two-way interaction type of TV by participants' decisions of evaluation difficulty, $F$<1, first contextually available attribute by participants' decisions of evaluation difficulty, $F$<1, and the three-way interaction type of TV by first contextually available attribute by participants' decisions of evaluation difficulty, $F(1,57)=1.27$, $p=.265$, $\eta_p^2=.02$, were statistically non-significant. However, the two-way interaction type of TV by first contextually available attribute, $F(1,57)=10.90$, $p=.002$, $\eta_p^2=.16$, was significant. As this two-way interaction does not include participants' decisions of evaluation difficulty and replicates the previously reported two-way interaction in section Purchase: Willingness to Pay, no further analysis including participants' decisions of evaluation difficulty will be reported.

The results showed a significant difference between participants' decisions of evaluation difficulty between warranty and brightness; specifically, brightness was chosen as the most difficult attribute to evaluate. Furthermore, the results revealed that participants' decisions of evaluation difficulty were not influenced by the first contextually available attribute, and type of TV. Moreover, participants' decisions of evaluation difficulty did not influence participants' WTP purchase value judgements. Accordingly, these results demonstrated that during JE participants' WTP purchase value judgements were not significantly influenced by participants' decisions of evaluation difficulty. Therefore, these results do not support evaluability theory, which predicts that WTP is influenced by evaluation difficulty (e.g., Hsee, 1996, 1998, 2000, Hsee & Zhang, 2010; Hsee et al., 1999).

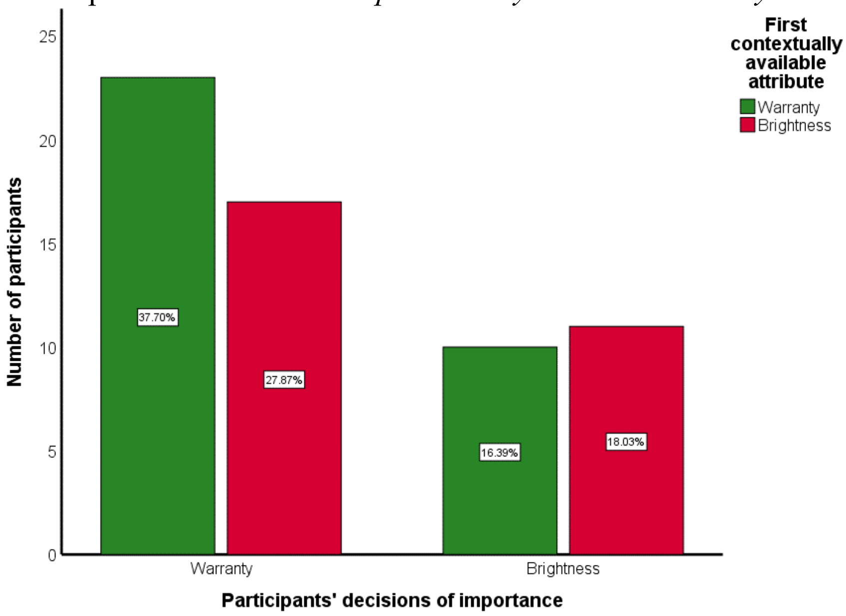
#### 4.3.3.1.3 Purchase: Willingness to Pay (Including Importance)

The following analysis explored whether the first contextually available attribute predicts participants' decisions of importance, and statistically tested the difference between choices made for warranty and brightness as being most important.

A binary logistic regression was performed with first contextually available attribute as a predictor, and participants' decisions of importance as an outcome variable (warranty or brightness). The results demonstrated that the regression model was non-significant, $\chi^2(1)= .54$, $p=.462$. Moreover, participants' decisions of importance between warranty and brightness was not significantly influenced by the first contextually available attribute (*OR EXP[B]*=1.49, $p=.463$, *CI*[.95] = [.515; 4.301]). Furthermore, the results revealed a significant difference on participants' decisions of importance for warranty (65.57%) and brightness (34.42%), $\chi^2(1)= 5.92$, $p=.015$; see Figure 28).

**Figure 28**

Participants' Decisions of *Importance by First Contextually Available Attribute*

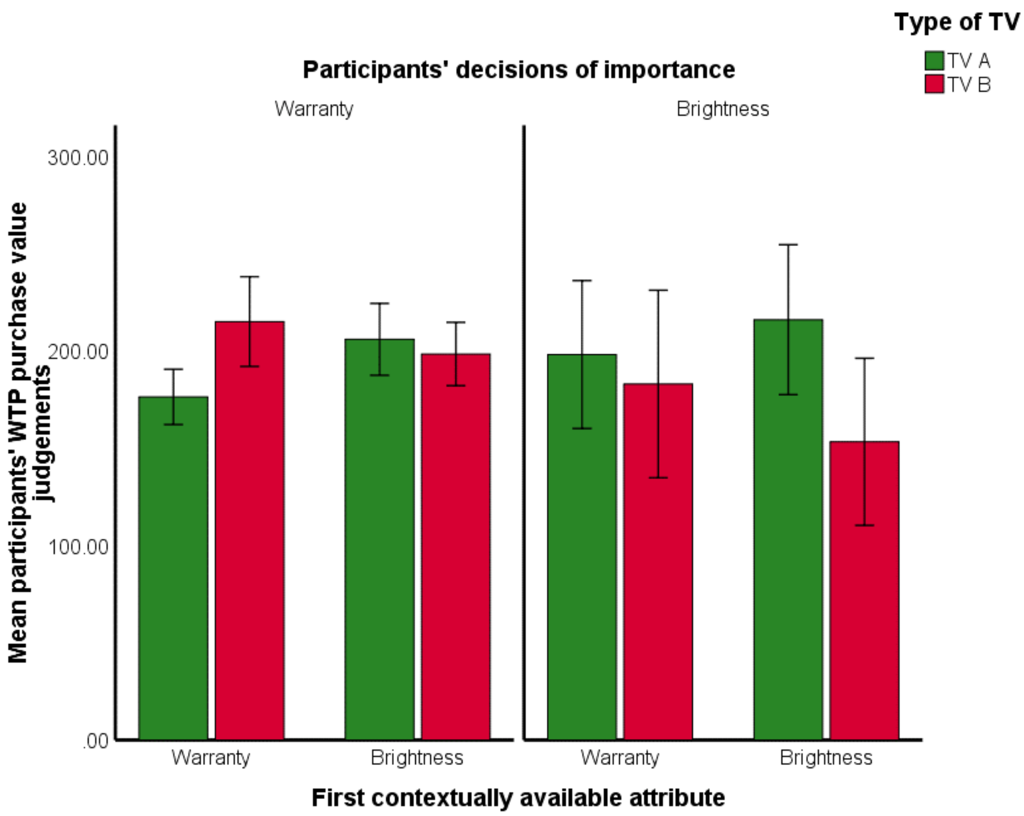



Participants' decisions of importance were not influenced by the first contextually available attribute, and it is therefore used as an independent variable in the following analysis of variance. Accordingly, a 2 x 2 x (2) mixed measures analysis of variance was conducted with the independent variables first contextually available attribute (warranty or brightness), participants' decisions of importance (warranty or brightness), and type of TV (TV A and TV B). The dependent variable was participants' WTP purchase value judgements.

The results demonstrated that the main effects first contextually available attribute, $F<1$, participants' decisions of importance, $F(1,57)=1.24$, $p=.270$, $\eta_p^2=.02$, and type of TV, $F(1,57)=2.08$, $p=.154$, $\eta_p^2=.04$, were statistically non-significant. Moreover, the two-way interaction first contextually available attribute by participants' decisions of importance, $F(1,57)=.37$, $p=.546$, $\eta_p^2=.01$, and the three-way interaction type of TV by first contextually available attribute by participants' decisions of importance, $F<1$, were statistically non-significant. However, the two-way interactions type of TV by first contextually available attribute, $F(1,57)=8.43$, $p=.005$, $\eta_p^2=.13$, and type of TV by participants' decisions of attribute importance, $F(1,57)=11.37$, $p=.001$, $\eta_p^2=.17$, were statistically significant; see Figure 29. Accordingly, because of the statistically significant two-way interactions, follow up analyses of variance were conducted.

**Figure 29**

*Participants' Willingness to Pay Purchase Value Judgements by First* Contextually Available *Attribute, Participants' Decisions of Importance and* Type of TV. *Error Bars Represent 95% CI of the Means.*




Follow up analyses of variance by first contextually available attribute (as warranty and brightness) were conducted. When the first contextually available attribute was warranty, the two-way interaction type of TV by participants' decisions of importance had a significant influence on participants' WTP purchase value judgements, $F(1,31)=6.39$, $p=.017$, $\eta_p^2=.17$. However, the main effects type of TV, $F(1,31)=1.23$, $p=.276$, $\eta_p^2=.04$, and participants' decisions of importance, $F<1$, did not. Furthermore, when the first contextually available attribute was brightness, participants' WTP purchase value judgements were significantly influenced by the main effect type of TV, $F(1,26)=8.14$, $p=.008$, $\eta_p^2=.24$, and the two-way interaction type of TV by participants' decisions of importance, $F(1,26)=5.02$, $p=.034$, $\eta_p^2=.16$, but not by the main effect participants' decisions of importance, $F(1,26)=1.85$, $p=.186$, $\eta_p^2=.07$.

Accordingly, because of the significant two-way interactions (with both first contextually available attributes - warranty and brightness), an additional four follow up repeated measures analyses of variance were conducted.

Four follow up analyses of variance were conducted with the independent variable type of TV (TV A and TV B) by first contextually available attribute (warranty or brightness) and participants' decisions of importance (warranty or brightness):

(i) First contextually available attribute (warranty) by participants' decisions of importance (warranty). The results demonstrated that type of TV, $F(1,22)=9.04$, $p=.006$, $\eta^2=.29$, significantly influenced participants' WTP (purchase value judgements). Specifically, WTP was higher for TV B (*M*=£214.96; *SD*=£53.25) than for TV A (*M*=£176.26; *SD*=£32.80); see Figure 29.

(ii) First contextually available attribute (warranty) by participants' decisions of importance (brightness). The main effect of type of TV was non-significant, $F(1,9)=1.46$, $p=.257$, $\eta^2=.14$; see Figure 29.

(iii) First contextually available attribute (brightness) by participants' decisions of importance (warranty). The main effect of type of TV on participants' WTP judgements was statistically non-significant, $F<1$; see Figure 29.

(iv) First contextually available attribute (brightness) by participants' decisions of importance (brightness). The main effect of type of TV was significant, $F(1,10)=5.28$, $p=.044$, $\eta^2=.35$. Specifically, participants' WTP was higher for TV A (*M*=£215.91; *SD*=£57.31) than for TV B (*M*=£153.18; *SD*=£63.89); see Figure 29.

With JE the results from Experiment 6 confirmed the findings of Experiment 5. In contrast to González-Vallejo and Moran's (2001) findings that importance influence participants' WTP in JE, the results in Experiment 6 provide evidence for a congruence effect between participants' decisions of importance and the first contextually available attribute on participants' WTP purchase value judgements. Specifically, with JE participants' WTP purchase value judgements for the TVs were only significantly different when the attribute chosen as most important was also the first contextually available attribute (congruency between attribute importance and the first contextually available attribute). For instance, WTP was higher for TV B than for TV A when warranty was chosen as the most important attribute, but only when warranty was also the first contextually available attribute (TV A 24 months, TV B, 34 months). Likewise, WTP was higher for TV A than for TV B when brightness was chosen as the most important attribute, but only when brightness was also the first contextually available attribute (TV A 230cd/m2, TV B 220cd/m2). In contrast, when there was incongruence between the attribute chosen as most important and the first contextually available attribute (e.g., with warranty chosen as the most important attribute but brightness was the first attribute) there was no significant difference between WTP for TV A and TV B. Therefore, consistent with Experiment 5 (the job candidate experiment), the results provide evidence that participants made a binary comparison on the first contextually available attribute, as with incongruence the first contextually available attribute eliminated the effect of importance on WTP, and with congruence the first contextually available attribute induced the effect of attribute importance on participants' WTP purchase value judgements during JE (see Figure 29).

Therefore, the results from JE in Experiment 6 confirmed the FAH findings from Experiment 5. Specifically, the results provided evidence of FAH where participants' WTP purchase value judgements were influenced by binary comparison on the first contextually available attribute. Moreover, the results also revealed further evidence for a congruence effect where participants' WTP purchase value judgements were influenced by the attribute which they chose as most important and made binary comparisons on this attribute, but only when the attribute chosen as most important was also the first contextually available attribute. In other words, participants compared the values on the first contextually available attribute only when the first attribute was also chosen as most important. Therefore, these results provide evidence that binary comparisons were only made on the first contextually available attribute.

#### 4.3.3.2 Separate Evaluation of TV A and TV B

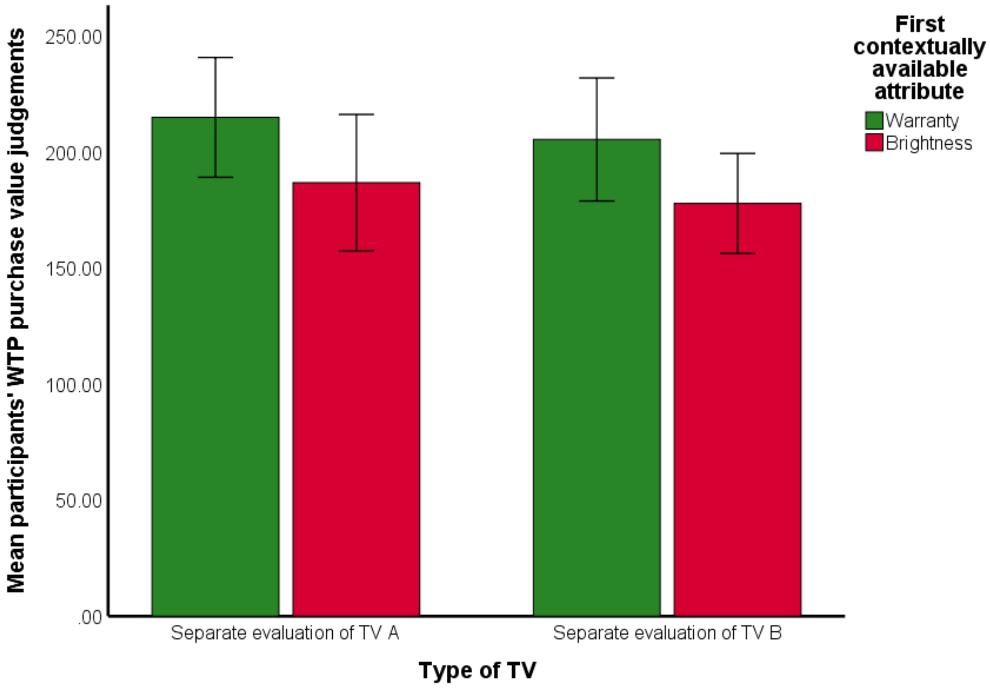
A 2 x 2 independent measures design was used, with the following independent variables: (i) first contextually available attribute (brightness or warranty), and (ii) type of TV (separate evaluation of TV A or separate evaluation of TV B). The dependent variable was participants' WTP purchase value judgements.

##### 4.3.3.2.1 Purchase: Willingness to Pay

A 2 x 2 analysis of variance was performed with the independent variables first contextually available attribute (warranty or brightness), and type of TV (separate evaluation of TV A or separate evaluation of TV B). The dependent variable was participants' WTP purchase value judgements. The results revealed that the main effect first contextually available attribute was statistically significant, $F(1,123)=4.76$, $p=.031$, $\eta_p^2=.04$. Specifically, WTP was higher for warranty, when warranty was the first contextually available attribute (*M*=£210.08; *SD*=£70.86) than when brightness was the first contextually available attribute (*M*=£182.31; *SD*=£72.00). However, the main effect of type of TV, as well as the two-way interaction type of TV by first contextually available attribute were not, $F<1$; see Figure 30. These results revealed that when warranty was the first contextually available attribute, participants were willing to pay more money for the TV than when brightness was the first contextually available attribute. In other words, the participants' WTP purchase value judgements indicated that the warranty attribute is more valued by the participants. This result is expected, as with separate evaluation there is no binary comparison on the first contextually available attribute, and therefore the FAH cannot influence participants' WTP purchase value judgements.

**Figure 30**

*Participants' Willingness to Pay Purchase Value Judgements by First Contextually Available Attribute and Type of TV. Error Bars Represent 95% CI of the Means*



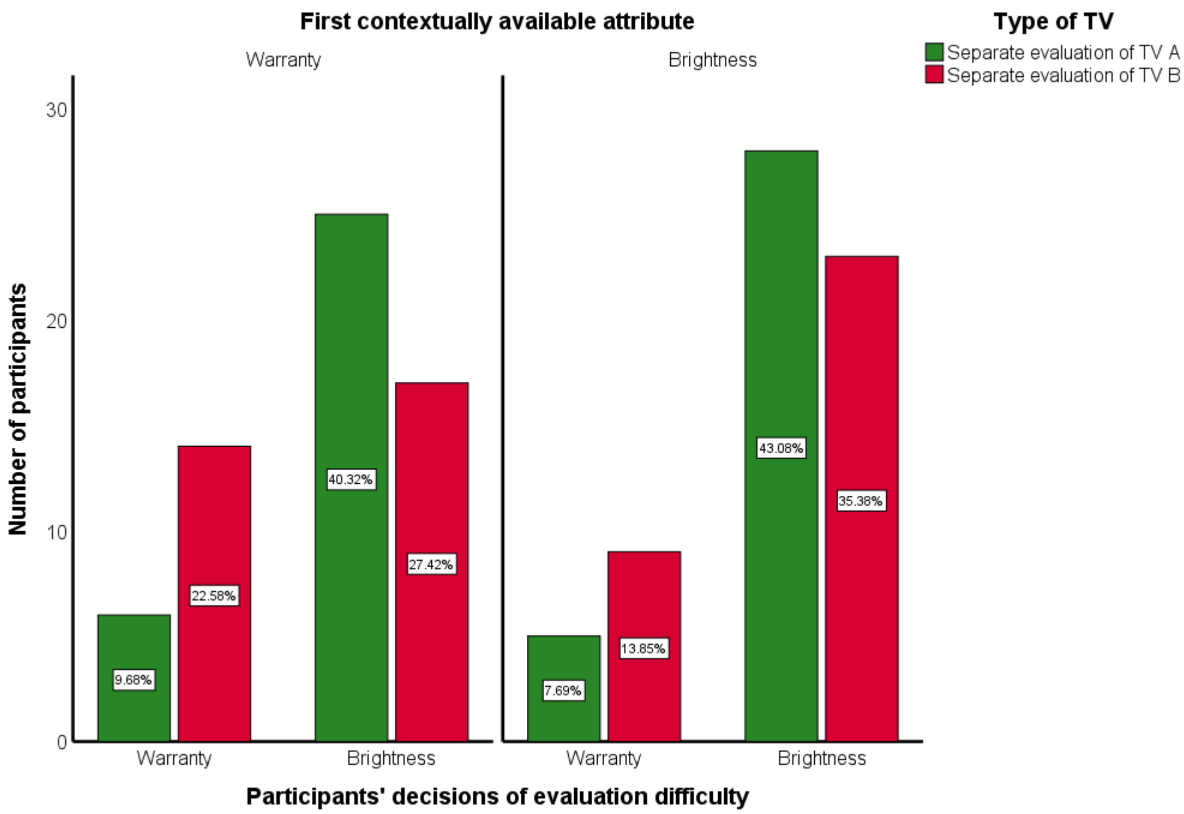

#### 4.3.3.2.2 Purchase: Willingness to Pay (Including Evaluation Difficulty)

The following analysis explored whether the first contextually available attribute predicts participants' decisions about evaluation difficulty, and statistically tests the difference between choices made for warranty and brightness as being most difficult to evaluate. A binary logistic regression was conducted with the predictors type of TV (separate evaluation of TV A or separate evaluation of TV B), first contextually available attribute (warranty or brightness), and participants' decisions of evaluation difficulty as the outcome variable. The results revealed that the regression model was statistically significant, $\chi^2(3)=8.33$, $p=.040$. Moreover, the results demonstrated that the type of TV significantly predicted participants' decisions of evaluation difficulty between warranty and brightness, *OR EXP(B)*=.29, $p=.034$, *CI*(.95) = (.093; .909). Specifically, the OR for choosing brightness was .29 times smaller with separate evaluation B than with separate evaluation A; see Figure 31. In other words, respondents were less likely to choose brightness as being the more difficult to evaluate attribute during separate evaluation of TV B than separate evaluation of TV A. Accordingly, it is plausible that this is because participants found it more difficult to interpret the warranty value for TV B (34 months; 2 years and 10 months) than they did for TV A (24 months; 2 years exactly).

However, the first contextually available attribute, *OR EXP(B)*=1.34, *p*=.657, *CI*(.95) = (.365; 4.949), and the two-way interaction type of TV by first contextually available attribute, *OR EXP(B)*=1.57, *p*=.599, *CI*(.95) = (.294; 8.330) did not significantly predict participants' decisions of evaluation difficulty. Furthermore, there was a significant difference, between the number of participants who found brightness (73.2%) more difficult to evaluate than warranty (26.8%), $\chi^2(1)=27.41$, $p<.001$; see Figure 31. Despite that type of TV was significantly associated with participants' decisions of evaluation difficulty, a follow up analysis of variance that includes participants' decisions of evaluation difficulty was conducted. The results from JE revealed that participants' decisions of evaluation difficulty did not influence participants' WTP purchase value judgements.

**Figure 31**

Participants' Decisions of *Evaluation Difficulty by First Contextually Available Attribute and Type of TV*




Accordingly, a 2 x 2 x 2 independent measures analysis of variance was conducted with the independent variables first contextually available attribute (warranty or brightness), participants' decisions of evaluation difficulty (warranty or brightness), and type of TV (separate evaluation of TV A or separate evaluation of TV B). The dependent variable was participants' WTP purchase value judgements. The results revealed that the main effect of the first contextually available attribute significantly influenced participants' WTP judgements, $F(1,119)=4.87$, $p=.029$, $\eta_p^2=.04$. As before, participants' WTP was higher for warranty ($M$ = 207.86; 95% CI [187.12, 228.60]), than for brightness ($M$ = 173.88; 95% CI [151.55, 196.21]). However, the main effects participants' decisions of evaluation difficulty, $F<1$, and type of TV, $F<1$, as well as the two-way interactions type of TV by first contextually available attribute, $F<1$, type of TV by participants' decisions of evaluation difficulty, $F<1$, first contextually available attribute by participants' decisions of evaluation difficulty, $F(1,119)=1.09$, $p=.300$, $\eta_p^2=.01$, and the three-way interaction type of TV by first contextually available attribute by participants' decisions of evaluation difficulty, $F<1$, did not influence participants' WTP purchase judgements.

These results revealed that participants' decisions of evaluation difficulty did not influence their WTP judgements during SE. Moreover, participants' WTP judgements were higher for warranty than for brightness, regardless of whether evaluation difficulty was included as an independent variable or not. This result is expected, as with separate evaluation there is no binary comparison on the first contextually available attribute, and therefore the FAH cannot influence participants' WTP purchase value judgements. Taken together, as with JE, the results indicated that with SE participants' decisions of evaluation difficulty did not influence participants' WTP purchase value judgements. This contrasts with the predictions of evaluability theory, which predicts that easy-to-evaluate attributes should have relatively more influence on WTP during SE than during JE, and that hard-to-evaluate attributes should have more influence on WTP during JE than during SE (Hsee, 1996, 1998, 2000; Hsee et al., 1999). Moreover, the results from Experiment 8 are not consistent with the predictions of González-Vallejo and Moran's (2001) who predict that WTP in SE is influenced by attribute importance, and other factors such as evaluation difficulty.

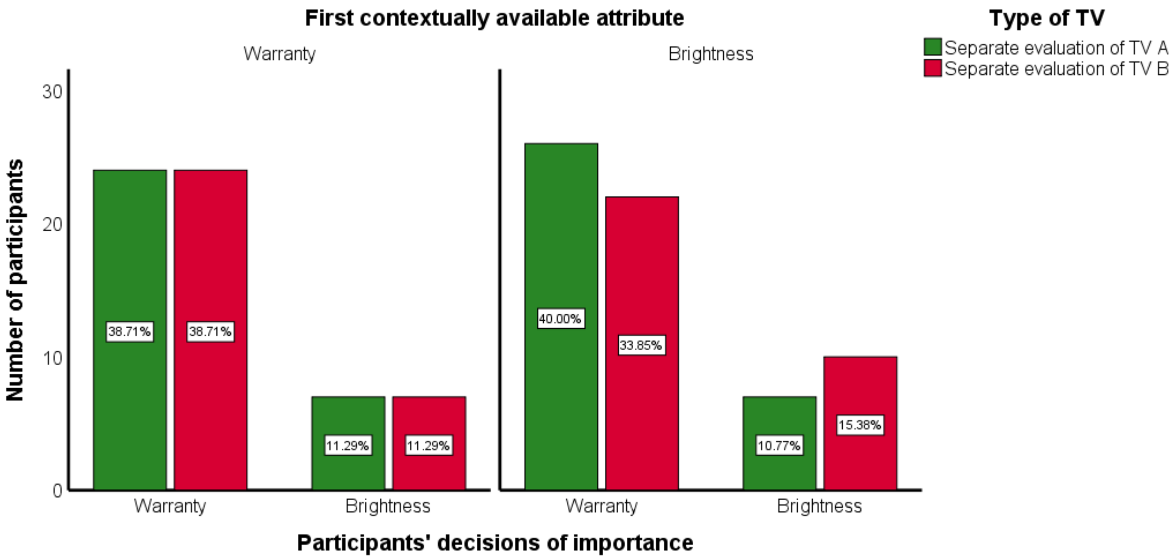
#### 4.3.3.2.3 Purchase: Willingness to Pay (Including Importance)

The following analysis explored whether the first contextually available attribute predicts participants' decisions of importance, and statistically tested the difference between choices made for warranty and brightness as being most important.

A binary logistic regression was conducted with the predictor type of TV (separate evaluation of TV A or separate evaluation of TV B) and first contextually available attribute (warranty or brightness). The outcome variable was participants' decisions of importance (warranty or brightness). The results revealed that the regression model was statistically non-significant, $\chi^2(3)= 1.07$, $p=.784$. Furthermore, the results revealed that the predictor type of TV, *OR EXP(B)*=1.00, $p=1.00$, $CI(.95) = (.304; 3.289)$, first contextually available attribute, *OR EXP(B)*=.92, $p=.895$, $CI(.95) = (.282; 3.021)$, and the two-way interaction type of TV by first contextually available attribute, *OR EXP(B)*=1.69, $p=.530$, $CI(.95) = (.329; 8.659)$, were statistically non-significant; see Figure 32. Moreover, there was a statistically significant difference between the number of participants who chose warranty as the most important attribute (75.6%), and those who chose brightness as the most important attribute (24.4%), $\chi^2(1)= 33.27$, $p<.001$.

**Figure 32**

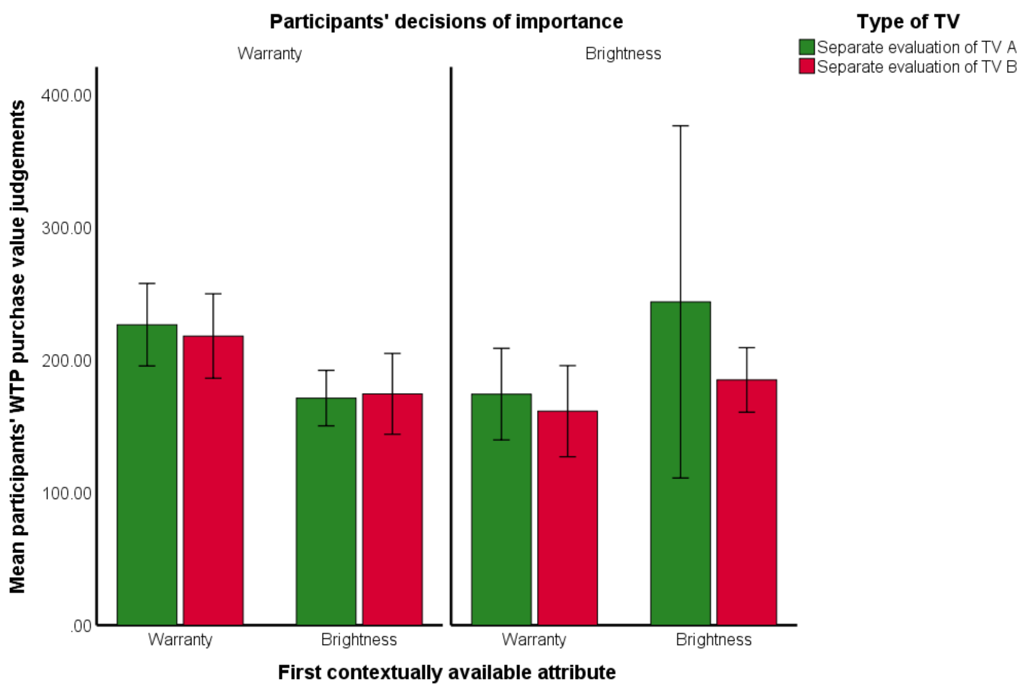
*Participants' Decisions of Importance by Type of TV and First Contextually Available Attribute*




Participants' decisions of importance were not influenced by the first contextually available attribute and will therefore be used as an independent variable in the following analysis of variance. Accordingly, a 2 x 2 x 2 independent measures analysis of variance was performed with the independent variables type of TV (separate evaluation of TV A or separate evaluation of TV B), first contextually available attribute (warranty or brightness), participants' decisions of importance (warranty or brightness), and participants' WTP purchase value judgements as the outcome variable. The results revealed that the main effects type of TV, $F(1,119)=1.77$, $p=.186$, $\eta_p^2=.02$, first contextually available attribute, and participants' decisions of importance were statistically non-significant, $F<1$. Furthermore, the two-way interactions type of TV by first contextually available attribute, $F<1$, and type of TV by participants' decisions of importance, $F(1,119)=1.31$, $p=.254$, $\eta_p^2=.01$, as well as the three-way interaction type of TV by first contextually available attribute by participants' decisions of importance, $F<1$, were non-significant. However, the two-way interaction first contextually available attribute by participants' decisions of importance did significantly influence participants' WTP purchase judgements, $F(1,119)=11.01$, $p=.001$, $\eta_p^2=.09$; see Figure 33. Therefore, because of the significant two-way interaction, follow-up analyses of variance were conducted.

**Figure 33**

*Participants' Willingness to Pay Purchase Value Judgements by Type of TV, First* Contextually Available *Attribute and Participants' Decisions of Importance. Error Bars Represent 95% CI of the Means*



Follow up analyses of variance were conducted by the first contextually available attribute warranty and brightness. When the first contextually available attribute was warranty, the main effect participants' decisions of importance (warranty or brightness) had a significant influence on participants' WTP purchase value judgements, $F(1,58)=6.86$, $p=.011$, $\eta_p^2=.11$. Specifically, participants who chose warranty as most important had higher WTP purchase value judgements ($M$=£222.40; $SD$=£73.92) than participants who chose brightness as the most important attribute ($M$=£167.86; $SD$=£36.41). However, the main effect type of TV, $F<1$, and the two-way interaction type of TV by participants' decisions of importance, $F(1,58)=.011$, $p=.918$, $\eta_p^2=.00$, did not significantly influence participants' WTP judgements. Moreover, when the first contextually available attribute was brightness, the main effect of participants' decisions of importance significantly influenced participants' WTP purchase value judgements, $F(1,61)=4.28$, $p=.043$, $\eta_p^2=.07$. Specifically, participants who chose brightness as most important had higher WTP purchase value judgements ($M$=£209.24; $SD$=£96.35) than participants who chose warranty as the most important attribute ($M$=£172.77; $SD$=£59.53). However, the main effect type of TV, $F(1,61)=1.92$, $p=.171$, $\eta_p^2=.03$, and the two-way interaction type of TV by participants' decisions of importance, $F(1,61)=2.39$, $p=.127$, $\eta_p^2=.04$, did not significantly influence participants' WTP judgements.

During SE, binary comparisons between TVs on the same attribute cannot be made, and therefore cannot influence participants' WTP purchase value judgements. However, the results revealed that participants' WTP purchase value judgements were significantly influenced by both participants' decisions of importance and the first contextually available attribute. Specifically, participants' WTP purchase value judgements were influenced by the attribute which they chose as most important, but only when the attribute chosen as most important is also the first contextually available attribute. Therefore, the first contextually available attribute determines the judgements of WTP, even when participants cannot compare values on the first contextually available attribute. For example, participants' WTP purchase value judgements for a TV was higher when the attribute chosen as most important was also the first contextually available attribute for the TV than when there was incongruence between the attribute chosen as most important and the first contextually available attribute.

The results in Experiment 6, for the first time, explored the FAH in experimental settings with JE and SE in non-risky tasks, and extended FAH to consumer choice tasks. Accordingly, consistent with Experiments 3, 4 and 5, the results confirmed that the FAH influenced respondents' WTP purchase value judgements when binary comparisons on the first contextually available attribute were possible (JE), and no other effects were competing with FAH. For example, participants compared the TVs on the first contextually available attribute and favoured the TV with the dominant value (brightness or warranty) relatively more than the TV with the inferior value. However, with SE the FAH did not influence participants' WTP purchase value judgements. This result was expected, as with SE there is no binary comparison on the first contextually available attribute, and therefore the FAH cannot influence participants' WTP purchase value judgements.

Furthermore, as in Experiment 5, the results also revealed evidence for a congruence effect where with JE participants' WTP purchase value judgements were influenced by the attribute which they chose as most important and made binary comparisons on this attribute, but only when the attribute chosen as most important was also the first contextually available attribute. In other words, participants compared the values on the first contextually available attribute only when the first contextually available attribute was also chosen as most important. Therefore, these results provide evidence that binary comparisons were only made on the first contextually available attribute. Moreover, with SE the results demonstrated evidence of a congruence effect where participants' WTP purchase value judgements were influenced by the attribute which they chose as most important, but only when the attribute chosen as most important is also the first contextually available attribute. Therefore, when participants were not given opportunity for binary comparison (SE), the first contextually available attribute determined their WTP purchase value. Crucially, I also found that the effect sizes of the congruence effect were larger in JE than the congruence effect in SE. This result indicates that the congruence effect is stronger when participants can make binary comparisons on the first contextually available attribute (JE) than when these binary comparisons are unavailable (SE).

Whilst the influence of attribute importance on WTP was anticipated by González-Vallejo and Moran (2001; see also Hsee, 2000), they also predicted an influence from other factors including evaluation difficulty during SE. Crucially, in contrast to evaluability theory (e.g., Hsee, 1996, 1998, 2000; Hsee et al., 1999; Hsee & Zhang, 2010), the results also revealed that evaluation difficulty (JE and SE) did not influence participants' WTP judgements.

## 4.4 General Discussion

Chapter 4 further explored and established the FAH in the non-risky domains of consumer and recruitment behaviour. Specifically, the predictions of FAH were competed against the empirically and methodologically supported assumptions made by the researchers developing evaluability theory (e.g., Hsee, 1996, 1998, 2000; Hsee et al., 1999). Furthermore, I have adapted the FAH method to accommodate published experimental findings and theoretical claims regarding the influence of attribute importance on participants' WTP judgements (González-Vallejo & Moran, 2001; see also Hsee, 2000).

In Experiment 5, I have explored whether and how the FAH influences participants' WTP salary judgements in tasks with JE. Moreover, in Experiment 5 I have also explored the influence of importance on participants' WTP salary judgements. González-Vallejo and Moran (2001; see also Hsee, 2000) argued that with JE participants' WTP judgements were higher for the option that dominates the decision set on the attribute considered to be most important by the participants. Accordingly, the results in Experiment 5 provided evidence for the FAH by demonstrating that binary comparison on the first contextually available attribute influenced participants' WTP salary judgements during JE, when binary comparisons on the first contextually available attribute were possible. Furthermore, the results in Experiment 5 revealed a congruence effect between the first contextually available attribute and participants' decisions of importance on WTP salary judgements. Specifically, participants were willing to pay a higher salary (WTP salary judgements) only when the attribute chosen as most important was also the first contextually available attribute for binary comparison (congruency between attribute importance and the first contextually available attribute). For instance, participants' WTP salary judgements were higher for candidate A than for candidate B when BSc degree result was chosen as the most important attribute, but only when BSc degree result was also the first contextually available attribute for comparison (candidate A 75%, candidate B 65%). Similarly, participants' WTP salary judgements were higher for candidate B than for candidate A when experience with KY was chosen as the most important attribute, but only when experience with KY was also the first contextually available attribute for comparison (candidate A 40, candidate B 50). In contrast, with incongruence between the attribute chosen as most important and the first contextually available attribute (e.g., BSc degree result chosen as being most important and experience with KY as the first attribute) there was no significant difference in participants' WTP salary judgements. Accordingly, this provides evidence that participants make binary comparisons on the first contextually available attribute, as with incongruence the first contextually available attribute eliminated the effect of attribute importance on WTP, and with congruence the first contextually available attribute induced the effect of attribute importance on participants' WTP salary judgements during JE.

The goal of Experiment 6 was to further explore FAH and the congruence effect by testing the first contextually available attribute and importance, with JE and SE consumer behaviour tasks. Moreover, the experimental method included measurements of evaluation difficulty. Theorists (e.g., González-Vallejo & Moran, 2001; Hsee, 1996, 1998, 2000; Hsee et al., 1999) have argued that easy-to-evaluate attributes have relatively more influence on participants' WTP judgements during SE than during JE, and that hard-to-evaluate attributes have more influence on participants' WTP judgements during JE than during SE.

The results in Experiment 6 confirmed the FAH (binary comparison on the first contextually available attribute) established in Experiment 5. Accordingly, the results revealed that FAH was utilised only during JE, when participants had the opportunity to make binary comparison between the TVs (e.g., TV A vs TV B) on the first contextually available attribute. Unsurprisingly, these contextual comparisons were not possible with SE, where participants only saw attribute information about a single TV.

Moreover, the results in Experiment 6 confirmed the findings in Experiment 5 regarding the congruence effect between the first contextually available attribute and participants' decisions of importance on their WTP purchase value judgements. Specifically, during JE (where binary comparison on the first contextually available attribute were possible) participants' WTP purchase value judgements for the TVs were only significantly different when the attribute chosen as most important was also the first contextually available attribute (congruency between attribute importance and the first contextually available attribute). For example, participants' WTP purchase value judgements were higher for TV B than for TV A when warranty was chosen as the most important attribute, but only when warranty was also the first contextually available attribute for comparison (TV A 24 months, TV B 34 months). Similarly, participants' WTP purchase value judgements were higher for TV A than for TV B when brightness was chosen as the most important attribute, but only when brightness was also the first contextually available attribute for comparison (TV A 230cd/m2, TV B 220cd/m2). However, with incongruence between the attribute chosen as most important and the first contextually available attribute (e.g., warranty chosen as being most important and brightness as the first contextually available attribute) there was no significant difference in participants' WTP purchase value judgements between TVs A and B. Moreover, the incongruence between the first contextually available attribute and the attribute chosen as most important eliminated the effect of importance. Accordingly, the results revealed that with JE participants' WTP purchase value judgements were influenced by the attribute which they chose as most important and made binary comparisons on this attribute, but only when the attribute chosen as most important was also the first contextually available attribute. In other words, participants compared the values on the first contextually available attribute only when the first attribute was also chosen as most important. Therefore, these results provide evidence that binary comparisons were only made on the first contextually available attribute.

Furthermore, the results established that there is also congruence between the first contextually available attribute and participants' decisions of importance which influenced participants' WTP purchase value judgements with SE. Specifically, participants' WTP purchase value judgements were influenced by the attribute which they chose as most important, but only when the attribute chosen as most important was also the first contextually available attribute. Therefore, the first contextually available attribute determines the judgements of WTP even when participants cannot compare values on this attribute. However, I also found that the effect sizes of the congruence effect were larger with JE than the congruence effect with SE. This result indicates that the congruence effect is stronger when participants can make binary comparisons on the first contextually available attribute (JE) than when these binary comparisons are unavailable (SE). Crucially, the results also revealed that evaluation difficulty (JE and SE) did not influence participants' WTP judgements.

In their research González-Vallejo and Moran (2001) argued that, with JE, attribute importance heavily influence participants' WTP judgements. However, the results in

Experiments 5 and 6 established the effect of congruence between the first contextually available attribute and the attribute chosen as most important. Moreover, theorists have argued that evaluation difficulty of attributes influences WTP judgements. Specifically, evaluability theory predicts that easy-to-evaluate attributes have relatively more influence on WTP judgements during SE than during JE, and that hard-to-evaluate attributes should have more influence on WTP judgements during JE than during SE (e.g., González-Vallejo & Moran, 2001; Hsee, 1996, 1998, 2000; Hsee et al., 1999). In contrast, the results from Experiment 6 (JE and SE) provide evidence that evaluation difficulty does not influence or predict participants' WTP judgements. Furthermore, the results from Experiment 6 provide evidence against the predictions of González-Vallejo and Moran's (2001) who argued that WTP during SE is influenced by attribute importance, along with other factors such as evaluation difficulty. Although, it is appropriate to acknowledge that whilst I measured evaluation difficulty using a binary choice, in some of his experiments Hsee (1996) required participants to answer questions regarding attribute values (e.g., 'If someone has written 10 KY programmes in the last 2 years, do you have any idea how experience he/she is with KY' [p. 251]) by choosing among four options ranging from 'I don't have any idea' to 'I have a clear idea'. Accordingly, it is possible that the sensitivity of the scale used to measure attribute evaluability could impact upon the results.

# Chapter 5

# The First Attribute Heuristic and Non-Risky Judgements With Ethical Consequences

## 5.1 Overview of Chapter 5

In contrast to utilitarianism which judges the moral appropriateness of an act according to its outcome (measured as utility), Kantian deontology proposes that the morality of an act is not determined by its consequences, but by the virtue of the act itself. Moreover, people ought to act in accordance with categorical imperatives (Kant, 1785/1989) - universal moral duties that are 'right' in themselves. Thus, from a deontological perspective, the morality of an act is the rightness of the act, regardless of the outcome of the act, or the act itself. Accordingly, the goal of Experiment 7 is to explore whether FAH is limited to binary contextual numerical comparisons on a task-relevant attribute (e.g., warranty or brightness); an attribute which does not directly reflect the quality of the TVs and which therefore a normatively rational person ought to ignore. Specifically, I explore the influence of the psychological activation (via priming manipulation) of a task-irrelevant attribute (without opportunity for binary numerical comparisons) on participants' WTP judgements. Moreover, I will test whether this task-irrelevant ethical attribute (ethical TV manufacturer: *which advocates for workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises,* and unethical TV manufacturer: *pollutes the environment, pays minimum wage, and refuses to donate to charitable causes*) supresses the influence of the task-relevant first contextually available attribute (as defined in Experiment 6).

Furthermore, as universal ethical rules can be implicitly understood and do not require binary comparisons of numerical attribute values, it is plausible that once activated, the task-irrelevant ethical attribute will be the only factor that influences participants' WTP purchase value judgements in both JE and SE. Furthermore, in contrast to Experiment 6, the task-irrelevant attribute ethics of the manufacturer also has judgement consequences for the manufacturers outside of the WTP task. For example, paying more money for a TV from the ethical manufacturer (regardless of the task-relevant attributes – warranty and brightness) could be considered by the participants as an act of endorsement which supports the ethical manufacturer.

Therefore, as participants' WTP judgements might be ethically motivated judgements of endorsement, it is plausible that priming participants with the task-irrelevant ethical attribute could lead to suppression of any other psychological influences and factors. Consistent with my proposal that people's WTP judgements will be influenced by the psychological activation of an ethical attribute and its judgement consequences outside the WTP task, the results revealed that participants' WTP was always higher for the TV produced by the ethical manufacturer than the TV produced by the unethical manufacturer. Moreover, the results indicated that the psychological activation of the ethical attribute influenced participants' WTP purchase value judgements in both JE and SE. Crucially, this pattern of preferences supports the evidence for task-irrelevant FAH where there is no opportunity for binary numerical comparisons in both JE and SE. Furthermore, the results revealed evidence that participants' decisions of attribute importance and evaluation difficulty (brightness or warranty) are dissociated from their WTP judgements and had not influenced their WTP judgements.

## 5.2 Experiment 7: The Influence of First Attribute Heuristic on WTP Purchase Value Judgements With Ethical Consequences

### 5.2.1 Introduction

In his Deontological Theory of ethics, Kant argues that a categorical imperative can be used to assess the moral appropriateness of and act (White, 2004). Specifically, according to Kant's categorical imperative, an act is moral (or 'right') if it is done out of duty to respect a maxim (a principle) which one reasons that all other rational people should follow, as if it were law (i.e., a universal law; Kant, 1785/1989). Or in other words, as argued by Geiger (2010, p. 289) 'universal moral laws determine the will of the moral agent'. Thus, from a deontological perspective, the morality of an act is the rightness of the act, regardless of the outcome of the act, or the act itself (Kant, 1785/1989). For example, if one believes that it should be universal law to never lie then, if one is to be moral, one – out of duty for the moral law – should never lie, regardless of the cost to oneself or others (e.g., they should not lie even if doing so would benefit the majority). Accordingly, from Kant's perspective, the morality of an act is judged by the intention behind the act (whether it is or is not done out of duty to respect the moral law), not by the outcome of the act, or even the act itself (White, 2004). For instance, one could still decide not to lie (e.g., to maintain trust) and whilst this act would be admirable, it would not be moral as it would be done out of self-interest, not out of duty for the moral law.

Whilst Kant assumed that people's moral behaviour is guided by reason (as did Bentham in his Utilitarianism), more recent empirical evidence has demonstrated that this is not always the case. In particular, research suggests that people's moral judgements and behaviour are often informed by intuitive emotional feelings (see Martin, Kusev, Teal, et al., 2021). For example, in one of their conditions, Haidt et al. (1993, p. 617) provided participants with the following scenario:

"A family's dog was killed by a car in front of their house. They had heard that dog meat was delicious, so they cut up the dog's body and cooked it and ate it for dinner"

They found that whilst the majority of adult participants indicated that the event was harmless (a small minority raised health concerns about cooking the dog), 72% of them suggested that they would be bothered about witnessing the event. Moreover, Haidt and colleagues also found that people's use of intuitive emotional feelings rather than reason when they are judging the moral appropriateness of acts can lead to moral dumbfounding – 'the stubborn and puzzled maintenance of a judgement without supporting reasons' (Haidt et al., 2000, p. 1). As an example, consider the prospect of two siblings (one male and one female) consensually engaging in an incestuous sexual relationship in a county where incest is legal (e.g., France), and where they use multiple forms of contraceptive to eliminate the possibility of pregnancy (Haidt et al., 2000; see Haidt, 2001). When presented with such a scenario, Haidt et al. (2000) found that most participants were 'dumbfounded', as they remarked it 'wrong' for the siblings to engage in a sexual relationship, but were unable to reason why. Specifically, Haidt et al. (2000) found that participants often gave 'dead end' arguments where they would start an argument, realise that it would not work part way through, and then drop the argument (e.g., arguing about the risk of pregnancy, and then realising that the chances of pregnancy were essentially nil; see Haidt, 2001).

Given the aforementioned findings, it has been argued that people's intuitive moral judgements (Haidt, 2001; Haidt et al., 2000) are informed by innate evolved mechanisms (Mikhail, 2007), or learned through reinforcement (e.g., Crockett, 2013). For example, according to Skinner (see Martin, Kusev, Teal, et al., 2021) people learn moral rules through stimulus-response associations (reinforcement learning), where learned moral rules are manifested as an aversion to particular outcomes (e.g., eating one's pet dog after it has been killed in an accident). Accordingly, regardless of whether people evaluate the 'rightness' of moral acts using reason (as assumed by Kant) or intuition, both of these perspectives imply (directly or indirectly) that people possess ethical rules which they believe should be universally obeyed (e.g., don't engage in an incestuous relationship, even in a county where it is legal to do so), and which they can implicitly understand.

In the previous FAH Experiments, exploration of FAH was limited to binary contextual numerical comparisons on a task-relevant attribute (e.g., warranty or brightness). Accordingly, in the present experiment I examine whether the psychological activation (via priming manipulation) of a task-irrelevant attribute (without opportunity for binary numerical comparisons) will influence participants' WTP judgements. Specifically, I prime a task-irrelevant ethical attribute (job candidates' employment history) which has judgement consequences for the manufacturers outside of the task. Accordingly, as universal ethical rules can be implicitly understood without binary comparison of numerical attribute values (people can compare contextual information against their internal representations and beliefs about ethical norms), it is plausible that once activated the task-irrelevant ethical attribute will suppress influence from all other factors (e.g., the task-relevant first contextually available attribute – warranty and brightness), in both JE and SE. In particular, participants might consider their WTP purchase value judgements to be ethically motivated judgements of endorsement (i.e., if they pay more for a TV from the ethical manufacturer then they might perceive this as an act of endorsing their ethical behaviour). Independent motivation which suggests that people might use FAH with a task-irrelevant ethical attribute comes from Gigerenzer (2008, 2010), who argued that people use the same heuristics to guide their moral and non-moral behaviour. Therefore, because I have demonstrated that FAH influences preferences in similar tasks in Experiments 5 and 6, it is plausible that FAH will influence participants' WTP in Experiment 7, even with task-irrelevant ethical information about job candidates' employment history.

Priming is frequently defined as a process of activating particular connections or associations in memory prior to conducting an action or task, via exposure to a specific stimulus or event. Accordingly, priming improves accessibility to information categories that include the primed stimulus (or other related stimulus), and therefore influences the subsequent processing of information (e.g., Gilad & Kliger, 2008). Consequently, priming has been demonstrated to influence judgement and decision-making behaviour across multiple domains, including psychology, economics, and finance (e.g., Cohn, et al., 2015; Eckles & Schaffner, 2011; Gilad & Kliger, 2008; Kusev, van Schaik & Aldrovandi, 2012).

### 5.2.2 Method

#### 5.2.2.1 Participants

An online data panel service was used to recruit participants in Experiment 7. The respondents in the experiment received a payment of £1 for their participation. A window of 14 days was set for data collection, and by the end of this window 445 participants had successfully completed the tasks. The mean age of participants was 53 years old (*SD*=13.63), and 218 (49%) of the participants were female. The experiment received approval from the Huddersfield Business School's research ethics committee. Moreover, all participants in the experiment were treated in accordance with the British Psychological Society's code of ethics and conduct, and the American Psychological Association's ethical principles.

For statistical testing a significance level of .05 was used. A retrospective power analysis was employed to determine whether the sample size allowed the detection of a large effect size f = .40 by convention (Cohen, 1988) of the repeated and independent measures effects. According to Cohen, a large effect size will achieve a statistical power of at least .95. Accordingly, post-hoc power analysis revealed that the sample size (N = 445) produced a power of 1 which exceeded the target of .95.

#### 5.2.2.2 Experimental Variables

In this experiment the following independent variables were manipulated: (i) ethics of the manufacturer (psychological activation of a task-irrelevant ethical attribute via priming); (ii) task-relevant first contextually available attribute as defined in Experiment 6; and (iii) type of TV. The analyses are conducted and reported within joint and separate evaluation modes. The dependent variable was WTP purchase value judgements. Unlike in Experiment 6, where the first contextually available attribute was manipulated to be either warranty or brightness, in Experiment 7 the task-irrelevant attribute ethics of the manufacturer was the new first contextually available attribute in both SE and JE.

#### 5.2.2.3 Materials and Procedure

Experiment 7 used the same procedure and materials as Experiment 6. However, there was a new task-irrelevant first contextually available attribute, which has judgement consequences outside of the WTP task (endorsing an ethical or unethical manufacturer). Accordingly, the independent variable ethics of the manufacturer is task irrelevant and was induced via psychological priming (describing the ethical or unethical practices and values of the manufacturers). Specifically, the materials were adapted from Experiment 6 so that immediately below the scenario (but above other attribute information – warranty and brightness) information regarding the ethics of the TV manufacturers was provided; see Figure 34. Accordingly, with JE, the information about ethics of the manufacturers was manipulated so that one TV (either TV A or TV B) was manufactured by an 'ethical' company ('advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises'), and the other TV (either TV A or TV B) was manufactured by an 'unethical' company ('pollutes the environment, pays minimum wage, and refuses to donate to charitable causes'); see Figure 34. Similarly, with SE, the manipulation was the same, although participants were only given information about a single TV (TV A or TV B), and were therefore only given information about the ethics of this manufacturer (ethical manufacturer or unethical manufacturer); see Figure 34. Moreover, the attribute ethics of the manufacturer was task irrelevant, had judgement consequences outside of the WTP task, was always the first contextually available attribute, but did not rely on binary comparisons of numerical attribute values.

**Figure 34**

*TV Scenarios Including Ethical Information for JE and SE*

| Joint evaluation | | Separate evaluation | |
|---|---|---|---|
| Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for each of the TVs.<br><br>**TV A**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.<br><br>**TV B**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.<br><br>TV A / TV B<br>Warranty: 24 / 34<br>Brightness: 230cd/m2 / 220cd/m2 | Ethical manufacturer TV A and unethical manufacturer TV B | Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.<br><br>**The TV**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.<br><br>**TV**<br>**Warranty:** 34<br>**Brightness:** 220cd/m2 | Ethical manufacturer |
| Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for each of the TVs.<br><br>**TV A**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.<br><br>**TV B**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.<br><br>TV A / TV B<br>Warranty: 24 / 34<br>Brightness: 230cd/m2 / 220cd/m2 | Unethical manufacturer TV A and ethical manufacturer TV B | Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.<br><br>**The TV**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.<br><br>**TV**<br>**Warranty:** 24<br>**Brightness:** 230cd/m2 | Unethical manufacturer |

Accordingly, the overall experimental procedure was as follows. Upon entering the experiment participants were presented with a scenario in which they were asked to assume that they are shopping to purchase a new 24” colour television, and that most such TVs cost around £200; Figure 34. Following the scenario, participants were provided with information about the ethics of both TV manufacturers in JE, or a single TV manufacturer in SE. Below the ethics information, participants were provided with information about the TV/TVs on the attributes warranty and brightness. Specifically, participants were either provided with information about TV A during separate evaluation A, TV B during separate evaluation B, or both TVs A and B during JE. Within the attribute brightness, TV A had a dominant value (230cd/m2) and TV B had an inferior value (220cd/m2). In contrast, within the attribute warranty, TV B had a dominant value (32 months) and TV A had an inferior value (24 months). Crucially in congruence with Hsee (1996; see also Hsee & Zhang, 2010) and Experiment 6, as participants were told that warranty rating reflects the length of the warranty in months, and that brightness reflects the brightness of the TV (see Figure 34), it was assumed that warranty would be easy-to-evaluate in isolation and that brightness would be the hard-to-evaluate in isolation. Furthermore, as in Experiments 5 and 6, the order of these attributes (brightness and warranty) was manipulated, although neither attribute was ever the first contextually available attribute as the new task-irrelevant attribute, ethics of the manufacturer, was always the first contextually available in both JE and SE. Once participants had seen the scenario and had information about the TV(s) presented to them, at the bottom of the page they were required to state their WTP for all TVs that they were presented with information for (both TVs A and B in JE, or either TV A or B in SE).

After participants had stated their WTP purchase value judgement (SE) or judgements (JE) for all TVs (both TVs – JE, or one of the TVs – SE), they were required to make two binary choices. In the first, they were required to choose between which attribute (warranty or brightness) they found more difficult to evaluate (see Figure 35). In the second binary choice, participants were required to choose which attribute (warranty or brightness) they considered to be most important (see Figure 36). By including measures of evaluability and attribute importance, I am able to compare the results of Experiment 7 against the results from Experiment 6 and the predictions of evaluability theory (e.g., Hsee, 1996, 1998; Hsee et al., 1999) as well as González-Vallejo and Moran (2001).

**Figure 35**

*Decision of Evaluation Difficulty in Experiment 7*

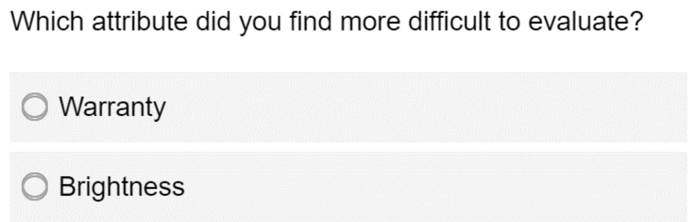
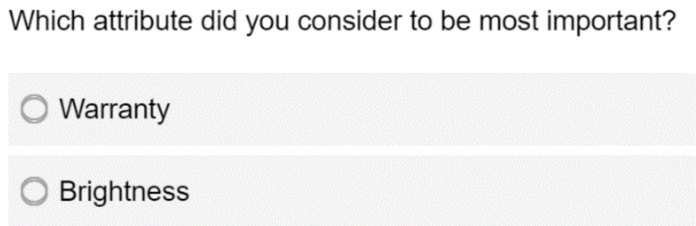



**Figure 36**

*Decision of Attribute Importance in Experiment 7*




### 5.2.3 Results and Discussion

In Experiment 7, the objectives are to: (i) determine whether FAH influences participants' WTP judgements when the first contextually available attribute is task-irrelevant and without opportunity for binary numerical comparisons; and (ii) whether with an ethical first contextually available attribute, participants' WTP judgements will be influenced by FAH in SE. Accordingly, as the evaluation mode (Type of TV) was manipulated, the results of the experiment were analysed within the conditions of joint and separate evaluations. Moreover, the dependent variable was WTP purchase value judgements.

**5.2.3.1 Joint Evaluation of TV A and TV B**

A 2 x 2 x (2) mixed measures design was used, with the following independent variables: (i) task-irrelevant ethical attribute: ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) as a between participants factor, (ii) task-relevant first contextually available attribute as defined in Experiment 6 (warranty or brightness) as a between participants factor, (iii) and type of TV (TV A and TV B) as a within participants factor. The dependent variable was participants' WTP purchase value judgements. Unlike in Experiment 6 where the first contextually available attribute was manipulated to be either warranty or brightness, in Experiment 7 the task-irrelevant ethical attribute (ethics of the manufacturer) was the new first contextually available attribute in both SE and JE.

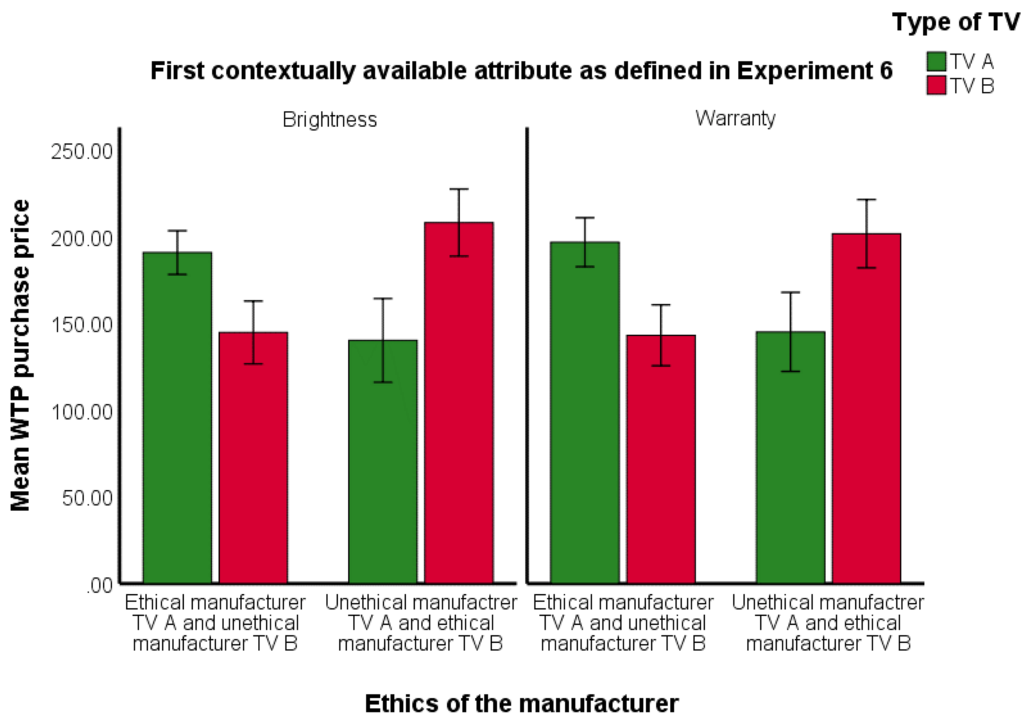
**5.2.3.1.1 Purchase: Willingness to Pay**

A 2 x 2 x (2) mixed measures analysis of variance was conducted with the independent variables task-relevant first contextually available attribute, as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B), and type of TV (TV A and TV B). The dependent variable was participants' WTP purchase value judgements.

The results revealed that the main effects task-relevant first contextually available attribute as defined in Experiment 6 , $F$<1, and type of TV did not have a statistically significant influence on participants' WTP purchase value judgements, $F(1,210)=1.99$, $p=.159$, $\eta_p^2=.009$. Likewise, the two-way interactions ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6, $F<1$, and type of TV by task-relevant first contextually available attribute as defined in Experiment 6 were non-significant, $F(1,210)=1.15$, $p=.286$, $\eta_p^2=.005$. Similarly, the three-way interaction type of TV by ethics of the manufacturer by task-relevant first contextually available attribute, as defined in Experiment 6 was statistically non-significant, $F<1$. However, the two-way interaction type of TV by ethics of the manufacturer did have a statistically significant influence on participants' WTP purchase value judgements, $F(1,210)=162.80$, $p<.001$, $\eta_p^2=.437$. Therefore, as there was a significant two-way interaction between type of TV and ethics of the manufacturer (see Figure 37), two follow up analyses of variance were performed.

**Figure 37**

*Participants' Willingness to Pay Purchase Value Judgements by First Contextually Available Attribute as Defined in Experiment 6, Ethics of the Manufacturer, and Type of TV. Error Bars Represent 95% CI of the Means*




Follow up analyses of variance by ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) and type of TV (TV A or TV B) were performed.

***Purchase: willingness to pay split by ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B).*** When the manufacturer of TV was ethical and the manufacturer of TV B was unethical, the main effect type of TV was statistically significant, *F*(1,104)=49.29, *p*<.001, $\eta_p^2$=.322. Accordingly, when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical, participants' WTP purchase value judgements were higher for TV A (*M*=£193.77; *SD*=£48.17) than for TV B (*M*=£144.05; *SD*=£64.57). However, the main effect of the task-relevant first contextually available attribute as defined in Experiment 6 and the two-way interaction type of TV by task-relevant first contextually available attribute as defined in Experiment 6 were non-significant, *F*<1. Furthermore, when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical, the main effect of type of TV was statistically significant, *F*(1,106)=142.41, *p*<.001, $\eta_p^2$=.573. Therefore, when the manufacturer of TV A was unethical, and the manufacturer of TV B was ethical participants' WTP purchase value judgements were greater for TV B (*M*=£205.00; *SD*=£71.29) than for TV A (*M*=£142.72; *SD*=£85.55). The results also revealed that the main effect of the task-relevant first contextually available attribute as defined in Experiment 6 was non-significant, *F*<1, as was the two-way interaction type of TV by task-relevant first contextually available attribute as defined in Experiment 6, *F*(1,106)=1.16, *p*=.283, $\eta_p^2$=.011.

***Purchase: willingness to pay split by type of TV (TV A or TV B).*** When the type of TV was A (warranty – 24, brightness – 230cd/m2), the main effect of ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) was statistically significant *F*(1,210)=28.67, *p*<.001, $\eta_p^2$=.120. Accordingly, when type of TV was A, participants' WTP purchase value judgements were higher when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical (*M*=£193.77; *SD*=£48.17), than when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical (*M*=£142.73; *SD*=£85.55). However, the main effect of the task-relevant first contextually available attribute as defined in Experiment 6 as well as the two-way interaction ethics of the manufacturer and task-relevant first contextually available attribute as defined in Experiment 6 were statistically non-significant, $F<1$. Furthermore, when the type of TV was B (warranty – 34, brightness – 220 cd/m2) the main effect of ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) was statistically significant $F(1,210)=42.59$, $p<.001$, $\eta_p^2=.169$. Specifically, when type of TV was B, participants' WTP purchase value judgements were lower when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical (*M*=£144.05; *SD*=£64.57) than when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical (*M*=£205.00; *SD*=£71.29). Moreover, the main effect of the task-relevant first contextually available attribute as defined in Experiment 6 as well as the two-way interaction ethics of the manufacturer and the task-relevant first contextually available attribute as defined in Experiment 6 were statistically non-significant, $F<1$.

These results confirm the findings of Experiments 3, 4, 5 and 6 by providing evidence for the FAH. Moreover, the results revealed evidence for task-irrelevant FAH where participants do not have opportunity to make binary numerical comparisons. Specifically, the task-irrelevant attribute (ethics of the manufacturer) influenced participants' WTP purchase value judgements as predicted by FAH. Accordingly, participants were willing to pay more for a TV built by an ethical manufacturer than for a TV built by an unethical manufacturer. Notably, the independent variable task-relevant first contextually available attribute as defined in Experiment 6 did not influence participants' WTP purchase value judgements. This could be explained by the psychologically primed ethical attribute with ethical decision-making consequences in Experiment 7. In contrast to Experiment 6, in Experiment 7 the first contextually available attribute (ethics of the manufacturer) was also task irrelevant and had judgement consequences outside of the WTP task; endorsing an ethical or unethical manufacturer (e.g., paying more for a TV from an ethical manufacturer or from an unethical manufacturer).

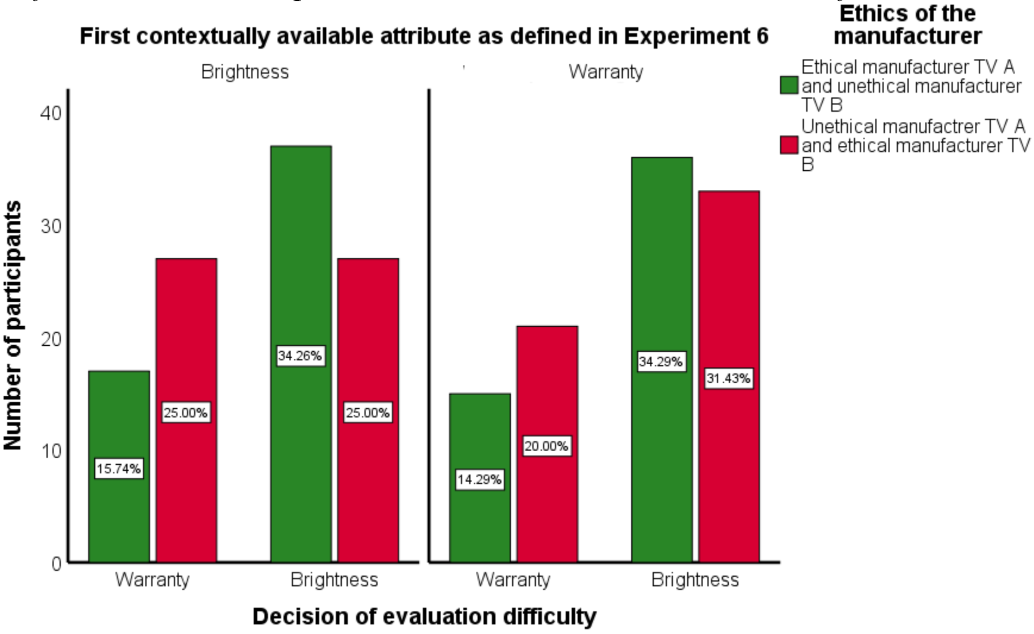
**5.2.3.1.2 Purchase: Willingness to Pay (Including Evaluation Difficulty)**

The following analysis explored whether the task-relevant first contextually available attribute as defined in Experiment 6 and ethics of the manufacturer predict evaluation difficulty, and statistically tested the difference between choices made for warranty and brightness as being most difficult to evaluate.

A binary logistic regression was conducted with the predictor task-relevant first contextually available attribute as defined in Experiment 6 and ethics of the manufacturer, with participants' decisions of evaluation difficulty (warranty or brightness) as the outcome variable. The results revealed that the regression model was a statistically non-significant fit to the data, $\chi^2(3)=5.858$, $p=.119$. Moreover, task-relevant first contextually available attribute as defined in Experiment 6 (*OR EXP[B]*=1.10, $p=.818$, *CI*[.95] = [.480; 2.534]), ethics of the manufacturer (*OR EXP[B]*=.459, $p=.052$, *CI*[.95] = [.210; 1.006]), and their two-way interaction (*OR EXP[B]*=1.425, $p=.539$, *CI*[.95] = [.460; 4.411]), did not predict participants' decisions of evaluation difficulty between warrant and brightness. However, with regard to participants' decisions of evaluation difficulty, the results revealed a significant difference between the attributes warranty (37.6%) and brightness (62.4%), $\chi^2(1)=13.19$, $p<.001$; see Figure 38.

**Figure 38**

*Participants' Decisions of Evaluation Difficulty by First Contextually Available Attribute as Defined in Experiment 6 and Ethics of the Manufacturer*




As the results revealed that the task-relevant first contextually available attribute as defined in Experiment 6 and the ethics of the manufacturer are not associated with participants' decisions of evaluation difficulty, and their decisions that brightness is more difficult to evaluate than warranty, in the following analysis participants' decisions of evaluation difficulty was included as an independent variable. Therefore, a 2 x 2 x 2 x (2) mixed measures analysis of variance was conducted with the independent variables task-relevant first contextually available attribute as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B), participants' decisions of evaluation difficulty (warranty or brightness), and type of TV (TV A and TV B). The dependent variable was participants' WTP purchase value judgements.

The results revealed that the main effects of task-relevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer, participants' decisions of evaluation difficulty, and type of TV were statistically non-significant, $F$<1. Moreover, the two-way interactions type of TV by task-relevant first contextually available attribute as defined in Experiment 6, $F(1,205)=1.07$, $p=.302$, $\eta_p^2=.005$, ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 , ethics of the manufacturer by participants' decisions of evaluation difficulty, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, and type of TV by participants' decisions of evaluation difficulty were non-significant, $F<1$. Likewise, the three-way interactions type of TV by ethics of the manufacturer by participants' decisions of evaluation difficulty, $F(1,205)=2.68$, $p=.103$, $\eta_p^2=.013$, ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, and type of TV by ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 , and type of TV by the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty were non-significant, $F<1$. Furthermore, the four-way interaction type of TV by ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty was non-significant, $F<1$. However, the two-way interaction type of TV by ethics of the manufacturer was significant, $F(1,205)=134.33$, $p<.001$, $\eta_p^2=.396$.

Follow up analyses of variance by ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) and type of TV (TV A or TV B) are reported.

***Purchase: willingness to pay (including evaluation difficulty) split by ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B).*** Two follow up analyses of variance were conducted by ethics of the manufacturer (ethical manufacturer TV A & and unethical manufacturer TV B, or unethical manufacturer TV A & ethical manufacturer TV B):

(i) When the manufacturer of TV A was ethical and the manufacturer of TV B was unethical, the main effect type of TV was statistically significant, $F(1,101)=35.67$, $p<.001$, $\eta_p^2=.261$. Accordingly, when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical, participants' WTP purchase value judgements were higher for TV A ($M$=£193.71; $SD$=£48.39) than for TV B ($M$=£143.99; $SD$=£64.87). However, the main effects of the task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of evaluation difficulty were statistically non-significant $F<1$. Moreover, the two-way interactions type of TV by task-relevant first contextually available attribute as defined in Experiment 6, type of TV by participants' decisions of evaluation difficulty, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, and the three-way interaction type of TV by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty were non-significant statistically $F<1$.

(ii) When the manufacturer of TV A was unethical and the manufacturer of TV B was ethical, the main effect of type of TV was statistically significant, $F(1,104)=133.96$, $p<.001$, $\eta_p^2=.563$. Therefore, when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical, participants' WTP purchase value judgements were greater for TV B ($M$=£205.00; $SD$=£71.29) than for TV A ($M$=£142.72; $SD$=£85.55). The results also revealed that the main effects of the task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of evaluation difficulty were statistically non-significant $F<1$. Moreover, the two-way interactions type of TV by task-relevant first contextually available attribute as defined in Experiment 6 $F(1,104)=1.68$, $p=.197$, $\eta_p^2=.016$, type of TV by participants' decisions of evaluation difficulty $F(1,104)=2.04$, $p=.155$, $\eta_p^2=.019$, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty $F<1$, and the three-way interaction type of TV by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty were non-significant statistically $F<1$.

***Purchase: willingness to pay (including evaluation difficulty) split by type of TV (TV A or TV B)***. Two follow up analyses of variance were conducted by type of TV (TV A or TV B):

i) When the type of TV was A (warranty – 24, brightness – 230cd/m2), the main effect of ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) was statistically significant $F(1,205)=23.02$, $p<.001$, $\eta_p^2=.101$. Accordingly, when type of TV was A, participants' WTP purchase value judgements were higher when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical (*M*=£193.71; *SD*=£48.39), than when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical (*M*=£142.72; *SD*=£85.55). However, the main effects task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of evaluation difficulty were statistically non-significant, $F<1$. Moreover, the two-way interactions ethics of the manufacturer by effects task-relevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by participants' decisions of evaluation difficulty, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, and the three-way interaction ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty were all non-significant, $F<1$.

(ii) Furthermore, when the type of TV was B (warranty – 34, brightness – 220 cd/m2), the main effect of ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) was statistically significant $F(1,205)=35.23$, $p<.001$, $\eta_p^2=.147$. Specifically, when type of TV was B, participants' WTP purchase value judgements were lower when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical (*M*=£143.99; *SD*=£64.87) than when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical (*M*=£205.00; *SD*=£71.29). However, the main effects task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of evaluation difficulty were statistically non-significant, $F<1$. Moreover, the two-way interactions ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by participants' decisions of evaluation difficulty, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, and the three-way interaction ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty were all non-significant, $F<1$.

The results demonstrated that participants' chose brightness as more difficult to evaluate attribute than the warranty attribute. However, the results revealed that participants' decisions of evaluation difficulty are dissociated from their WTP purchase value judgements and did not influence their WTP purchase value judgements. Furthermore, the results provided further evidence for the FAH as participants paid a higher purchase value for the TV built by the ethical manufacturer than the TV built by the unethical manufacturer.

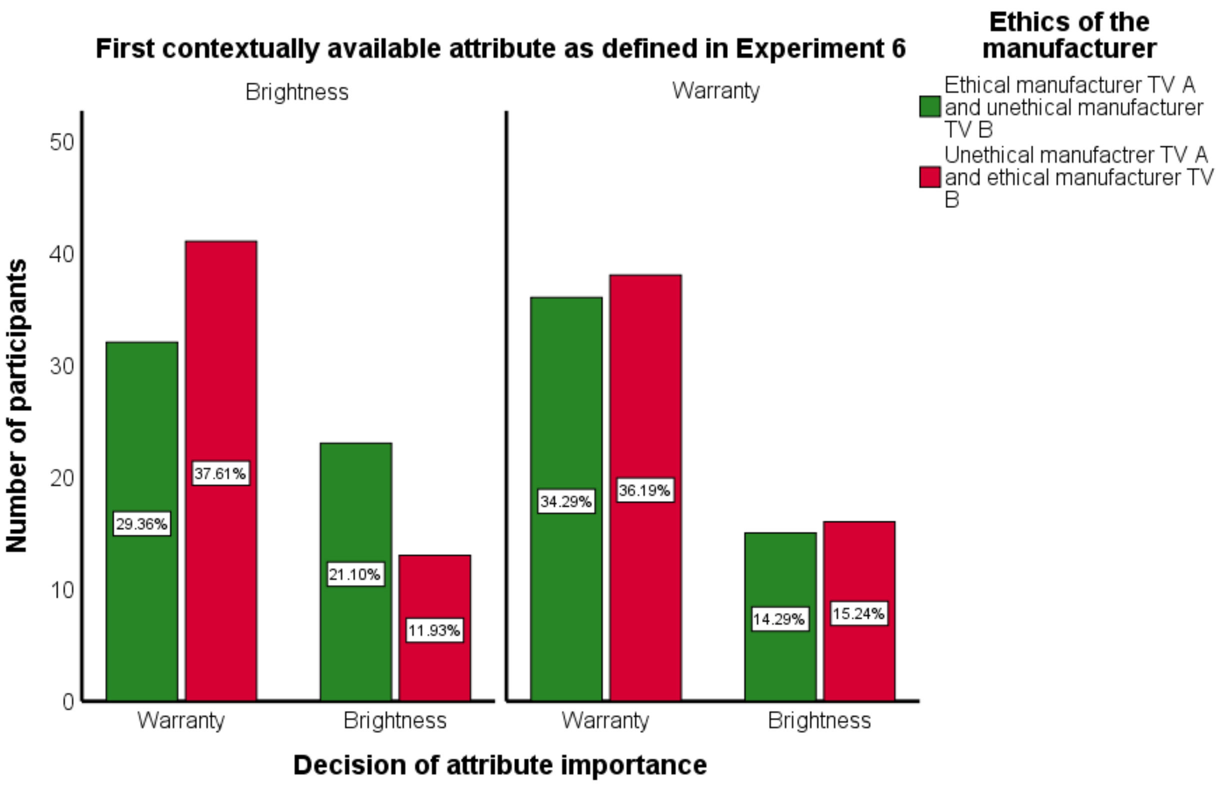
**5.2.3.1.3 Purchase: Willingness to Pay (Including Importance)**

The following analysis explored whether the task-relevant first contextually available attribute as defined in Experiment 6 and ethics of the manufacturer predict participants' decisions of importance, and statistically tested the difference between choice made for warranty and brightness as being most important.

A binary logistic regression was performed with the task-relevant first contextually available attribute as defined in Experiment 6 and ethics of the manufacturer as predictors, and participants' decisions of importance (warranty or brightness) as an outcome variable. The results revealed that the regression model was statistically non-significant, $\chi^2(3)= 4.22$, $p=.238$. Furthermore, participants' decisions of importance between warranty and brightness were not influenced significantly by the main effects ethics of the manufacturer (*OR EXP[B]*=.441, $p=.051$, *CI*[.95] = [.194; 1.004]), and the task-relevant first contextually available attribute as defined in Experiment 6 (*OR EXP[B]*=.580, $p=.185$, *CI*[.95] = [.259; 1.298]). Similarly, the two-way interaction ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 was non-significant, *OR EXP(B)*=2.291, $p=.167$, *CI*(.95) = (.708; 7.416). Moreover, the results revealed a significant difference between participants' decisions of importance between warranty (68.7%) and brightness (31.3%), $\chi^2(1)= 29.91$, $p<.001$; see Figure 39.

**Figure 39**

*Participants' Decisions of Importance by First Contextually Available Attribute as Defined in Experiment 6 and Ethics of the Manufacturer*

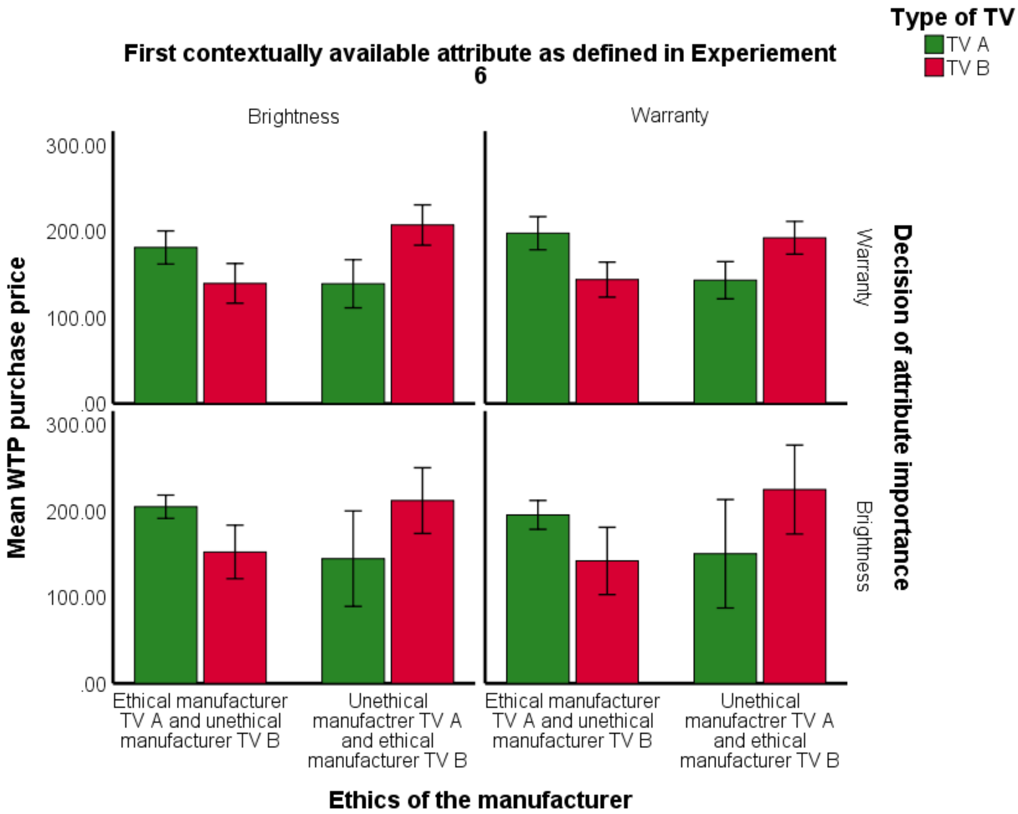



Participants' decisions of importance were not influenced by the task-relevant first contextually available attribute as defined in Experiment 6 or ethics of the manufacturer, and therefore it will be used as an independent variable in the following analysis of variance. Accordingly, a 2 x 2 x 2 x (2) mixed measures analysis of variance was performed with the independent variables the task-relevant first contextually available attribute as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B), participants' decisions of importance (warranty or brightness), and type of TV (TV A and TV B). The dependent variable was participants' WTP purchase value judgements.

The results revealed that the main effects of participants' decisions of importance, $F(1,206)=1.28$, $p=.258$, $\eta_p^2=.006$, type of TV, $F(1,206)=2.24$, $p=.136$, $\eta_p^2=.011$, ethics of the manufacturer, and the task-relevant first contextually available attribute as defined in Experiment 6 were statistically non-significant, $F<1$. Moreover, the two-way interactions ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by participants' decisions of importance, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of importance, type of TV by the task-relevant first contextually available attribute as defined in Experiment 6, and type of TV by participants' decisions of importance were non-significant, $F<1$. Likewise, the three-way interactions ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of importance, type of TV by ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6, type of TV by ethics of the manufacturer by participants' decisions of importance, and type of TV by the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of importance were non-significant, $F<1$. Similarly, the four-way interaction type of TV by ethics of the manufacturer by the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of importance was non-significant, $F<1$. However, the two-way interaction type of TV by ethics of the manufacturer was statistically significant, $F(1,206)=141.33$, $p<.001$, $\eta_p^2=.407$; see Figure 40. Accordingly, because of the significant two-way interaction, two follow up analyses of variance were conducted.

**Figure 40**

*Participants' Willingness to Pay Purchase Value Judgements by First Contextually Available Attribute as Defined in Experiment 6, Ethics of the Manufacturer, Participants' Decisions of Attribute Importance, and Type of TV. Error Bars Represent 95% CI of the Means.*




Follow up analyses of variance by ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) and type of TV (TV A or TV B) are reported.

***Purchase: willingness to pay (including importance) split by ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B).*** Two follow up analyses of variance were conducted by ethics of the manufacturer (ethical manufacturer TV A & and unethical manufacturer TV B, or unethical manufacturer TV A & ethical manufacturer TV B):

(i) When the manufacturer of TV A was ethical and the manufacturer of TV B was unethical, the results revealed that the main effect of type of TV was statistically significant,

$F$(1,102)=44.01, $p$<.001, $\eta_p^2$=.301. Accordingly, when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical participants were willing to pay a higher price to purchase TV A (*M*=£193.77; *SD*=£48.17) than they were to purchase TV B (*M*=£144.05; *SD*=£64.57). The results also revealed that the main effects of the task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of attribute importance were all statistically non-significant, $F$<1, Moreover, the two-way interactions the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance, $F$(1,102)=1.27, $p$=.262, $\eta_p^2$=.012, type of TV by the task-relevant first contextually available attribute as defined in Experiment 6, type of TV by participants' decisions of attribute importance, and the three-way interaction type of TV by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance were all non-significant $F$<1.

(ii) When the manufacturer of TV A was unethical and the manufacturer of TV B was ethical, the main effect of type of TV was statistically significant, $F$(1,104)=120.41, $p$<.001, $\eta_p^2$=.537. Therefore, when TV A was unethical and TV B was ethical participants were willing to pay more to purchase TV B (*M*=£205.00; *SD*=£71.29) than they were TV A (*M*=£142.72; *SD*=£85.55). However, the main effects of the task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of attribute importance were all statistically non-significant, $F$<1. Likewise, the two-way interactions type of TV by the task-relevant first contextually available attribute as defined in Experiment 6, $F$<1, type of TV by participants' decisions of attribute importance, $F$(1,104)=1.07, $p$=.304, $\eta_p^2$=.010, and the task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance, $F$<1, were all non-significant. Moreover, the three-way interaction type of TV by the task-relevant first contextually available attribute as defined in

Experiment 6 by participants' decision of attribute importance was statistically non-significant, $F(1,104)=1.21$, $p=.273$, $\eta_p^2=.012$.

***Purchase: willingness to pay (including importance) split by type of TV (TV A or TV B).*** Two follow up analyses of variance were conducted by Type of TV (TV A or TV B):

(i) When the type of TV was A (warranty – 24, brightness – 230cd/m2), the main effect of ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) was statistically significant $F(1,206)=22.95$, $p<.001$, $\eta_p^2=.100$. Accordingly, when type of TV was A, participants' WTP purchase value judgements were higher when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical ($M$=£193.77; $SD$=£48.17) than when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical ($M$=£142.73; $SD$=£85.55). However, the main effects task-relevant first contextually available attribute as defined in Experiment 6 and participants' decisions of attribute importance were both statistically non-significant $F<1$. Moreover, the two-way interactions ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by participants' decisions of attribute importance, task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance, and the three-way interaction ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance were all statistically non-significant $F<1$.

(ii) Furthermore, when the type of TV was B (warranty – 34, brightness – 220 cd/m2) the main effect of ethics of the manufacturer (ethical manufacturer TV A and unethical manufacturer TV B, or unethical manufacturer TV A and ethical manufacturer TV B) was statistically significant $F(1,206)=39.60$, $p<.001$, $\eta_p^2=.161$. Specifically, when type of TV was

B, participants' WTP purchase value judgements were lower when the manufacturer of TV A was ethical and the manufacturer of TV B was unethical (*M*=£144.05; *SD*=£64.57) than when the manufacturer of TV A was unethical and the manufacturer of TV B was ethical (*M*=£205.00; *SD*=£71.29). However, the main effects task-relevant first contextually available attribute as defined in Experiment 6 $F$<1, and participants' decisions of attribute importance $F(1,206)=1.41$, $p=.237$, $\eta_p^2=.007$, were both statistically non-significant. Moreover, the two-way interactions ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by participants' decisions of attribute importance, and task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance were all non-significant $F$<1. Likewise, the three-way interaction ethics of the manufacturer by task-relevant first contextually available attribute as defined in Experiment 6 by participants' decisions of attribute importance was statistically non-significant $F(1,206)=1.06$, $p=.304$, $\eta_p^2=.005$.

The results demonstrated that participants chose warranty as more important attribute than the brightness attribute. However, the results revealed that participants' decisions of attribute importance are dissociated from their WTP purchase value judgements and did not influence their WTP purchase value judgements. Furthermore, the results provided more evidence for the FAH as participants paid a higher purchase value for the TV built by the ethical manufacturer than the TV built by the unethical manufacturer.

#### 5.2.3.2 Separate Evaluation of TV A and TV B

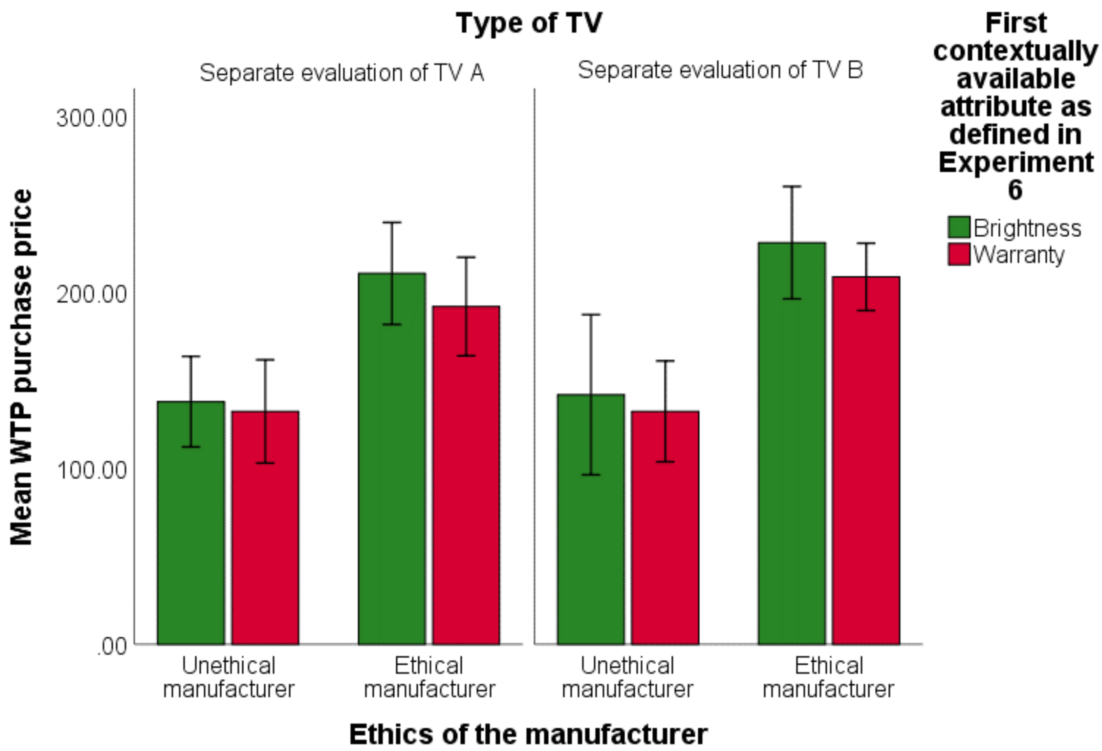
A 2 x 2 x 2 independent measures design was used with the following independent variables: (i) task-irrelevant ethical attribute: ethics of the manufacturer (ethical manufacturer or unethical manufacturer); (ii) task-relevant first contextually available attribute as defined in Experiment 6 (warranty or brightness); and (iii) type of TV (separate evaluation of TV A or separate evaluation of TV B). The dependent variable was participants' WTP purchase value judgements. Unlike in Experiment 6 where the first contextually available attribute was manipulated to be either warranty or brightness, in Experiment 7 the task-irrelevant ethical attribute (ethics of the manufacturer) was the new first contextually available attribute in both SE and JE.

#### 5.2.3.2.1 Purchase: Willingness to Pay

A 2 x 2 x 2 analysis of variance was performed with the independent variables the task-irrelevant first contextually available attribute as defined in Experiment 6 (warranty or brightness) ethics of the manufacturer (ethical manufacturer or unethical manufacturer), and type of TV (separate evaluation of TV A or separate evaluation of TV B). The dependent variable was participants' WTP purchase value judgements. The results revealed that the main effect of ethics of the manufacturer was statistically significant, $F(1,222)=50.15$, $p<.001$, $\eta_p^2=.184$. Specifically, participants' WTP purchase value judgements were higher when the manufacturer was ethical (*M*=£210.00; *SD*=£72.08) than when the manufacturer was unethical (*M*=£136.03; *SD*=£84.25); see Figure 41. However, the main effects of type of TV, $F<1$, and the task-irrelevant first contextually available attribute as defined in Experiment 6 were non-significant, $F(1,222)=1.63$, $p=.203$, $\eta_p^2=.007$. Moreover, the two-way interactions ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by type of TV, and the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV were statistically non-significant, $F<1$. Similarly, the three-way interaction ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV was non-significant, $F<1$.

**Figure 41**

*Participants' Willingness to Pay Purchase Value Judgements by First Contextually Available Attribute as Defined in Experiment 6, Type of TV, and Ethics of the Manufacturer. Error Bars Represent 95% CI of the Means*




These results confirmed the findings of the JE tasks. However, they are in contrast with the results from SE in Experiment 6 as participants' WTP purchase value judgements were consistent with the FAH prediction. Specifically, the results revealed evidence for task-irrelevant FAH where participants do not have the opportunity to make binary numerical comparisons. In other words, the task-irrelevant attribute (ethics of the manufacturer) influenced participants' WTP purchase value judgements, as predicted by FAH. Accordingly, participants were willing to pay more for a TV built by an ethical manufacturer than for a TV built by an unethical manufacturer. This could be explained by the psychologically primed ethical attribute with ethical decision-making consequences in Experiment 7. In contrast to Experiment 6, in Experiment 7 the first contextually available attribute (ethics of the manufacturer) was also task irrelevant and had judgement consequences outside of the WTP task; endorsing an ethical or unethical manufacturer (e.g., paying more for a TV from an ethical manufacturer or from an unethical manufacturer).

**5.2.3.2.2 Purchase: Willingness to Pay (Including Evaluation Difficulty)**

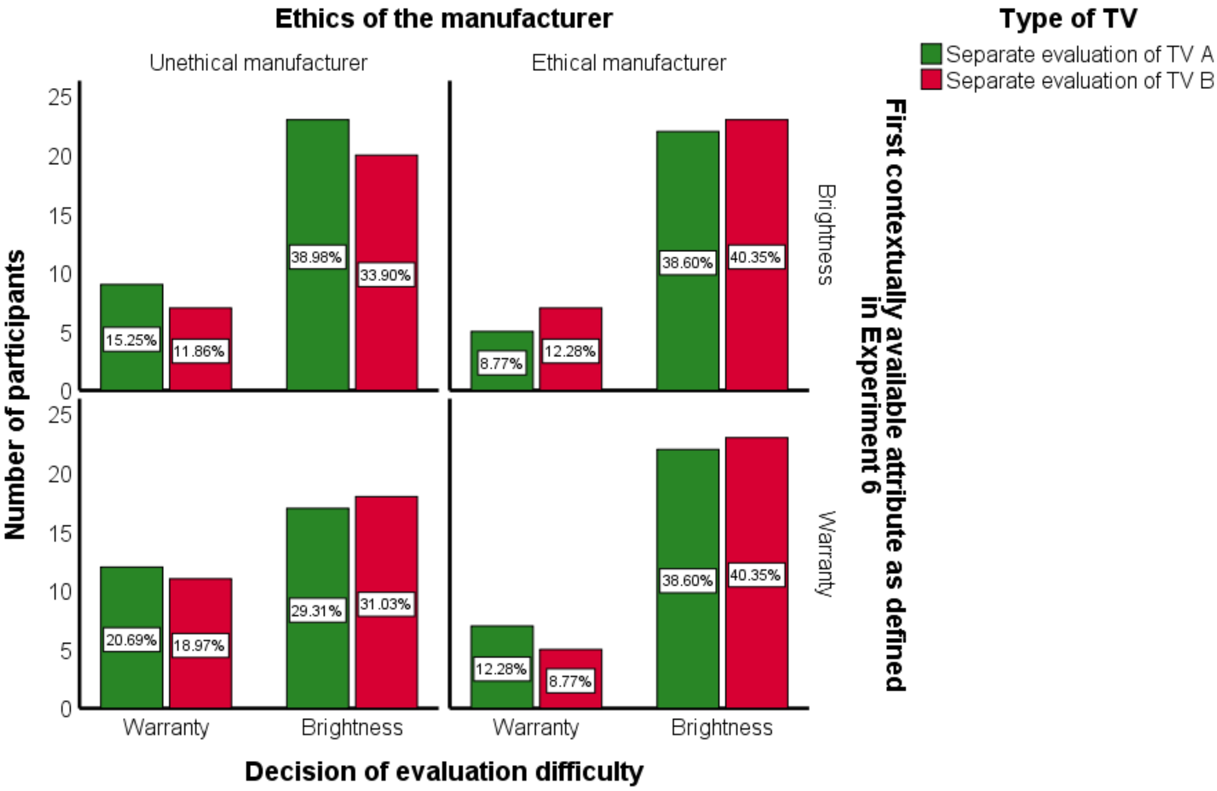
The following analysis explored whether the task-irrelevant first contextually available attribute as defined in Experiment 6 and ethics of the manufacturer predict participants' decisions about evaluation difficulty, and statistically tested the difference between choices made for warranty and brightness as being the most difficult to evaluate.

Accordingly, a binary logistic regression was performed with the predictors task-irrelevant first contextually available attribute as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer or unethical manufacturer), and type of TV (separate evaluation of TV A or separate evaluation of TV B). The outcome variable was participants' decisions of evaluation difficulty. The results revealed that the regression model was statistically non-significant, $\chi^2(7)=7.15$, $p=.414$. Furthermore, the predictors ethics of the manufacturer, *OR EXP(B)*=1.72, $p=.390$, *CI*(.95) = (.498; 5.948), task-irrelevant first contextually available attribute as defined in Experiment 6, *OR EXP(B)*=.55, $p=.279$, *CI*(.95) = (.191; 1.612), and type of TV, *OR EXP(B)*=1.12, $p=.850$, *CI*(.95) = (.352; 3.550), did not significantly predict participants' decisions of evaluation difficulty. Similarly, the two-way interactions ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6, *OR EXP(B)*=1.29, $p=.767$, *CI*(.95) = (.241; 6.880), ethics of the manufacturer by type of TV, *OR EXP(B)*=.67, $p=.648$, *CI*(.95) = (.118; 3.768), and type of TV by the task-irrelevant first contextually available attribute as defined in Experiment 6, *OR EXP(B)*=1.03, $p=.967$, *CI*(.95) = (.216; 4.932) were statistically non-significant. Moreover, the three-way interaction ethics of the manufacturer by type of TV by the task-irrelevant first contextually available attribute as defined in Experiment 6 was non-significant, *OR*

*EXP(B)*=1.90, *p*=.601, *CI*(.95) = (.172; 20.916). However, with regard to participants' decisions of evaluation difficulty, the results revealed a significant difference between the attributes warranty (27.3%) and brightness (72.7%), $\chi^2(1)=47.73$, $p<.001$; see Figure 42.

**Figure 42**

*Participants' Decisions of Evaluation Difficulty by First Contextually Available Attribute as Defined in Experiment 6, Ethics of the Manufacturer, and Type of TV*




As the results demonstrated that the task-irrelevant first contextually available attribute as defined in Experiment 6, and type of TV are not associated with participants' decisions of evaluation difficulty and their decision that brightness is more difficult to evaluate than warranty, in the proceeding analysis participants' decisions of evaluation difficulty was included as an independent variable. Accordingly, a 2 x 2 x 2 x 2 independent measures analysis of variance was conducted with the independent variables: task-irrelevant first contextually available attribute as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer or unethical manufacturer, type of TV (separate evaluation of TV A or separate evaluation of TV B), and participants' decisions of evaluation difficulty (warranty or brightness). The dependent variable was participants' WTP purchase value judgements.

The results revealed that the main effect ethics of the manufacturer had a statistically significant influence on participants' WTP purchase value judgements, $F(1,214)=40.80$, $p<.001$, $\eta_p^2=.160$. Specifically, participants WTP was higher for the TV built by the ethical manufacturer ($M$ = 210.00; $SD$=£72.08) than the unethical manufacturer ($M$ = 136.03; $SD$=£84.25). However, the main effects of the task-irrelevant first contextually available attribute as defined in Experiment 6, $F(1,214)=2.72$, $p=.101$, $\eta_p^2=.013$, type of TV, $F(1,214)=1.06$, $p=.305$, $\eta_p^2=.005$, and participants' decisions of evaluation difficulty did not statistically significantly influence participants' WTP purchase value judgements, $F<1$,. Similarly, the two-way interactions task-irrelevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, $F(1,214)=1.78$, $p=.183$, $\eta_p^2=.008$, type of TV, ethics of the manufacturer by participants' decisions of evaluation difficulty, task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV, and type of TV by participants' decisions of evaluation difficulty were non-significant, $F<1$. Moreover, the three-way interactions ethics of the manufacturer by type of TV by participants' decisions of evaluation difficulty, $F(1,214)=3.06$, $p=.082$, $\eta_p^2=.014$, ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV, ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by participants' decisions of evaluation difficulty, and the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV by participants' decisions of evaluation difficulty were non-significant, $F<1$. Likewise, the four-way interaction ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV by participants' decisions of evaluation difficulty was statistically non-significant, $F<1$.

The results demonstrated that participants chose brightness as more difficult to evaluate attribute than the warranty attribute. However, the results revealed that participants' decisions of evaluation difficulty are dissociated from their WTP purchase value judgements and did not influence their WTP purchase value judgements. Furthermore, the results provided more evidence for the FAH as participants paid a higher purchase value for the TV built by the ethical manufacturer than the TV built by the unethical manufacturer.

**5.2.3.2.3 Purchase: Willingness to Pay (Including Importance)**

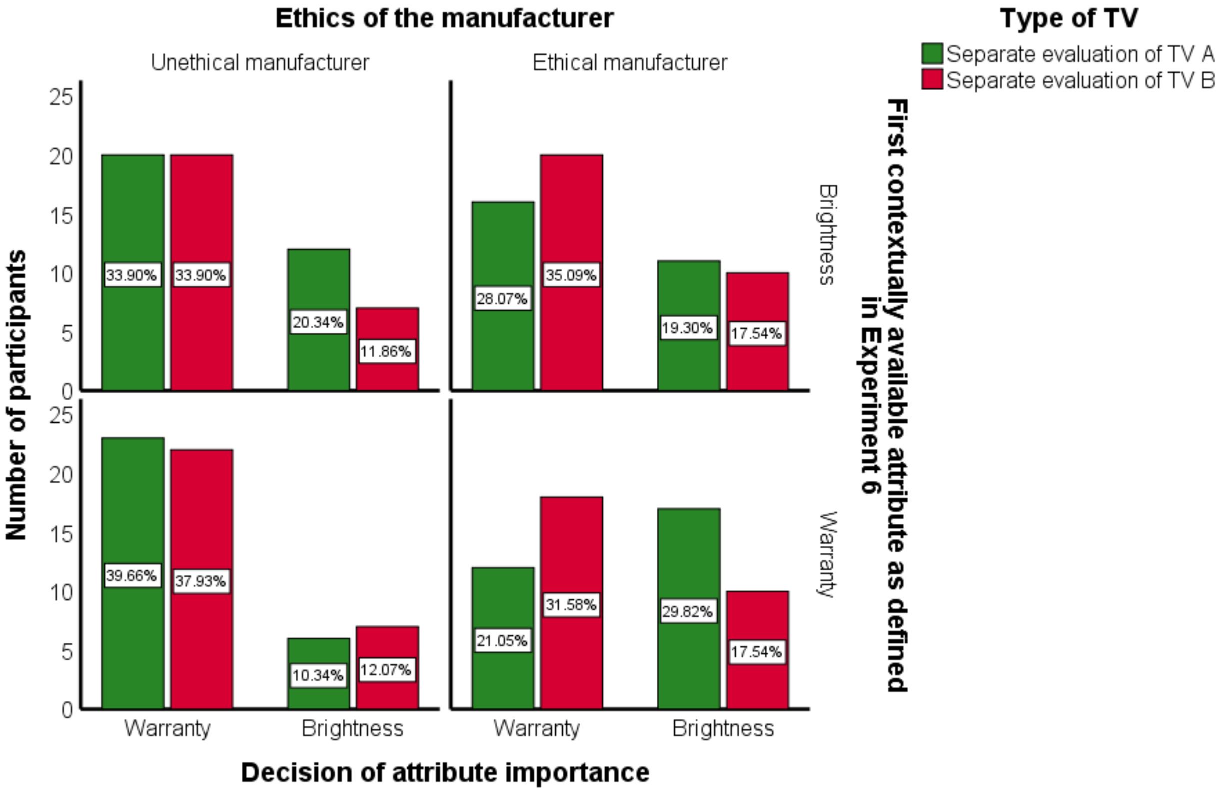
The following analysis explored whether the task-irrelevant first contextually available attribute as defined in Experiment 6 and ethics of the manufacturer predict participants' decisions of importance, and statistically tested the difference between choices made for warranty and brightness as being most important.

A binary logistic regression was conducted with the predictors task-irrelevant first contextually available attribute as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer or unethical manufacturer), and type of TV (separate evaluation of TV A or separate evaluation of TV B). The outcome variable was participants' decisions of importance. The results revealed that the regression model was statistically non-significant, $\chi^2(7)= 12.66$, $p=.081$. Moreover, the predictors ethics of the manufacturer, *OR EXP(B)*=1.15, $p=.799$, *CI*(.95) = (.401; 3.273), the task-irrelevant first contextually available attribute as defined in Experiment 6, *OR EXP(B)*=.44, $p=.155$, *CI*(.95) = (.138; 1.371), and type of TV, *OR EXP(B)*=.58, $p=.345$, *CI*(.95) = (.190; 22.708) were non-significant. Furthermore, the two-way interactions ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6, *OR EXP(B)*=4.74, $p=.052$, *CI*(.95) = (.989;

22.708), ethics of the manufacturer by type of TV, *OR EXP(B)*=1.25, *p*=.781, *CI*(.95) = (.263; 5.905), and type of TV by the task-irrelevant first contextually available attribute as defined in Experiment 6, *OR EXP(B)*=2.09, *p*=.386, *CI*(.95) = (.394; 11.090), were statistically non-significant. Likewise, the three-way interaction ethics of the manufacturer by type of TV by the task-irrelevant first contextually available attribute as defined in Experiment 6 was non-significant, *OR EXP(B)*=.26, *p*=.239, *CI*(.95) = (.027; 2.463). However, there was a significant difference between the number of participants who chose warranty (65.4%) and brightness (34.6%) as the most important attribute, $\chi^2(1)= 21.82$, $p<.001$; see Figure 43.

**Figure 43**

*Participants' Decisions of Importance by Type of TV, First Contextually Available Attribute as Defined in Experiment 6, and Ethics of the Manufacturer*




Participants' decisions of importance were not influenced by the task-irrelevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer, or type of TV, and will therefore be used as an independent variable in the following analysis of variance. Accordingly, a 2 x 2 x 2 x 2 independent measures of analysis of variance was performed with the independent variables the task-relevant first contextually available attribute as defined in Experiment 6 (warranty or brightness), ethics of the manufacturer (ethical manufacturer or unethical manufacturer), type of TV (separate evaluation of TV A or separate evaluation of TV B), and participants' decisions of importance (warranty or brightness). The outcome variable was participants' WTP purchase value judgements.

The results revealed that the main effect of ethics of the manufacturer had a significant influence on participants' WTP purchase value judgements, $F(1,214)=38.04$, $p<.001$, $\eta_p^2=.151$. Accordingly, participants WTP purchase price was higher for the TV built by the ethical manufacturer ($M$ = 210.00; $SD$=£72.08) than for the TV built by the unethical manufacturer ($M$ = 136.03; $SD$=£84.25). However, the main effects of type of TV, $F(1,214)=1.58$, $p=.210$, $\eta_p^2=.007$, the task-irrelevant first contextually available attribute as defined in Experiment 6, and participants' decisions of importance, were statistically non-significant, $F<1$. Moreover, the two-way interactions ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6, ethics of the manufacturer by type of TV, ethics of the manufacturer by participants' decisions of importance, task-irrelevant first contextually available attribute as defined in Experiment 6 by participants' decisions of importance, and type of TV by participants' decisions of importance were statistically non-significant, $F<1$. Similarly, the three-way interactions ethics of the manufacturer by type of TV by participants' decisions of importance, $F(1,214)=1.18$, $p=.279$, $\eta_p^2=.005$, task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV by participants' decisions of importance, $F(1,214)=1.87$, $p=.173$, $\eta_p^2=.009$, ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV, and ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by participants' decisions of importance, were statistically non-significant, $F<1$.

Furthermore, the four-way interaction ethics of the manufacturer by the task-irrelevant first contextually available attribute as defined in Experiment 6 by type of TV by participants' decisions of importance was non-significant statistically, $F<1$.

The results demonstrated that participants chose warranty as more important attribute than the brightness attribute. However, the results revealed that participants' decisions of attribute importance are dissociated from their WTP purchase value judgements and did not influence their WTP purchase value judgements. Furthermore, the results provided more evidence for the FAH as participants paid a higher purchase value for the TV built by the ethical manufacturer than the TV built by the unethical manufacturer.

## 5.3 General Discussion

The goal of Experiment 7 was to explore whether FAH is limited to binary contextual numerical comparisons on a task-relevant attribute (e.g., warranty or brightness – as in Experiment 6). Specifically, I used a priming manipulation to explore the influence of the psychological activation of the task-irrelevant attribute ethics of the manufacturer (without opportunity for binary numerical comparisons) on participants' WTP purchase value judgements. Moreover, I also examined whether this task-irrelevant ethical attribute (ethics of the manufacturer) supresses the influence of the task-relevant first contextually available attribute (as defined in Experiment 6). As the understanding of universal ethical rules do not require participants to make binary comparisons of numerical attribute values, I suggested it is plausible that once activated, the task-irrelevant ethical attribute could be the only factor influencing participants' WTP purchase value judgements in both JE and SE. Furthermore, as the task-irrelevant attribute ethics of the manufacturer also has judgement consequences outside of the WTP task, I suggested that participants might consider paying more money for a TV from the ethical manufacturer (regardless of the task-relevant attributes – warranty and brightness) to be an ethically motivated act of endorsement. Accordingly, I argued that priming participants with the task-irrelevant ethical attribute could lead to suppression of any other psychological influences and factors.

Consistent with the results from Experiments 3,4,5 and 6, Experiment 7 confirmed that participants' WTP purchase value judgements were influenced by FAH in JE. However, the results from Experiment 7 provided evidence for task-irrelevant FAH, where participants did not have the opportunity to make binary numerical comparisons. Specifically, participants' WTP purchase value judgements were influenced by the task-irrelevant ethical attribute (ethics of the manufacturer), and their WTP was higher for a TV built by an ethical manufacturer than for a TV built by an unethical manufacturer. Notably, in contrast to Experiment 6, in Experiment 7 participants' WTP purchase value judgements were not influenced by the independent variable task-relevant first contextually available attribute, as defined in Experiment 6. These results were anticipated, as the psychologically primed (and task irrelevant) first contextually available attribute (ethics of the manufacturer) had judgement consequences outside of the WTP task. Accordingly, I proposed that participants might have considered their WTP purchase value judgements (e.g., paying more for a TV from an ethical manufacturer or from an unethical manufacturer) as endorsement of an ethical or unethical manufacturer.

Moreover, in contrast to the results from Experiment 6 that showed no effect from FAH on WTP judgements in SE, in Experiment 7 the results revealed that participants' WTP purchase value judgements were consistent with the FAH prediction. Specifically, the task-irrelevant first contextually available attribute (ethics of the manufacturer) influenced participants' WTP judgements even when they did not have opportunity to make binary numerical comparisons in SE. Accordingly, participants' WTP purchase value judgements were higher for the TV built by the ethical manufacturer than for the TV built by the unethical manufacturer. As in JE, I predicted these results as the psychologically primed (and task irrelevant) first contextually available attribute (ethics of the manufacturer) had judgement consequences outside of the WTP task. Accordingly, as anticipated, participants might have considered their WTP purchase value judgements (e.g., paying more for a TV from an ethical manufacturer or from an unethical manufacturer) as endorsement of an ethical or unethical manufacturer.

In his evaluability theory Hsee (1996, 1998, 2000) argued that attributes which are easy-to-evaluate in isolation have relatively more influence on participants' WTP judgements during SE than during JE, and that attributes which are hard-to-evaluate in isolation have more influence on participants' WTP judgements during JE than during SE. Specifically, Hsee's evaluability theory predicts a preference reversal from the option dominant on hard-to-evaluate attribute in JE, to the option dominant on the easy-to-evaluate attribute in SE. Accordingly, as in Experiment 6, in Experiment 7 participants were asked to choose which attribute they found most difficult to evaluate (warranty or brightness). Moreover, participants in Experiment 7 were given information about the attribute warranty (that it represents the length in months of the warranty), but not the brightness attribute. As expected, they chose the attribute brightness as more difficult to evaluate than the attribute warranty. This effect and result are anticipated by Hsee (1996) and Hsee and Zhang (2010). Moreover, Hsee also predicts a preference reversal from the option dominant on hard-to-evaluate attribute brightness (TV A – 230 cd/m2, TV B – 220 cd/m2) during JE, to the option dominant on the easy-to-evaluate attribute warranty (TV A – 24, TV B – 34) in SE. However, in contrast to this specific prediction by Hsee, the results from Experiment 7 revealed that participants' decisions of evaluation difficulty were dissociated from their WTP purchase value judgements and did not influence their WTP purchase value judgements in both SE and JE. Furthermore, the results provided evidence for the FAH as participants' WTP purchase value was higher for the TV built by the ethical manufacturer than the TV built by the unethical manufacturer in both JE and SE. Although, it is appropriate to acknowledge that whilst I measured evaluation difficulty using a binary choice, in some of his experiments Hsee (1996) required participants to answer questions regarding attribute values (e.g., 'If someone has written 10 KY programmes in the last 2 years, do you have any idea how experience he/she is with KY' [p. 251]) by choosing among four options ranging from 'I don't have any idea' to 'I have a clear idea'. Accordingly, it is possible that the sensitivity of the scale used to measure attribute evaluability could impact upon the resultsused to measure attribute evaluability could impact upon the results.

González-Vallejo and Moran (2001) have suggested that people use different evaluation procedures across joint and separate evaluation modes. Specifically, they argued that in JE people use a comparative procedure which is largely influenced by attribute importance (people have a tendency to prefer the option superior on the important attribute), whilst in SE people weight each of the attributes relative to their importance and evaluation difficulty. In other words, González-Vallejo and Moran (2001) propose that attribute importance is a key determinant of participants' WTP in JE, and that attribute importance also heavily influences WTP in SE along with other factors including evaluation difficulty. Accordingly, as in Experiment 6, in Experiment 7 participants were asked to choose the attribute they considered to be the most important (warranty or brightness). The results from Experiment 7 demonstrated that participants chose warranty as more important attribute than the brightness attribute in both JE and SE. Moreover, in contrast to González-Vallejo and Moran (2001; see also Hsee, 2000), participants' decisions of attribute importance were dissociated from their WTP purchase value judgements and did not influence their WTP purchase value judgements.

As a final note, in Experiment 7 I did not manipulate the order of the first contextually available attribute (ethics of the manufacturer and brightness and warranty) as in the previous experiments. Accordingly, it is plausible that the attribute ethics of the manufacturer will be always the first attribute for consideration (despite its task-irrelevance and regardless of its contextual position) due to its importance/salience. Future research could explore whether FAH proposal goes beyond the contextual explanation offered in this dissertation. This would provide further scope for the theory.

# Chapter 6

# Thesis Conclusions and Follow-Up Research Work

## 6.1 Overview of Chapter 6

In this final chapter (Chapter 6), I start by discussing key behavioural theories which are bounded by desirability and FAH. I then move on to discuss the influence of desirability on the consistency of people's judgement and decision-making preferences, with a focus on DbS (Stewart et al., 2006) and Ungemach et al. (2011) predictions. Following this, I discuss the role of FAH in the construction of human preferences, and then summarise the results of Experiments 3-7 which revealed that FAH influenced risky choices, and non-risky WTP salary and purchase value judgements for job candidates and TVs respectively. Furthermore, I also consider the methodological and theoretical contributions of this thesis, as well as its practical contributions and implications. This chapter ends with a discussion regarding the limitations of my experiments, follow-up research, and research which could demonstrate the influence that desirability and FAH have on people's behaviour in applied settings.

## 6.2 Summary of Main Findings and Discussion

### 6.2.1 Behavioural Theories of Decision Making Bounded by Desirability and FAH

In this thesis, I have introduced and empirically demonstrated a novel behavioural effect (desirability) and psychological mechanism (FAH) which influence human judgement and decision-making preferences. Accordingly, under this section I will give an overview of behavioural theories which are bounded by desirability and FAH, and briefly explain why my experimental results indicate that this is the case.

At the beginning of this thesis (Experiments 1 and 2) I explored the influence of recent sampling experience and the desirability of gambles' prizes on people's risk preferences. The results from these experiments revealed that, as predicted, participants' preferences for risky gambles were influenced by the desirability of their prizes, but not always by sampling experience, and thus relative rank differences (only in Experiment 1, with non-desirable prizes). Accordingly, overall, the results from Experiments 1 and 2 do not support the predictions made by Ungemach et al. (2011) or Stewart et al. (2006). In particular, in their DbS relative rank model – the only decision-making theory to have successfully challenged PT, Stewart and colleagues assume that people construct their judgements and decisions using consistent psychological processing. Specifically, Stewart et al. argued that the subjective value of an option (e.g., a gamble) is represented by its relative rank within an attribute (e.g., money), when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory and/or context). In other words, according to DbS predictions, people's preferences for and about choice options are informed solely by relative ranking, not by absolute values (e.g., Stewart et al., 2006; Stewart et al., 2015; Ungemach et al., 2011). Given this very stringent prediction, DbS cannot currently account for my empirical evidence that people's preferences can be influenced by desirability (i.e., absolute values).

More generally, desirability (Experiments 1 and 2) and FAH (Experiments 3-7) are incompatible with the assumptions and predictions of influential normative and descriptive theories of judgement and decision-making. In particular, EUT (von Neumann & Morgenstern, 1947) and PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) assume that people have stable and consistent preferences which are informed solely by computational processing. However, in contrast to these assumptions desirability and FAH contribute towards research which indicates that people's preferences are constructed 'on the fly' (e.g., Kusev et al., 2020), using psychological mechanisms and effects which are triggered by context and task-related factors (e.g., Brandstätter et al., 2006; Gigerenzer et al., 1999; Kusev & van Schaik, 2011; Kusev et al., 2020; Payne, Bettman & Johnson, 1992; Slovic, 1995; Stewart et al., 2006). Accordingly, as EUT and PT do not account for preference lability and non-computational processing, their predictive validity is limited. Moreover, as Tversky and Kahneman did not account for desirability and FAH in their CE experimental method, it is plausible that they had an undetected influence on the construction of their participants' preferences.

In Experiments 5-7, I used Hsee's (1996) experimental method to examine the influence on FAH on participants' WTP judgements, outside the domain of risk. Hsee used his experimental method to validate his evaluability theory, in which he argued that JE-SE preference reversals (e.g., see Bazerman et al., 1992) can occur because some attributes are easier to evaluate in isolation than others (see Hsee et al., 1999; Hsee & Zhang, 2010). In particular, Hsee proposed that in JE people's preferences are determined by attributes which are easy-to-evaluate in isolation (i.e., they can be understood without comparison), whilst in joint evaluation (when comparison between choice options is possible), people's preferences are determined by both easy-to-evaluate attributes and hard-to-evaluate attributes (those which cannot be understood in isolation). Accordingly, Hsee's (1996) evaluability theory predicts a preference reversal from the option dominant on hard-to-evaluate attribute during JE to the option dominant on the easy-to-evaluate attribute in SE. However, the predictions of Hsee's evaluability theory were not supported by results in this thesis; Experiments 5-7 found that FAH influenced preferences in JE (and in SE – Experiment 7), but that participants' decisions of evaluation difficulty did not (Experiments 6 and 7). Together, these results are inconsistent with Hsee's (1996) evaluability theory, and point to the possibility that his results may have been influenced by FAH, as his experimental method did not control for FAH influence, or designed to detect its influence.

More recently, González-Vallejo and Moran (2001; see also Hsee, 2000) have argued that evaluation difficulty and attribute importance influenced participants' WTP judgements, but that the influence of these factors changes across evaluation modes. Specifically, González-Vallejo and Moran argued that in SE people's preferences are influenced by attribute importance and evaluation difficulty, whilst in JE people's preferences are determined by attribute importance. Accordingly, González-Vallejo and Moran predict that JE-SE preference reversals occur when a hard-to-evaluate attribute is more important that an easy-to-evaluate attribute. However, González-Vallejo and Moran's predictions were not supported by Experiments 6 and 7, which found that participants' decisions of evaluation difficulty did not influence their WTP judgements. Moreover, Experiments 5 and 6 found that participants' WTP judgements were only influenced by their decisions of attribute importance when it was congruent with the first contextually available attribute, whilst Experiment 7 found no influence of participants' decisions of attribute importance on their WTP judgements. Taken together, the results from Experiments 5-7 did not support González-Vallejo and Moran's predictions. Furthermore, like Hsee, González-Vallejo and Moran did not account for the influence from FAH in their experimental method, which makes it possible that their results might be a product of FAH.

### 6.2.2 The Influence of Desirability on The Consistency of Human Judgement and Decision-Making Preferences.

Consistent with DbS (Stewart et al., 2006) predictions, Ungemach et al. (2011) demonstrated that participants' choices for a safe (55% chance of winning £0.50) and risk (15% chance of winning £1.50) gambles were constructed in relation to recently sampled monetary amounts. However, the results from Experiment 1 revealed that people's risk preferences were only influenced by recently sampled amounts, when they were choosing between gambles with non-desirable prizes (the gambles used by Ungemach et al.). This result is consistent with my prediction that the non-desirable and negligible gambles' prizes used by Ungemach and colleagues did not trigger participants' risk preferences, and thus prompted them to sample from experience. Indeed, with choice between a safe gamble (55% chance of winning £0.50) with a non-desirable prize and a risky-gamble (0.15% chance of winning £150) with a desirable prize, participants were more likely to choose the risky gamble regardless of how recently sampled monetary amounts were distributed.

In congruence with the results from Experiment 1, the results from Experiment 2 revealed that with choice between a safe gamble with a non-desirable prize (55% chance of winning £0.50) and a risky gamble with a non-desirable prize (15% chance of winning £1.50) the majority of participants were risk-averse. Although, risk-aversion increased with choice between safe (55% chance of winning £100) and risky (15% chance of winning £300) gambles with desirable prizes. Moreover, the results from Experiment 2 also revealed that regardless of the desirability of gambles' prizes, participants' preferences were not influenced by sampling experience, but were influenced by type of gamble presentation. Specifically, participants were more risk-averse with vertically presented gambles, than with horizontally presented gambles.

Taken together, the results from Experiments 1 and 2 supported my proposal that the desirability of gambles' prizes influenced whether people made comparisons between gambles on the probability attribute (probability comparisons) or on the money attribute (money comparisons), and that these comparisons could be disrupted or enhanced by type of presentation (horizontal or vertical). Specifically, I reasoned that participants compared gambles on the money attribute when the safe gamble had a non-desirable prize and the risky gamble a desirable prize (Experiment 1), but compared the gambles on the probability attribute when both the safe and risky gambles were with either non-desirable prizes or desirable prizes (Experiment 2). However, in Experiment 3 (and onwards) I found evidence to support my alternate FAH proposal; participants made comparisons on the first contextually available attribute, which in Experiments 1 and 2 was always probability.

### 6.2.3 The Role of FAH in The Construction of Human Judgement and Decision-Making Preferences

The FAH is not good (rational) or bad (irrational) as, like many heuristics (e.g., see Gigerenzer et al., 1999), it produces outcomes which are relative to the structure of information in the environment. Specifically, as demonstrated in Experiments 3-7, the order of choice option's attribute values (i.e., manipulating the order of the first contextually available attribute) can have a significant influence on people's judgement and decision-making preferences. Thus, in contrast to the influential normative (EUT; von Neumann & Morgenstern, 1947) and descriptive (PT; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) theories of decision-making, Experiments 3-7 provide evidence that human preferences are not stable and consistent, but 'constructed on the fly' with influence from contextual factors and features of the task (e.g., Kusev & van Schaik, 2011; Kusev et al., 2020; Slovic, 1995).

Indeed, FAH poses a significant methodological challenge to existing risky judgement and decision-making studies which have required participants to choose between options defined on at least two attributes, but did not control for its influence. In particular, within the context of risk, choice between probabilistically defined gambles has been an indispensable tool for eliciting people's risk preferences (Lopes, 1983), and have been used to validate most theories of risky decision-making including PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) and DbS (Stewart et al., 2006). However, the aforementioned theories did not account for FAH in their experimental method (design, materials and procedure), and therefore their results and conclusions are likely to be confounded with FAH influences. Accordingly, in light of the empirical evidence presented in this thesis, future studies which explore risky judgement and decision-making using gambles (or other tasks with probabilistically defined information) should control for the influence of FAH in their design. The most obvious way to achieve this is by counterbalancing the order of attributes (so that all attributes have opportunity to be the first contextually available attribute) and ensuring that each choice option is superior (and inferior) on an equal number of attributes (i.e., forcing a trade-off between options). Although, the methodological implications of FAH are not limited to studies investigating risk preferences, as studies investigating non-risky judgement and decision-making also use experimental methods which make them prone to influence from FAH. For example, when validating his evaluability theory Hsee (1996) used an experimental method which did not account for influence from FAH. However, in this thesis I have demonstrated that FAH (but not evaluability) influences the construction of people's WTP judgements in Hsee's method.

### 6.2.4 The Effects of FAH on Risky Decision Making, Recruitment and Consumption WTP Judgements

Most of the experiments (3-7) in this thesis were dedicated to introducing FAH and exploring its influence on participants' risky and non-risky preferences. Accordingly, in this section I will provide an overview of my experimental evidence which indicates that people's risky choice preferences (Experiments 3 and 4), and non-risky WTP judgements for job candidates (Experiment 5) and TVs (Experiments 6 and 7) were influenced by FAH.

The results from Experiments 3 and 4 demonstrated that participants' risky choice preferences were influenced by FAH. Accordingly, in Experiment 3 participants' preferences for safe and risky gambles were influenced by the order in which the attributes probability and money were presented, but not by gamble presentation (horizontal or vertical), as the within attribute comparisons were never disrupted. Specifically, participants were more likely to choose the risky gamble when it had a dominant value on the first contextually available attribute (money), than when it had an inferior value on the first contextually available attribute (probability). Subsequently, Experiment 4 extended the findings of Experiment 3 by demonstrating that FAH influenced people's preference for risky gambles in a repeated choice task, where safe gambles were not associated with a dominant value on the probability attribute, and risky gambles were not associated with a dominant value on the money attribute.

Moreover, the results from Experiment 4 revealed that participants had overall risk-seeking preferences in the domain of gain. This finding is inconsistent with PT which predicts overall risk-aversion in the domain of gain (Tversky & Kahneman, 1992), but it is anticipated by experienced based decision researchers (e.g., Hertwig et al., 2004; see Hertwig, 2012) who employ methods that require experience, sampling and complex cognitive interpretations. Given the above, overall, the results from Experiments 3 and 4 were inconsistent with the assumption that humans possess stable and consistent preferences informed by computational processing (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992; von Neumann & Morgenstern, 1947). However, the results were consistent with the proposal that people's preferences are constructed 'on the fly' with influence from context and task effects (e.g., Kusev et al., 2011; Kusev et al., 2020), and that people often use heuristic processing to construct their preferences (e.g., Brandstätter et al., 2006; Gigerenzer & Gaissmaier, 2011; Gigerenzer et al., 1999; Goldstein & Gigerenzer, 2002; Kusev et al., 2011; Tversky & Kahneman, 1974).

Outside the domain of gain, the results from Experiments 5-7 empirically demonstrated that people's non-risky WTP judgements for job-candidates (Experiment 5) and TV's (Experiments 6 and 7) were influenced by FAH, but not by evaluability, as predicted by Hsee (1996). Indeed, in Experiments 5 participants' WTP salary judgements were influenced by FAH in JE. Accordingly, participants were willing to pay a relatively higher salary for the job candidate with the dominant value on the first contextually available attribute, than for the job candidate with the inferior value on the first contextually available attribute. Moreover, when participants' decisions of attribute importance were introduced into the model, the results revealed that participants' WTP salary judgements were influenced by a congruence effect. Specifically, in the congruence effect, participants' WTP salary judgements were only significantly different when the attribute chosen by participants as being most important was also the first contextually available attribute. These results were replicated in Experiment 6 with a task in which participants stated their WTP purchase value judgements for TVs. Although, the results from Experiment 6 also revealed that, as predicted, participants' WTP purchase values judgements were not influenced by FAH in SE, as binary comparison on the first contextually available attribute was not possible. Furthermore, the results from Experiment 6 also revealed a congruence effect in SE between the first contextually available attribute and participants' decisions of attribute importance. In particular, participants' WTP purchase value judgements were influenced by the attribute which they chose as most important, but only when the attribute chosen as most important was also the first contextually available attribute. Taken together, the results from Experiments 5 and 6 were consistent with FAH, but not Hsee's (1996) evaluability theory, and also demonstrated that participants' preferences were influenced by attribute importance (in the congruence effects), but not as predicted by González-Vallejo and Moran (2001).

Experiment 7 extended my previous FAH experiments (3-6) by demonstrating that FAH is not limited to binary contextual numerical comparisons on a task-relevant attribute. Specifically, the results revealed that with a task-irrelevant first contextually available attribute (ethics of the TV manufacturer), which could be implicitly understood, and had judgement consequences outside of the WTP task (supporting or not supporting an ethical TV manufacturer), participants were always willing to pay relatively more for the TV produced by the ethical manufacturer than for the TV produced by the unethical manufacturer. Accordingly, participants' WTP judgements were influenced by FAH in JE where they could make non-numerical binary comparisons, and in SE where they could compare the non-numerical available contextual information with their non-numerical internal representations and beliefs about ethical norms. Therefore, non-numerical binary comparisons on the task-irrelevant ethical first contextually available attribute, suppressed all other psychological influences and factors (e.g., the task-relevant first contextually available attribute, and participants' decisions of attribute importance), including congruence effects which were not present in either JE or SE.

### 6.3 Methodological and Theoretical Contributions of The Thesis

The first theoretical contribution of this thesis is the introduction of a novel behavioural effect (desirability) and a novel psychological mechanism (FAH), and empirical demonstrations that they influence people's risky and non-risky preferences. In particular, both desirability and FAH are incompatible with EUT (von Neumann & Morgenstern, 1947) and PT (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) which assume that human preferences are stable and consistent, and a product of computational processing. In contrast to these assumptions, my empirical findings that people's preferences are influenced by FAH and desirability indicate that they are not stable and consistent, and influenced by non-computational behavioural effects and psychological mechanisms which enable judgements and decisions to be made with little effort (i.e., heuristics). Accordingly, desirability and FAH are consistent with Behavioural Science research which has demonstrated that human agents' preferences are constructed 'on the fly' (e.g., Kusev et al., 2020; Slovic, 1995), using psychological mechanisms which are triggered by features of the context and task (e.g., Gigerenzer et al., 1999; Kusev & van Schaik, 2011; Payne, Bettman, Coupey & Johnson, 1992). Furthermore, FAH – like other behavioural heuristics – guides the construction of judgements and decisions (for better or worse) by exploiting the structure of information in the environment (see Gigerenzer et al., 1999). Given the above, my research exploring desirability and FAH is consistent with the current direction of research investigating human judgement and decision-making. Moreover, the discovery of novel behavioural effect (desirability) and the proposal regarding the psychological mechanism of FAH, broaden the understanding of contextual and task-related features which can trigger psychological activations and guide the construction of people's preferences.

My results from Experiments 1 and 2 also make a contribution towards DbS research as using Ungemach et al.'s (2011) experimental method, they revealed that people's preferences for risky gambles were influenced by the desirability of the gambles prizes. This influence from desirability, a novel behavioural effect, is theoretically challenging for Stewart et al.'s (2006) DbS relative rank model, as it cannot currently be accommodated by its predictions. In particular, in their DbS theory, Stewart and colleagues proposed that the subjective value of an option (e.g., a gamble) is represented by its relative rank within an attribute (e.g., money), when compared against comparable attribute values (e.g., other amounts of money) sampled from experience (memory and/or context). In other words, a core prediction of DbS is that people's preferences for and about choice options are informed solely by relative ranking, not by absolute values (i.e., desirability). Accordingly, the influence of desirability on people's risky preferences is inconsistent with DbS prediction. This novel finding is theoretically important for risky judgement and decision-making research, as it reveals a weakness in DbS - a contemporary theory which has successfully challenged the predictions of EUT and PT (see Stewart et al., 2006; Stewart et al., 2015; Ungemach et al., 2011; Walasek & Stewart, 2015, 2019). Accordingly, desirability may help guide DbS future development.

The third theoretical contribution in this thesis comes from the non-risky experiments which found evidence that in Hsee's (1996) experimental method, participants' non-risky WTP judgements were influenced by FAH (Experiments 5-7), but not by their decisions of evaluation difficulty (Experiments 6 and 7). Accordingly, the results from the aforementioned experiments make a theoretical contribution to research investigating human preferences in non-risky domains, as they demonstrate that FAH influences participants' WTP salary judgements for job candidates (i.e., recruitment judgements) and WTP purchase value judgements for TVs (i.e., consumption judgements). Moreover, the results from Experiments 6 and 7 are theoretically important for Hsee's evaluability theory (Hsee, 1996, 1998; see Hsee et al., 1999), as the results revealed no evidence to support his predictions. Specifically, in his evaluability theory, Hsee (1996) argues that in SE people's preferences are determined by attributes which are easy-to-evaluate in isolation, whilst in joint evaluation people's preferences are determined by attributes which are easy and hard to evaluate in isolation. Given this, in his evaluability theory, Hsee (1996) predicts a preference reversal from the option dominant on hard-to-evaluate attribute during JE to the option dominant on the easy-to-evaluate attribute in SE.

Moreover, the results from Experiments 5-7 also make a theoretical contribution to research exploring the influence of attribute importance on human WTP judgements within Hsee's experimental method. In particular, González-Vallejo and Moran (2001; see also Hsee, 2000) argued that JE-SE preference reversals can occur because people use different evaluation strategies across JE (comparative) and SE (absolute). Specifically, according to González-Vallejo and Moran, in JE people's preferences are informed mostly by attribute importance (thus people have a tendency to select the option superior on the most important attribute regardless of its evaluability). In contrast in SE, González-Vallejo and Moran suggest that people's preferences are determined by combining available attributes, according to their importance and evaluability. Accordingly, González-Vallejo and Moran predict that JE-SE preferences reversals occur when a hard-to-evaluate attribute is more important that an easy-to-evaluate attribute. However, as discussed in the previous paragraph, Experiments 6 and 7 found that participants' WTP judgements were not influenced by their decisions of evaluation difficulty, which violates the prediction that evaluability should influence preferences in SE. Furthermore, the findings of Experiments 5-7 are not consistent with González-Vallejo and Moran's predictions regarding attribute importance. In particular, Experiments 5 and 6 found that participants' decisions of attribute importance significantly influenced participants WTP judgements only with congruence with the first contextually available attribute. The results from Experiment 7 are more directly inconsistent with González-Vallejo and Moran's predictions, as participants' WTP judgements were not influenced by their decisions of attribute importance. Taken together, the results from Experiments 5-7 are consistent with FAH predictions, but inconsistent with the predictions of González-Vallejo and Moran (2001), and therefore make an important theoretical contribution towards research investigating the influence of attribute importance on humans' preferences.

Besides the aforementioned theoretical contributions which this thesis makes to judgement and decision-making research, my introduction and experimental exploration of desirability and FAH also make methodological contributions. Specifically, I have demonstrated that desirability and FAH can influence people's choices between risky gambles and that preferences are triggered by features of context and task; the desirability of gambles' prizes and the order of choice options' attribute values (the first contextually available attribute). Given that choice between descriptively defined gambles has been an indispensable tool for eliciting people's risk preferences in judgement and decision-making research (Lopes, 1983), and that prior studies have not controlled for triggers of desirability and FAH in their experimental methods, the research documented in this thesis poses a major methodological problem for existing research. Indeed, the predictions of all major theories of risky choice (including PT and DbS) have been examined and/or validated using experimental methods which have required participants to choose between descriptively defined gambles. For example, in all experiments which have been used to validate the predictions of DbS in the domain of risk, participants have been required to make choices between gambles with numerically stated probabilistic information (e.g., Stewart et al., 2015; Ungemach et al., 2011; Walasek et al., 2015, 2019). Moreover, it is plausible that the results of future experimental studies which require choice between descriptively defined gamble options will be contaminated by influence from desirability of FAH, if they are not controlled for, or if people use experimental methods which are unable to detect their influence.

However, as demonstrated in Experiments 5-7 the methodological implications of FAH extend beyond experiments investigating human behaviour in the domain of risk. This is because, as in the domain of risk, researchers exploring non-risky judgement and decision-making have often elicited their participants' preferences by requiring them to choose between (or make WTP judgements for) choice options which have descriptively detailed attribute values/information on shared attributes. One example of this – explored in Experiments 5-7 – is the experimental method which Hsee (1996) used to validate his evaluability theory. Specifically, in his experimental method participants had to judge their WTP for one (in SE) or two (in JE) choice options, which had different values on two common attributes. Moreover, as in the domain or risk, because FAH is a novel heuristic first introduced in this thesis, it is plausible that researchers investigating non-risky judgement and decision-making have not detected or control for its influences. Thus, it is possible that studies exploring non-risky judgement and decision-making are contaminated with unintended and undetected influence from FAH.

Overall, considering the aforementioned paragraphs together, FAH is a valuable behavioural theory as it is simpler (makes fewer assumptions) than existing theories (e.g., DbS) including those which are famed for their simplicity (e.g., take the best and priority heuristics). Moroever, as FAH assumes the use of a single domain-general cognitive tool (binary comparison) it, like all leading behavioural theories (i.e., EUT, PT and DbS), makes predictions which are not domain specific. Accordingly, when triggered, FAH can be used to predict human behaviour for judgement and choice in risky and non-risky domains.

## 6.4 Practical Implications and Contributions of The Thesis

This thesis – particularly FAH – has significant practical implications for people who have to choose between at least two options, which are described (particularly numerically) on shared attributes. Specifically, as exemplified in Experiments 5-7 which demonstrated that FAH influenced participants' WTP judgements (non-risky preferences) for job applicants and TVs, FAH has the potential to influence people's behaviour in a broad variety of tasks and scenarios (assuming that the aforementioned conditions are met). Moreover, like many cognitive heuristics, FAH is not good (rational) or bad (irrational) as it produces outcomes which are relative to the environment (the order of the first contextually available attribute determines preferences). Accordingly, to reduce the possibility that FAH leads people to make poor and harmful judgements and decisions, policy makers ought to consider regulating the choice architecture of major decisions (e.g., pension decisions), so that triggering FAH increases the likelihood that people will make pro-social and rational decisions. This proposal is consistent with the nudge agenda which has guided policy makers in recent years (see Thaler & Sunstein, 2009). In particular, the purpose of nudge is to design the architecture (contextual features) of choices so that they trigger automatic psychological mechanisms (i.e., heuristic processes), and lead people to unknowingly make better decisions.

Of course, rather than leveraging FAH's potential, policy makers could instead regulate choice architecture so that FAH is not triggered and cannot influence people's behaviour. As demonstrated in Experiment 5, the most practical way to achieve this is by presenting choice options separately. Although, there are limitations to this approach as it will only work with attributes for which people do not have any internal representations. However, for example, it will not work for ethical attributes (see Experiment 7), as people could compare the contextually available attribute information with attribute information recalled from memory.

## 6.5 Thesis Limitations and Follow-Up Research and Applications

Scientific research is a product of its time; naturally bounded by human's collective understanding of reality and of the scientific method. Accordingly, whilst limitations can undermine scientific research by revealing fundamental issues, they are also necessary for guiding people towards new avenues of research, and are thus a cornerstone for the development of knowledge. Given this, in this section I will address the limitations of my experimental explorations and propose ways in which future research can navigate these limitations. Moreover, as a catalyst for future research activity, I will briefly discuss potential follow-up research and possible applications of FAH, which I believe ought to be investigated.

As it is typical in psychology research (see Hertwig & Ortmann, 2001), in all experiments in this thesis I paid a flat fee for participation. Accordingly, as none of my experiments rewarded participants according to their performance, economists would argue that the value of the research presented in this thesis is limited. Indeed, the provision of performance based financial incentives is such an elementary doctrine of experimental economics that it is practically impossible to publish studies (in economics journals) which do not use them (Camerer & Hogarth, 1999; Hertwig & Ortmann, 2001). Specifically, according to a review by Hertwig and Ortmann there are four reasons why economists use financial incentives: (i) theories of economics are built on the assumption that people seek to maximise utility; (ii) they believe that rewards and punishments reduce variability in performance; (iii) they assume that the salience of financial rewards is easier to regulate than the salience of non-financial rewards; and, (iv) they assume that people always want more (there is no reward saturation). In other words, economists assume that as cognitive activity is effortful and people do not want to work for free, they work harder and more effectively (are more willing to engage in effortful thinking) if better performance leads to a greater reward (Camerer & Hogarth, 1999). In contrast to the aforementioned perspective, more recently Wakker (2010) argued that hypothetical choice is central for normative applications and should not be ignored. Although, to examine the possibility that financial incentives might change my experimental results, in future research I ought to explore the replicability of my results when participants are rewarded according to their performance.

Within the social sciences (at least outside of psychology), the findings of laboratory experiments have been met with suspicion by researchers who believe that they are not generalizable in non-experimental settings, or replicable in field experiments (see Lunn & Choisdealbha, 2018). In particular, researchers have expressed doubts that laboratory experiments produce realistic data which can be used to understand the real world (Falk & Heckman, 2009). Accordingly, given scepticism about the 'realism' of laboratory experiments, it is unsurprising that experimental exploration of human behaviour has been dominated by researchers who have used field experiments rather than laboratory experiments. This position is exemplified by the UK government's 'Behavioural Insight Team', who, in the majority of their publications have used randomised controlled trials or field trials rather than laboratory experiments (see Lunn & Choisdealbha, 2018). However, in spite of these concerns, laboratory experiments offer benefits which make them a powerful tool for exploring human behaviour, and in particular their psychological mechanisms. Specifically, unlike other methods (e.g., field experiments) laboratory experiments enable researchers to tightly control variations in experimental conditions (Falk & Heckman, 2009), which enables the isolation of specific psychological mechanisms (Lunn & Chiosdealbha, 2018). Given that the purpose of this thesis was to examine the influence of a specific behavioural effect (desirability) and psychological mechanism (FAH) on human behaviour, my use of laboratory experiments has been entirely appropriate. Although, as I would find it interesting to explore the generalisability of my research in real world environments, I will consider replicating (at least some of) my experiments in 'live' settings. Moreover, I will also identify opportunities to examine whether desirability and FAH influence people's preferences in other applied settings (I have discussed some ideas later in this sub-section).

The third limitation of the experimental research presented in this thesis, is that as I used samples restricted to UK participants, it is possible that my experimental findings may not generalise outside of a western population. A lack of diversity is a general problem for psychology research, which is dominated by scholars from western countries (particularly the USA), who predominantly study WEIRD (white, educated, industrialised, rich, and democratic) populations, and then generalised their findings/theories to non-WEIRD populations (i.e., they generalise to all humans; see Pollet & Saxton, 2019). Indeed, this behaviour is reflected in published research, as the majority of publications in leading journals rely on WEIRD samples and make generalisations regarding the behaviour of humans in general (Arnett, 2008; Nielsen et al., 2017; Rad et al., 2018). However, as WEIRD samples are not representative of the whole human population (Arnett, 2008; Henrich et al. 2010) and non-WEIRD samples are underrepresented in published articles, scholars have raised concerns that published psychology research might not generalise to non-WEIRD populations (e.g., Nielsen et al., 2017; Pollet & Saxton, 2019; Rad et al., 2018).

Given these concerns, before I make any claim about the generalisability of my research beyond a western population, I ought to investigate the influences of desirability and FAH on the preferences of non-WEIRD populations. This seems particularly important for FAH, as in this thesis I have implicitly assumed that the 'first contextually available attribute' is the attribute presented first on the left (this is consistent with left-to-right, top-to-bottom script). However, it is of course possible that people who use languages which do not use left-to-right script (e.g., right-to-left, top-to-bottom script or top-to-bottom, right-to-left script) will perceive the 'first contextually available attribute' differently, and therefore might make binary comparisons on a different attribute leading to a different pattern of preferences. For instance, consider an example with two gambles (A and B):

| | |
|---|---|
| A. £100 | 55% |
| B. £300 | 15% |

In this example (see Experiment 3), I have assumed that the money is the first contextually available attribute as it is featured in the top left position (i.e., reading from left-to-right, top-to-bottom it is the first attribute which is read). Therefore, with FAH, I assume that people make binary comparisons on the attribute money and favour B (£300) over A (£100) as it is dominant. However, in populations which read from right-to-left, top-to-bottom (e.g., Hebrew) probability would be considered as the first contextually available attribute. Accordingly, people might compare gambles binary on the probability attribute, leading to preference for A (55%) over B (15%) as it is dominant. In other words, cultural differences in the processing of written script could influence which attribute is psychologically designated as being the first contextually available, and with FAH this could lead to a shift in participants' preferences (e.g., as described, possibly a reversal in preferences between groups).

Moreover, as in this thesis my experimental investigations of FAH have been limited to risky choices in the domain of gain (choices between gambles involving no possibility of loss), there is an opportunity to explore FAH in the domain of loss (choices between gambles involving no possibility of gain). Given the evidence from psychological research that human decision-making in the domains of gain and loss shares the same psychological mechanism, it is plausible that FAH could influence participants' preferences in the domain of loss too. Nevertheless, using FAH in the domain of loss will result in the opposite decision making consequences (e.g., select the option with the lowest value within the first contextually available attribute).

With regard to applied research, there is opportunity to explore the influence of desirability on people's risk preferences in a live setting. In particular, it would be relatively easy to adapt Ungemach et al.'s (2011) Study 1a (a live experiment) to accommodate the desirability manipulation from Experiment 1. Specifically, in one of their studies (Study 1a) Ungemach and colleagues offered participants leaving a shop with an opportunity to exchange their receipt (which displayed all items that they had purchased) for an opportunity to choose between safe (55% chance of winning £0.50) or risky (15% chance of winning £1.50) gambles. In congruence with DbS (Stewart et al., 2006), they hypothesised that participants would choose the risky gamble when more of the items on their receipt were for amounts between the gambles' prizes (£0.50 and £1.50). As they anticipated, the results were consistent with their hypothesis, as participants were more likely to choose the risky gamble when there was a large difference in the relative rank of the gambles' outcomes (i.e., when they experience supermarket prices mostly between the gambles prizes). Accordingly, I could closely replicate Ungemach et al.'s field experiment by asking people leaving a supermarket (which sells a wide variety of high- and low-priced goods) to exchange their receipt and then choose between either gambles with non-desirable prizes (safe - 55% chance of winning £0.50, risky -15% chance of winning £1.50), or gambles with a non-desirable prize (safe - 55% chance of winning £0.50) and a desirable prize (risky – 0.15% chance of winning £150).

As with desirability, there is also an opportunity to explore the influence of FAH on human behaviour within applied settings. For instance, understanding of FAH within the context of comparison (or aggregator) websites could help people to avoid overlooking information, and therefore improve decision-making. Comparison websites enable people to specify their requirements, and then to directly compare providers for a wide range of services (e.g., insurance, finance, and utility providers). Specifically, they provide customers with an aggregated list of sellers described (usually numerically) on common attributes and ordered by their rank on the attribute which is listed first (i.e., the first contextually available attribute), regardless of their values on the other attributes. Accordingly, it is plausible that aggregated lists trigger FAH which leads people to prefer the seller dominant on the first contextually available attribute relatively more than other sellers, and to ignore other available attribute information. Whilst is it reasonable to assume that the majority of customers benefit from aggregated lists which trigger FAH (i.e., they are guided to money-saving decisions), it is also plausible that in some instances triggering FAH might result in poor decisions. For example, on car insurance aggregators the policy premium is usually the first contextually available attribute, and therefore participants are guided towards preference for the policy with the cheapest premium. However, this can lead customers to overlook other important features of the policy (e.g., the amount of excess which has to be paid in the event of a claim). Therefore, it is likely that in some instances, FAH leads customers to prefer an insurance provider (with the cheapest policy premium) that is only marginally cheaper than the next cheapest provider, but which requires a significantly greater excess in the event of a claim.

Moreover, there is also opportunity for future research to explore FAH within multi-attribute decision-making methods, which could involve multiple attributes (more than two) or multiple options for consideration (more than two). Indeed, given that FAH is a heuristic and the empirical evidence that FAH influences people’s risky and non-risky preferences (choice and WTP judgements) with two attributes and two decision options, it is plausible that FAH could also influence people’s preferences in more complex tasks when they are more likely to use heuristic processes/mechanisms. However, it is also possible that in multi-attribute decision-making methods, the influence of FAH on people’s behaviour could be weakened. Specifically, people may be less likely to use FAH if comparisons on the first contextually available attribute are too difficult (e.g., because of lots of information, or because the comparisons are disrupted).

Moreover, if there are many attributes/options then it is plausible that people's behaviour will be influenced more strongly by a primacy effect, rather than FAH (which is not primacy).

### 6.6 Final Remarks

In this thesis, I have introduced, explored and experimentally demonstrated two novel psychological phenomena – desirability (a behavioural effect) and FAH (a psychological mechanism) – which influence human judgement and decision-making behaviour. In particular, with regard to desirability, I have argued that in Ungemach et al. (2011) participants' preferences were influenced by recently sampled monetary amounts as their gambles' prizes were negligible and non-desirable, did not trigger risk-preferences, and prompted sampling from experience. Accordingly, I revealed that the desirability of gambles' prizes (absolute values) can influence risky choice preferences, which is not predicted by Ungemach and colleagues or more generally DbS (Stewart et al., 2006). Moreover, I also demonstrated FAH where people make binary (contextual or in some cases non-contextual) comparisons between choice options on the first contextually available attribute and prefer the option with the superior value on the first contextually available attribute relatively more than the option with the inferior value on the first contextually available attribute. Considered together, desirability and FAH are congruent with evidence that people's preferences are not stable and consistent, but constructed 'on the fly' (e.g., Kusev et al., 2020) using a variety of context and task dependent psychological mechanisms (e.g., Gigerenzer et al., 1999; Kusev & van Schaik, 2011; Payne, Bettman, Coupey & Johnson, 1992; Slovic, 1995). In other words, the research presented in this thesis indicates that preferences are constructed, not revealed (e.g., Pedroni et al., 2017).

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## Appendix: Experimental Materials (Visual Stimuli, Tasks and Questions)

<u>Experiment 1: Preliminary Study</u>

Choose one of the following two hypothetical options that provide a chance of winning an amount of money:

55% chance of winning £0.50 ○ | 15% chance of winning £1.50 ○

Judge the desirability of the following option by dragging the slide bar from 0 (non-desirable) to 9 (desirable).

55% chance of winning £0.50

**Non-Desirable** **Desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (non-desirable) to 9 (desirable).

15% chance of winning £1.50

**Non-desirable** **Desirable**

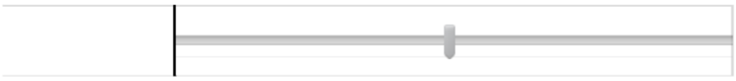
<u>Experiment 1: Type of Decision-Making Task (Gambles with Non-Desirable Monetary Prizes) / Type of Sampling Experience (Below and Above the Gambles Prizes)</u>

| Products | Price |
|---|---|
| A 250 grams packet of ginger biscuits | £0.19 |
| A single red onion | £0.19 |
| A single garlic | £0.19 |
| A 2 litres bottle of still spring water | £0.19 |
| A bed (single) | £380 |

| | |
|---|---|
| A double mattress | £380 |
| A garden shed | £380 |
| A two-seater sofa | £380 |

Judge the value of the product

Extremely poor value Extremely good value



Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Choose one of the following two hypothetical options that provide a chance of winning an amount of money:

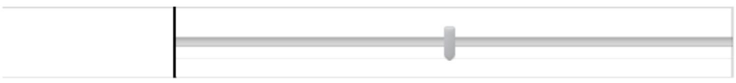
- 55% chance of winning £0.50
- 15% chance of winning £1.50

Experiment 1: Type of Decision-Making Task (Gambles with Non-Desirable Monetary Prizes) / Type of Sampling Experience (Within the Range of the Gambles Prizes)

| Products | Price |
|---|---|
| A 500 millilitre bottle of lemon and lime flavoured sparkling water | £0.74 |
| A 500 grams packet of Fusilli pasta | £0.74 |
| A 432 grams tin of sliced pineapple | £0.74 |
| A 500 grams packet of spaghetti | £0.74 |
| A 4 pints bottle of semi-skimmed milk | £1.07 |
| A 1 litre bottle of clementine juice | £1.07 |
| A frozen 10” pepperoni pizza | £1.07 |
| A 400 grams tin of spicy parsnip and carrot soup | £1.07 |

Judge the value of the product

Extremely poor value Extremely good value



Please indicate whether you would buy the product

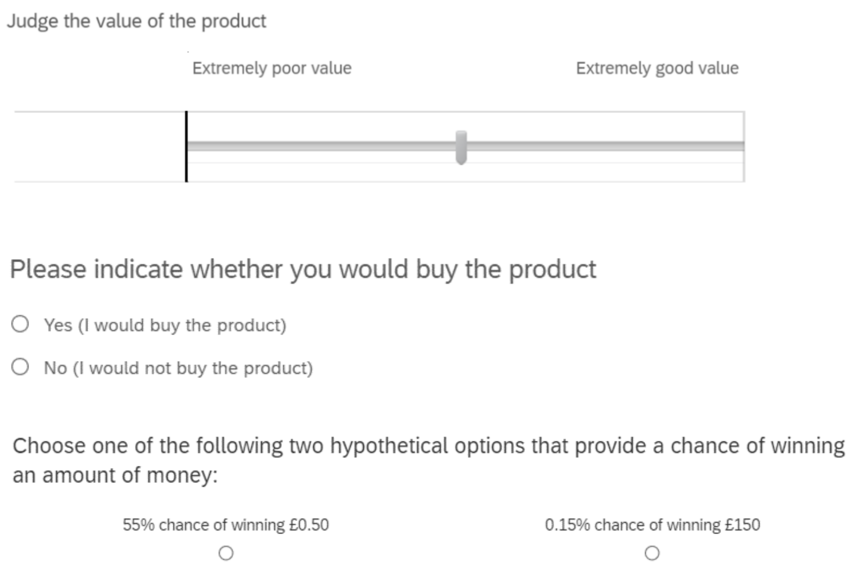
- Yes (I would buy the product)
- No (I would not buy the product)

Choose one of the following two hypothetical options that provide a chance of winning an amount of money:

- 55% chance of winning £0.50
- 15% chance of winning £1.50

Experiment 1: Type of Decision-Making Task (Gambles with a Non-Desirable Monetary Prize and a Desirable Monetary Prize) / Type of Sampling Experience (Below and Above the Gambles Prizes)

| Products | Price |
|---|---|
| A 250 grams packet of ginger biscuits | £0.19 |
| A single red onion | £0.19 |
| A single garlic | £0.19 |
| A 2 litres bottle of still spring water | £0.19 |
| A bed (single) | £380 |
| A double mattress | £380 |
| A garden shed | £380 |
| A two-seater sofa | £380 |




Experiment 1: Type of Decision-Making Task (Gambles with a Non-Desirable Monetary Prize and a Desirable Monetary Prize) / Type of Sampling Experience (Within the Range of the Gambles Prizes)

| Products | Price |
|---|---|
| A 500 millilitre bottle of lemon and lime flavoured sparkling water | £0.74 |
| A 500 grams packet of Fusilli pasta | £0.74 |
| A 432 grams tin of sliced pineapple | £0.74 |
| A 500 grams packet of spaghetti | £0.74 |
| A 4 pints bottle of semi-skimmed milk | £1.07 |
| A 1 litre bottle of clementine juice | £1.07 |
| A frozen 10” pepperoni pizza | £1.07 |
| A 400 grams tin of spicy parsnip and carrot soup | £1.07 |

Judge the value of the product

Extremely poor value | Extremely good value

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Choose one of the following two hypothetical options that provide a chance of winning an amount of money:

55% chance of winning £0.50 | 0.15% chance of winning £150

Experiment 2: Type of Decision-Making Task (Gambles with Non-Desirable Monetary Prizes) / Type of Sampling Experience (Below and Above the Gambles Prizes) / Presentation of Gambles (Horizontal)

| Products | Price |
|---|---|
| A 250 grams packet of ginger biscuits | £0.19 |
| A single garlic | £0.19 |
| A bed (single) | £380 |
| A double mattress | £380 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** | **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

| | | | |
|---|---|---|---|
| **A.** 55% | £0.50 | **B.** 15% | £1.50 |

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £0.50

**Very undesirable** **Very desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £1.50

**Very undesirable** **Very desirable**

Experiment 2: Type of Decision-Making Task (Gambles with Non-Desirable Monetary Prizes) / Type of Sampling Experience (Below and Above the Gambles Prizes) / Presentation of Gambles (Vertical)

| Products | Price |
|---|---|
| A 250 grams packet of ginger biscuits | £0.19 |
| A single garlic | £0.19 |
| A bed (single) | £380 |
| A double mattress | £380 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

- **A.** 55% £0.50
- **B.** 15% £1.50

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £0.50

**Very undesirable** **Very desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £1.50

**Very undesirable** **Very desirable**

Experiment 2: Type of Decision-Making Task (Gambles with Non-Desirable Monetary Prizes) / Type of Sampling Experience (Within the Range of the Gambles Prizes) / Presentation of Gambles (Horizontal)

| Products | Price |
|---|---|
| A 500 millilitre bottle of lemon and lime flavoured sparkling water | £0.74 |
| A 500 grams packet of Fusilli pasta | £0.74 |
| A 4 pints bottle of semi-skimmed milk | £1.07 |
| A 1 litre bottle of clementine juice | £1.07 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

- **A.** 55% £0.50
- **B.** 15% £1.50

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £0.50

**Very undesirable** **Very desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £1.50

**Very undesirable** **Very desirable**

Experiment 2: Type of Decision-Making Task (Gambles with Non-Desirable Monetary Prizes) / Type of Sampling Experience (Within the Range of the Gambles Prizes) / Presentation of Gambles (Vertical)

| Products | Price |
|---|---|
| A 500 millilitre bottle of lemon and lime flavoured sparkling water | £0.74 |
| A 500 grams packet of Fusilli pasta | £0.74 |
| A 4 pints bottle of semi-skimmed milk | £1.07 |
| A 1 litre bottle of clementine juice | £1.07 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

- **A.** 55% £0.50
- **B.** 15% £1.50

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £0.50

Very undesirable Very desirable

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £1.50

Very undesirable Very desirable

Experiment 2: Type of Decision-Making Task (Gambles with Desirable Monetary Prizes) / Type of Sampling Experience (Below and Above the Gambles Prizes) / Presentation of Gambles (Horizontal)

| Products | Price |
|---|---|
| A 250 grams packet of ginger biscuits | £0.19 |
| A single garlic | £0.19 |
| A bed (single) | £380 |
| A double mattress | £380 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

Extremely poor value Extremely good value

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

- **A.** 55% £100
- **B.** 15% £300

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £100

**Very undesirable** **Very desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £300

**Very undesirable** **Very desirable**

Experiment 2: Type of Decision-Making Task (Gambles with Desirable Monetary Prizes) / Type of Sampling Experience (Below and Above the Gambles Prizes) / Presentation of Gambles (Vertical)

| Products | Price |
|---|---|
| A 250 grams packet of ginger biscuits | £0.19 |
| A single garlic | £0.19 |
| A bed (single) | £380 |
| A double mattress | £380 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

- **A.** 55% £100
- **B.** 15% £300

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £100

Very undesirable Very desirable

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £300

Very undesirable Very desirable

Experiment 2: Type of Decision-Making Task (Gambles with Desirable Monetary Prizes) / Type of Sampling Experience (Within the Range of the Gambles Prizes) / Presentation of Gambles (Horizontal)

| Products | Price |
|---|---|
| A bed (double) | £148 |
| A wooden table | £148 |
| A garden shed | £214 |
| A washing machine | £214 |

Please indicate whether you would buy the product

- Yes (I would buy the product)
- No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

◯ **A.** 55% £100 ◯ **B.** 15% £300

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £100

**Very undesirable** **Very desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £300

**Very undesirable** **Very desirable**

Experiment 2: Type of Decision-Making Task (Gambles with Desirable Monetary Prizes) / Type of Sampling Experience (Within the Range of the Gambles Prizes) / Presentation of Gambles (Vertical)

| Products | Price |
|---|---|
| A bed (double) | £148 |
| A wooden table | £148 |
| A garden shed | £214 |
| A washing machine | £214 |

Please indicate whether you would buy the product

◯ Yes (I would buy the product)

◯ No (I would not buy the product)

Judge the value of the product by dragging the slider from 0 (extremely poor value) to 4 (extremely good value).

**Extremely poor value** **Extremely good value**

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

- **A.** 55% £100
- **B.** 15% £300

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**A.** 55% £100

**Very undesirable** **Very desirable**

Judge the desirability of the following option by dragging the slide bar from 0 (very undesirable) to 9 (very desirable).

**B.** 15% £300

**Very undesirable** **Very desirable**

Experiment 3: First Contextually Available Attribute (Probability) / First Attribute Presentation (Horizontal)

Choose one of the following two hypothetical options by clicking once on the chosen option (A or B). For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

| A. | B. |
|---|---|
| 55% | 15% |
| £100 | £300 |

Experiment 3: First Contextually Available Attribute (Probability) / First Attribute Presentation (Vertical)

Choose one of the following two hypothetical options by clicking once on the chosen option (A or B). For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

| | | |
|---|---|---|
| A. | 55% | £100 |
| B. | 15% | £300 |

Experiment 3: First Contextually Available Attribute (Money) / First Attribute Presentation (Horizontal)

Choose one of the following two hypothetical options by clicking once on the chosen option (A or B). For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

| A. | B. |
|---|---|
| £100 | £300 |
| 55% | 15% |

Experiment 3: First Contextually Available Attribute (Money) / First Attribute Presentation (Vertical)

Choose one of the following two hypothetical options by clicking once on the chosen option (A or B). For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

| | | |
|---|---|---|
| **A.** | £100 | 55% |
| **B.** | £300 | 15% |

## Experiment 4: Introduction

In this decision-making task you will be asked to choose between pairs of hypothetical options. For example:

Choose one of the following two hypothetical options. For each of the options (A and B), the probability (%) represents the chance of winning the amount of money (£).

| | | | | |
|---|---|---|---|---|
| **A.** 30% | £100 | and | 65% | £50 |
| **B.** 35% | £80 | and | 55% | £100 |

## Experiment 4: First Contextually Available Attribute (Probability) / Gambles with Dominant Values Within the First Contextually Available Attribute (Risky)

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 30% | £100 | and | 65% | £50 |
| **B.** 35% | £80 | and | 55% | £100 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 29% | £90 | and | 64% | £40 |
| **B.** 34% | £70 | and | 54% | £90 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 28% | £80 | and | 63% | £30 |
| **B.** 33% | £60 | and | 53% | £80 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 27% | £70 | and | 62% | £20 |
| **B.** 32% | £50 | and | 52% | £70 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 26% | £60 | and | 61% | £10 |
| **B.** 31% | £40 | and | 51% | £60 |

Experiment 4: First Contextually Available Attribute (Probability) / Gambles with Dominant Values Within the First Contextually Available Attribute (Safe)

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 65% | £50 | and | 30% | £100 |
| **B.** 55% | £100 | and | 35% | £80 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 64% | £40 | and | 29% | £90 |
| **B.** 54% | £90 | and | 34% | £70 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 63% | £30 | and | 28% | £80 |
| **B.** 53% | £80 | and | 33% | £60 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 62% | £20 | and | 27% | £70 |
| **B.** 52% | £70 | and | 32% | £50 |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** 61% | £10 | and | 26% | £60 |
| **B.** 51% | £60 | and | 31% | £40 |

Experiment 4: First Contextually Available Attribute (Money) / Gambles with Dominant Values Within the First Contextually Available Attribute (Risky)

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £50 | 65% | and | £100 | 30% |
| **B.** £100 | 55% | and | £80 | 35% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £40 | 64% | and | £90 | 29% |
| **B.** £90 | 54% | and | £70 | 34% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £30 | 63% | and | £80 | 28% |
| **B.** £80 | 53% | and | £60 | 33% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £20 | 62% | and | £70 | 27% |
| **B.** £70 | 52% | and | £50 | 32% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £10 | 61% | and | £60 | 26% |
| **B.** £60 | 51% | and | £40 | 31% |

Experiment 4: First Contextually Available Attribute (Money) / Gambles with Dominant Values Within the First Contextually Available Attribute (Safe)

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £100 | 30% | and | £50 | 65% |
| **B.** £80 | 35% | and | £100 | 55% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £90 | 29% | and | £40 | 64% |
| **B.** £70 | 34% | and | £90 | 54% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £80 | 28% | and | £30 | 63% |
| **B.** £60 | 33% | and | £80 | 53% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £70 | 27% | and | £20 | 62% |
| **B.** £50 | 32% | and | £70 | 52% |

Choose one of the following options (A or B):

| | | | | |
|---|---|---|---|---|
| **A.** £60 | 26% | and | £10 | 61% |
| **B.** £40 | 31% | and | £60 | 51% |

Experiment 5: Scenario

Imagine that you are the owner of a consulting firm, and that you are looking to hire a new programmer to use a computer language called KY. You plan to pay the new programmer between £20,000 and £40,000 per year. Using the information provided below, please state the annual salary that you would pay each of the candidates. Both candidates have a BSc degree in computer science from the same UK university.

Experiment 5: First Contextually Available Attribute (BSc Degree Result) / Candidate Type (Candidate A and Candidate B)

| | **Candidate A** | **Candidate B** |
|---|---|---|
| **BSc degree result:** | 75% | 65% |
| **Experience with KY:** | 40 | 50 |

Please state the annual salary (£) that you would pay Candidate A:

Please state the annual salary (£) that you would pay Candidate B:

Which attribute did you consider to be most important?

- BSc degree result
- Experience with KY

Experiment 5: First Contextually Available Attribute (Experience with KY) / Candidate Type (Candidate A and Candidate B)

| | Candidate A | Candidate B |
|---|---|---|
| **Experience with KY:** | 40 | 50 |
| **BSc degree result:** | 75% | 65% |

Please state the annual salary (£) that you would pay Candidate A:

Please state the annual salary (£) that you would pay Candidate B:

Which attribute did you consider to be most important?

- BSc degree result
- Experience with KY

Experiment 6: First Contextually Available Attribute (Brightness) / Type of TV (TV A and TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for each of the TVs.

| | TV A | TV B |
|---|---|---|
| **Brightness:** | 230cd/m2 | 220cd/m2 |
| **Warranty:** | 24 | 34 |

Please state the amount (£) that you would pay for TV A:

Please state the amount (£) that you would pay for TV B:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 6: First Contextually Available Attribute (Warranty) / Type of TV (TV A and TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for each of the TVs.

| | TV A | TV B |
|---|---|---|
| **Warranty:** | 24 | 34 |
| **Brightness:** | 230cd/m2 | 220cd/m2 |

Please state the amount (£) that you would pay for TV A:

Please state the amount (£) that you would pay for TV B:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 6: First Contextually Available Attribute (Brightness) / Type of TV (Separate Evaluation of TV A)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for the TV.

| | TV |
|---|---|
| **Brightness:** | 230cd/m2 |
| **Warranty:** | 24 |

Please state the amount (£) that you would pay for the TV:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 6: First Contextually Available Attribute (Brightness) / Type of TV (Separate Evaluation of TV B)

Assume that you are shopping for a basic 24” colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for the TV.

| | TV |
|---|---|
| **Brightness:** | 220cd/m2 |
| **Warranty:** | 34 |

Please state the amount (£) that you would pay for the TV:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 6: First Contextually Available Attribute (Warranty) / Type of TV (Separate Evaluation of TV A)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for the TV.

| | **TV** |
|---|---|
| **Warranty:** | 24 |
| **Brightness:** | 230cd/m2 |

Please state the amount (£) that you would pay for the TV:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

<u>Experiment 6: First Contextually Available Attribute (Warranty) / Type of TV (Separate Evaluation of TV B)</u>

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Using the information provided below, please state the amount that you would pay for the TV.

| | **TV** |
|---|---|
| **Warranty:** | 34 |
| **Brightness:** | 220cd/m2 |

Please state the amount (£) that you would pay for the TV:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Ethical Manufacturer TV A and Unethical Manufacturer TV B) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Warranty) / Type of TV (TV A and TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for each of the TVs.

**TV A**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

**TV B**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

| | TV A | TV B |
|---|---|---|
| Warranty: | 24 | 34 |
| Brightness: | 230cd/m2 | 220cd/m2 |

Please state the amount (£) that you would pay for TV A:

Please state the amount (£) that you would pay for TV B:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Unethical Manufacturer TV A and Ethical Manufacturer TV B) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Warranty) / Type of TV (TV A and TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for each of the TVs.

**TV A**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

**TV B**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

| | TV A | TV B |
|---|---|---|
| Warranty: | 24 | 34 |
| Brightness: | 230cd/m2 | 220cd/m2 |

Please state the amount (£) that you would pay for TV A:

Please state the amount (£) that you would pay for TV B:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Ethical Manufacturer TV A and Unethical Manufacturer TV B) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Brightness) / Type of TV (TV A and TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for each of the TVs.

**TV A**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

**TV B**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

| | TV A | TV B |
|---|---|---|
| Brightness: | 230cd/m2 | 220cd/m2 |
| Warranty: | 24 | 34 |

Please state the amount (£) that you would pay for TV A:

Please state the amount (£) that you would pay for TV B:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Unethical Manufacturer TV A and Ethical Manufacturer TV B) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Brightness) / Type of TV (TV A and TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for each of the TVs.

**TV A**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

**TV B**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

| | TV A | TV B |
|---|---|---|
| Brightness: | 230cd/m2 | 220cd/m2 |
| Warranty: | 24 | 34 |

Please state the amount (£) that you would pay for TV A: [ ]

Please state the amount (£) that you would pay for TV B: [ ]

Which attribute did you find more difficult to evaluate?

- ○ Warranty
- ○ Brightness

Which attribute did you consider to be most important?

- ○ Warranty
- ○ Brightness

## Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Ethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Warranty) / Type of TV (Separate Evaluation of TV A)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

| | **TV** |
|---|---|
| **Warranty:** | 24 |
| **Brightness:** | 230cd/m2 |

Please state the amount (£) that you would pay for the TV: [ ]

Which attribute did you find more difficult to evaluate?

- ◯ Warranty
- ◯ Brightness

Which attribute did you consider to be most important?

- ◯ Warranty
- ◯ Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Ethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Warranty) / Type of TV (Separate Evaluation of TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

| | **TV** |
|---|---|
| **Warranty:** | 34 |
| **Brightness:** | 220cd/m2 |
| Please state the amount (£) that you would pay for the TV: | |

Which attribute did you find more difficult to evaluate?

- ◯ Warranty
- ◯ Brightness

Which attribute did you consider to be most important?

- ◯ Warranty
- ◯ Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Ethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Brightness) / Type of TV (Separate Evaluation of TV A)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

| | **TV** |
|---|---|
| **Brightness:** | 230cd/m2 |
| **Warranty:** | 24 |
| Please state the amount (£) that you would pay for the TV: | |

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

## Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Ethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Brightness) / Type of TV (Separate Evaluation of TV B)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which advocates workplace equality, supports an Animal Welfare Charity, and pays for the maintenance of a small park located near its premises.

| | **TV** |
|---|---|
| **Brightness:** | 220cd/m2 |
| **Warranty:** | 34 |
| Please state the amount (£) that you would pay for the TV: | |

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Unethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Warranty) / Type of TV (Separate Evaluation of TV A)

Assume that you are shopping for a basic 24" colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

| | **TV** |
|---|---|
| **Warranty:** | 24 |
| **Brightness:** | 230cd/m2 |
| Please state the amount (£) that you would pay for the TV: | |

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Unethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Warranty) / Type of TV (Separate Evaluation of TV B)

Assume that you are shopping for a basic 24” colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

| | TV |
|---|---|
| **Warranty:** | 34 |
| **Brightness:** | 220cd/m2 |

Please state the amount (£) that you would pay for the TV:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- Warranty
- Brightness

## Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Unethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Brightness) / Type of TV (Separate Evaluation of TV A)

Assume that you are shopping for a basic 24” colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

| | TV |
|---|---|
| **Brightness:** | 230cd/m2 |
| **Warranty:** | 24 |

Please state the amount (£) that you would pay for the TV:

Which attribute did you find more difficult to evaluate?

- Warranty
- Brightness

Which attribute did you consider to be most important?

- ○ Warranty
- ○ Brightness

## Experiment 7: Task-Irrelevant Ethical Attribute: Ethics of the Manufacturer (Unethical Manufacturer) / Task-Relevant First Contextually Available Attribute as Defined in Experiment 6 (Brightness) / Type of TV (Separate Evaluation of TV B)

Assume that you are shopping for a basic 24” colour TV, and that most such TVs cost around £200. Assume that you are shopping in a store where the salespeople know nothing about TVs, and that the tag on the TVs contain two indices, Brightness and Warranty. Brightness reflects how bright the picture is. The warranty rating indicates the length, in months, of the warranty. For both indices, the higher the number, the better. Please state the amount that you would pay for the TV.

**The TV**: this TV was produced by a company which pollutes the environment, pays minimum wage, and refuses to donate to charitable causes.

| | **TV** |
|---|---|
| **Brightness:** | 220cd/m2 |
| **Warranty:** | 34 |
| Please state the amount (£) that you would pay for the TV: | |

Which attribute did you find more difficult to evaluate?

- ○ Warranty
- ○ Brightness

Which attribute did you consider to be most important?

- ○ Warranty
- ○ Brightness