Costs Analysis and the Role of Heuristics in Fairness

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Summary

Although numerous theoretical traditions postulate that human fairness depends on the ratio of costs-to-benefits, theory and empirical data remain divided on the direction of the effect. Particularly, answers to the following questions have remained unclear: how cost/benefit ratios affect people's fairness decision-making during resource allocations, how cost/benefit ratios affect people's emotions and cognition when they receive fair or unfair treatments, whether people are intuitively selfish or fair, and how cost/benefit ratios of sharing affect it. To address these questions, I conducted three lines of studies in Chapters 2 to 4 of this dissertation.

In Chapter 2, I examined how cost/benefit ratios of sharing affect people to make fair or unfair decisions in resource allocations. Results showed that more participants acted fairly when the costs were equal to the benefits as compared to when the costs were higher or lower than the benefits.

Shifting from resource dividers to receivers, in Chapter 3 I tested people's emotional responses and cognitive judgements when they receive fair or unfair treatments at different cost/benefit ratios. My findings revealed that people felt more negative under unfair treatments when the costs were equal to the benefits as compared to when the costs were higher or lower than the benefits.

Findings from Chapter 2 and 3 suggested an even-split heuristic: When the costs were equal to the benefits and thus the even-split was fair, more people tended to make fair decisions, and people felt more negative about receiving an unfair offer. Building on these findings, Chapter 4 tested the even-split heuristic using a fast-slow dual process framework and proposed the Value-Heuristic Framework. Results in Chapter 4 showed that people took the shortest time to make the even-and-fair decision (i.e., the even-split was also fair). I also found that people took longer to make the even-but-not-fair decision (i.e., giving an even-split, which results in uneven payoffs), and the longest time to make the not-even-but-fair decision (i.e., giving an uneven-split that results in even payoffs).

Based upon the overall findings from my three empirical chapters. I formulated a conceptual framework for explaining and predicting people's fairness decision-making.

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This dissertation is submitted to the University of Cambridge for the degree of Doctor of Philosophy

August 2017

To all the people I love and all who love me.

Declaration

This dissertation is the result of my own work and includes nothing, which is the outcome of work done in collaboration except as declared in the Preface and specified in the text.

It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text.

I have made every attempt to reference properly for any idea or finding that is not my own.

This dissertation does not exceed 60,000 words.

Acknowledgements

The 4 years of my PhD study at Cambridge has been the most enjoyable and the most fascinating learning experience of my life. This is primarily because I had the privilege to work with and learn from so many insightful and kind people.

Before I started my PhD, I was curious about the whole world of academia, research and science but was just hanging around by the gate. I'm incredibly fortunate to have my PhD supervisor, Aleksandr Kogan, leading me into the world and guiding me through every step of the exciting yet challenging journey of pursuing scientific truth. Alex always amazes me with his ingenious ability to theorize novel research arguments and extract insights from raw data patterns. Alex is also generous with his time and is devoted to my intellectual, professional, and personal development. Over our dedicated meetings and countless conversations, Alex has taught me how to think, write and speak as a scholar. Alex has also devoted to making the lab a big family for everyone. This gives me strength, and supports me to advance and grow during the difficult times.

I feel truly blessed to have Gillian Sandstrom, Joseph Chancellor, and Max Krasnow as my collaborators. I want to especially thank Gillian Sandstrom. You are not only a great collaborator and an amazing friend, but also a female model that teaches me how to work, collaborate and grow as a female scholar.

Finally, when it comes to family and friends, how can I every over express my gratitude? Thank you, Mom and Dad, for everything. And thank you, my friends over the globe for your love and support. Thank you, Maurice, Antonia, Laurie, Rui, Bryant, and the endless list. I thank you for all the wonders you have brought into my life and for making me who I am today.

Publications

The work described in this dissertation contributed to the following manuscripts:

Li. S., Sandtrom, G. & Kogan, A. (under review) Decision Costs Moderate Fairness Decision Making: A Reverse U-shape Effect*. Social Psychological and Personality Science*

Li. S., Sandtrom, G. & Kogan, A. (under review) Playing Fair vs. Being Fair: The Value-Heuristics Model of Fairness Decision-making. *Journal of Personality and Social Psychology*

Li. S., Kogan, A. & Krasnow, M. (in preparation) Heuristics Matter: Examining Emotions and Cognition Under Fairness Decision Making.

Abstract

Although numerous theoretical traditions postulate that human fairness depends on the ratio of costs-to-benefits, theory and empirical data remain divided on the direction of the effect. Particularly, answers to the following questions have remained unclear: how cost/benefit ratios affect people's fairness decision-making during resource allocations, how cost/benefit ratios affect people's emotions and cognition when they receive fair or unfair treatments, whether people are intuitively selfish or fair, and how cost/benefit ratios of sharing affect it. To address these questions, I conducted three lines of studies in Chapters 2 to 4 of this dissertation.

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Findings from Chapter 2 and 3 suggested an even-split heuristic: When the costs were equal to the benefits and thus the even-split was fair, more people tended to make fair decisions, and people felt more negative about receiving an unfair offer. Building on these findings, Chapter 4 tested the even-split heuristic using a fast-slow dual process framework and proposed the Value-Heuristic Framework. Results in Chapter 4 showed that people took the shortest time to make the even-and-fair decision (i.e., the even-split was also fair). I also found that people took longer to make the even-but-not-fair decision (i.e., giving an even-split, which results in uneven payoffs), and the longest time to make the not-even-but-fair decision (i.e., giving an uneven-split that results in even payoffs).

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Chapter 1 General Introduction

Philosophers, evolutionary theorists, and behavioural scientists alike have long recognized that humans are spectacularly successful in caring about social good and behaving fairly during social interactions (Fehr & Schmidt, 1999; Fehr & Fischbacher, 2003; Henrich et al., 2003). In particular, people resist inequitable outcomes and prefer fair payoffs, sometimes even when the unfair outcomes are in their favour (Dawes et al., 2007; Dawes, 2012; Henrich et al., 2005; 2006; Lavergne and Strobel, 2004; Tricomi et al., 2010). A vast amount of evidence shows that fairness consideration affects people's decision-making in many important areas and across different cultures. In anonymous resource allocation situations, the resource divider frequently offers an egalitarian share (Fehr and Schmidt, 1999). In labor markets, firms are willing to maintain fair wages despite an excess supply of labor (Bewley, 1995; Campbell and Kamlani, 1997). In hunter-gatherer societies, people are found to follow the moral rules of sharing material resources, especially meat fairly (Seabright, 2006; Gurven, 2004).

Given the important role of fairness consideration in human social interactions, understanding fairness has long been the provenance of controversy and a major point of interest for both scientists and the public. Research from biology, economics, philosophy, and psychology alike has generated a vast amount of work on this topic, asking questions about the origins of fairness, the underlying mechanism, the overall ontology, and the downstream consequences of fairness. Within the corpus of research, a major enduring question remains unsettled: What are the factors that encourage humans to act fairly? One long held belief is that fairness decision-making is cost/benefit dependent (Hamilton, 1964; Trivers, 1971). On the one hand, evolutionary biologists and economists have long suggested that people give and share only if the benefits outweigh the costs of this act, and that people are more likely to act fairly when the benefits are high relative to the costs (Andreoni & Miller, 2002; 2008; Hamilton, 1964; Nowak, 2006; Trivers, 1971). On the other hand, emerging perspectives in psychology suggest that people are driven by the simple norm of fairness, and internalize the simple heuristic that "being fair" is the same as "sharing half of what I have" (Güth et al., 2001). When costs are equal to benefits, the even-split heuristic leads to the fair decision naturally. However, in situations where costs differ from benefits, the even-split heuristic is not applicable, so that people may be less likely to make fair decisions. Without the drive of the even-split heuristic, even when costs are lower than benefits, people may still make fewer fair decisions. The aim of my dissertation is to understand how the price of a fair decision affects people's resource allocation strategies and to explore the underlying mechanisms. Specifically, I plan to address this question from three angles: (a) how cost/benefit ratios of sharing affect resource allocation, (b) how cost/benefit ratios of sharing affect resource receivers' emotions and cognition, and (c) what the mechanism that explains the effect of cost/benefit ratios on fairness is.

The subsequent sections of this chapter aim to provide a thorough accounting of theoretical and research basis for the empirical chapters that follow. To that end, I first provide an account of theories about costs and benefits in fairness decision-making. Second, I review the scientific research on how cost/benefit ratios affect receivers' emotions and cognition. Third, I tackle the theoretical perspectives and summarize empirical studies on the mechanisms that explain the effect of cost/benefit ratios on fairness. This chapter will conclude with an overview of the following three empirical chapters of this dissertation (Chapters 2 to 4), which provide substantial answers to the questions I raise.

1.1 An Overlook of the History of Fairness Research

What is fairness? An instinctual answer is to follow the do-as-you-would-be-done-by principle. This definition is appealing as it is interpreted entirely in naturalistic terms. This definition also seems to be applied to our everyday life by us unconsciously when we interact with our peers (Binmore, 1998). However, what we say about our beliefs and motivations often heavily varies from our behaviour. Therefore, we need experiments to discover how we actually split a surplus. Social psychologists have conducted experiments on fairness decision-making and developed the psychological equity theory, which suggests an empirical evidence based law: equalizing the ratio of each person's gain to his worth (Furby 1986; Mellers, 1982; Mellers and Baron 1993; Walster et al., 1978). In particular, the worth is context dependent and various researches have suggested measuring it in terms of social status, merit, effort, and need (Almås et al., 2010). The remaining question is: what the original position that a context is mapped onto is. Rawls (1972) invented the maximin criterion as a reference of the original position. It advocates redistributing fairness can be achieved if we give priority to ensuring that the worst-off members of the society get as much as possible. Although what is fair is not a simple question, a simplified version is that fairness consideration leads to egalitarian outcomes without any side claiming any special privilege. This definition will be used throughout arguments and discussion in this dissertation.

Research on fairness has been remarkable in its pervasiveness. Research from evolutionary, psychology, economics, and related disciplines has generated a vast amount of work on the topic from different perspective (Henrich 2004; Nowak & Sigmund 2005; Trivers 1971, 1972; Nowak 2006; Fehr, Bernhard, and Rockenbach, 2008; Almås et al., 2010). Evolutionary biologists tackle questions from the ultimate cause of fairness to the proximate mechanisms (Axelrod 2006; Fehr & Fischbacher 2003; Hamilton 1964; Hardy & Van Vugt 2006; Henrich 2004; Nowak & Sigmund 2005; Rand et al. 2009; Sober & Wilson 1998; Trivers 1971, 1972). Based on evolutionary theories, research points to the survival benefits of fairness through mechanisms like kin selection, tit-for-tat, reciprocal fairness, reputation-seeking, altruistic punishment and group selection (Nowak 2006). Consistent with the argument that evolutionary fitness is the ultimate cause of fairness, growing evidence has documented that fair strategies generate more personal benefits than selfish strategies (Nowak, Page, Sigmund, 2000; Rand et al., 2013). Concerning the proximate mechanisms, two major theoretical approaches have sought to explain why fairness is widely observed in anonymous interactions both in daily life and in experiments (Henrich et al., 2010). The first approach proposes that humans possess heuristics calibrated to kin or acquaintance interactions in the small-scale societies and argues that these heuristics are mistakenly extended to non-kin and ephemeral interactants. For example, natural selection can favor fairness among kinship because it benefits the related genes. Similarly, it can provide fitness benefits if individuals interact repeatedly and return the benefits after receiving them in the first place. Supporting this view, prosocial and fair behaviours observed in experiments directly reflect the operation of these ancient heuristics (Burnham et al., 2005; Nowak, 2006). An alternative approach proposes that the development of new social norms is crucial to maintaining fairness, especially in the rise of more complex societies (North, 1990). It is these particular norms and their gradual internalization to serve as proximate motivations that recalibrate our innate psychology for life in small-scale societies in a manner that permits successful larger scale cooperation and exchange

(Fehr and Camerer, 2007). Empirical evidence shows that social norms for enforcing fairness are sustained through mechanisms like punishment, signalling, and reputation-seeking (Panchanathan and Boyd, 2003; Gintis et al., 2001; Henrich and Boyd, 2001; Sigmund et al., 2001). For example, altruistic punishment illustrates that people are willing to punish others at a cost to themselves to prevent unfair outcomes or to sanction unfair behaviours. This motivates people to act fairly to avoid the punishment. In addition, people are encouraged to act fairly to establish a good reputation and be rewarded by others. Many studies show that people tend to act fairly when others can learn about their behaviours or hear about them (gossip, reputation, etc., Dunbar, 2004).

Studies within developmental psychology have long been interested in the ontogenetic development of fairness: How inequality acceptance develops at different ages (Fehr, Bernhard, and Rockenbach, 2008; Almås et al., 2010). Inequality aversion – a type of other-regarding preferences – is important for large-scale cooperation and fair interactions with genetic strangers. Research on the developmental roots of it shows that young children's inequality aversion develops strongly between the ages of 3 and 8. At age 3–4, the overwhelming majority of children behave selfishly, whereas most children at age 7–8 prefer resource allocations that are equal (Fehr, Bernhard, and Rockenbach, 2008). The above research studied fairness in a situation where fairness required equality. Further research aimed to capture more realistic situations where people considered individual achievements, luck, and efficiency and to understand the nature and development of people's fairness preferences in a broader sense. They found that as children enter adolescence, they increasingly view inequalities reflecting differences in individual achievements, but not luck, as fair, whereas efficiency considerations mainly play a role in late adolescence (Almås et al., 2010). These results indicate that human egalitarianism has deep developmental roots.

Behavioral economists have sought explanations for why people would behave fairly with costs occurring to the self by re-evaluating utility as a function of both material payoffs and a social concern on equality (Fehr and Schmidt, 1999; Loewenstein, Thompson, and Bazerman, 1998). Loewenstein, Thompson, and Bazerman (1998) provided strong evidence for the importance of relative payoffs. They asked subjects to rank outcomes that differed in the distribution of payoffs between the subject and a comparison person. On the basis of these ordinal rankings, the authors estimated how relative material payoffs entered the person's utility function. The results showed that subjects exhibited a strong and robust aversion against disadvantageous inequality: For a given own income xi, subjects ranked outcomes in which a comparison person earned more than xi substantially lower than an outcome with equal material payoffs. Many subjects also exhibited an aversion to advantageous inequality where they received more than the fair amount. This effect seems to be significantly weaker than the aversion to disadvantageous inequality though.

Studies within social psychology have long grappled with effects of individual differences and contextual factors on fairness decision-making (Keltner et al., 2014). For example, individual differences such as empathy, perspective-taking, and belief in a just world were found to be positively correlated with a fair action (Page & Nowak, 2002). Feature of the recipient, such as being female (as opposed to being male), lower social status, and higher attractiveness were found to positively associate with being treated more generously and fairly (Solnick & Schweitzer, 1999). Besides, higher perceived self-other similarity and increased religious conviction also contribute to a higher tendency of acting fairly (Woods & Ironson, 1999). This empirical evidence suggests that factors across the intrapsychic, dyadic, group, and sociocultural levels influence fairness decision-making.

1.2 Cost and Benefit in Fairness

1.2.1 The Evolutionary and Economic Perspective

Within the corpus of research on fairness, there is an emerging line of inquiry, which examines the effect of cost/benefit ratios on fairness. The classic remark by J. B. S. Haldane, "I will jump into the river to save two brothers or eight cousins," became known as Hamilton's rule (1964), which described the logic under which an individual should, at a cost to the self, provide benefits to other people only when the coefficient of relatedness exceeds the cost/benefit ratio of the prosocial act. Hamilton's rule was initially applied to explaining kin altruism, emphasizing fitness benefits for genetically related others. Concerning non-kin altruism, direct reciprocity, indirect reciprocity, and altruistic punishment provide channels through which return benefits could come (Fehr & Henrich, 2003; Gintis et al., 2000; Richerson et al., 2003; Gurven, 2004). Direct reciprocity was formalized by Trivers (1971) to solve the puzzle why people provide costly benefits to individuals who are not closely related to them. It assumes that there are repeated encounters between the same two individuals and says that an individual gives back in the later interaction if he has received a kind treatment from the other. Direct reciprocity can lead to the evolution of fairness only if the probability of another encounter between the same two individuals exceeds the cost/benefit ratio of the altruistic act (Nowak, 2006). Direct reciprocity explains altruistic acts in direct personal interactions. In situations where there is no possibility for a direct reciprocation, such as helping strangers who are in need or donating to charities, indirect reciprocity explains helping behaviors. People learn a great deal about other's cooperative tendencies by observing them in interactions and from hearing what others say about them (gossip, reputation, etc., Dunbar, 2004), so that helping someone establish a good reputation and will be rewarded by others. Indirect reciprocity can only promote fairness if the probability of knowing someone's reputation exceeds the cost-to-benefit ratio of the altruistic act (Nowak, 2006).

The above approaches demonstrate how benefits can be returned after a costly giving act. Hamilton's rule is one of the first formal treatments in an evolutionary context that describes when and why individuals should give benefits to another. Following Hamilton's rule, it is expected that the higher the cost of help is, the less help given. Empirical research from varied disciplines provides evidence that is in line with this deduction. Psychologists from 1970s have found that people in a hurry to reach their destination (i.e., high time cost) were more likely to pass by a shabbily dressed person slumped by the side of the road without stopping (Darley and Batson, 1973). A study that directly examined Hamilton's rule found that as the cost of help rose, the share of help fell. In this study, help was divided into three categories by the cost: Low-cost help was represented by a single item (emotional support); medium-cost help was represented by five items (help during an illness, help during a crisis, help with everyday living, help with housing, and financial help); and high-cost help was represented by a hypothetical question about the willingness to donate a kidney and the willingness to risk injury or death providing life-saving help in an emergency. Results showed that non-kin (e.g. friends and acquaintances) received a smaller share of medium- than low-cost help, and a smaller share of high- than medium-cost help (Stewart-Williams , 2007). To examine the effect of cost/benefit ratios on giving behaviour in a quantitative manner, researchers have used a simple modification to the standard dictator game (Almås et al., 2010; Andreoni, Brown, &Vesterlund, 2002; Andreoni & Miller, 2002; 2008; Andreoni & Vesterlund, 2001). In the dictator game, one person decides how to split money between himself and another player. In studies with cost benefit manipulations (Andreoni & Miller, 2002), participants played a game in which the cost to benefit ratios of giving varied. Across studies using this modified dictator game paradigm, people tended to give less money, on average, as costs increased (Almås et al., 2010; Andreoni, Brown, &Vesterlund, 2002; Andreoni & Miller, 2002; 2008; Andreoni & Vesterlund, 2001). Thus, extant research suggests that humans become less generous when the cost to the self is greater than the benefit to the recipient—a finding in line with classic evolutionary and economic thinking.

1.2.2 The Egalitarian Perspective

Although findings from past studies provide support for the notion that high costs-to-benefits inhibit fair behaviour, inequality aversion theory provides the alternative hypothesis. Human resistance to inequitable outcomes is known as inequality aversion. Inequality aversion is widely thought to be instrumental to fair decisions in social interactions. Inequality aversion has been shown to develop strongly between the ages of 3 and 8. At age 3–4, the overwhelming majority of children behave selfishly, whereas most children at age 7–8 prefer fair allocations than advantageous or disadvantageous unequal allocations (Fehr, Bernhard, and Rockenbach, 2008). At the neural level, there is substantial computational and neuroimaging evidence connecting such preferences to activity in brain regions known to receive abundant dopaminergic projections (Weinberger, Berman, and Chase, 1988; Haber and Knutson, 2010) in ways that are consistent with reward-encoding and reinforcement properties (Behrens, Hunt, and Rushworth, 2009; King-Casas et al., 2005). Saez and colleagues (2015) used the dictator game with modified cost/benefit ratios to examine the effect of cost/benefit ratios on inequality aversion. Inequality was defined as the absolute difference in payoffs between the self and the other. They found that average inequality was lowest at the 1/1 cost/benefit ratio, when the cost of giving and the benefit to the recipient were equal compared to both the high and low cost/benefit ratios. This result indicates that lower cost relative to benefit is not as efficient as equal cost relative to benefit in terms of maintaining fairness and equal payoffs.

The above study provides contrasting evidence to Hamilton's rule and the deduction that high cost/benefit ratios inhibit fair decisions. In Chapter 2, I focus primarily on how cost/benefit ratios affect resource dividers' selfish and fair decisions.

1.2.3 The Resource Receiver's Angle

The above literature summarises the effect of cost benefit on resource dividers' fairness decision-making. Altruistic punishment—the action that receivers punish unfair resource dividers at a cost—has been considered the main pathway to maintain fairness. However, the question how the cost and benefit affects receiver's response to fair and unfair treatment still remains unexamined. Classic economic and evolutionary theories predict that, when being fair is cheap, there is little excuse not to be fair so that fairness violations lead to the most negative responses. Emerging psychological theories, however, emphasize that people internalize the even-split fairness norm. The even-split fairness norm states that the even-split is also the fair split when the cost of sharing equals to the benefit of sharing and is commonly applied in resource allocation situations. Based on this, psychologists argue that the violation of the even-split fairness triggers more negative responses compared to the violation of fairness norms in general, even when fairness is cheap or easy.

To test how varying levels of cost/benefit ratios impact people's responses to fairness violations, I plan to utilize a resource allocation paradigm and measure both the emotional response and the cognitive representations of receivers following offers from resource deciders at different cost/benefit ratios.

1.2.4 Proposing the Values-Heuristics Framework

The above literature demonstrates effects of costs and benefits on fairness in resource allocation from both the resource divider's and the receiver's perspective. Yet what remains unclear is the underlying mechanism for fairness: Are people predisposed toward acting fairly, or are they intuitively selfish, behaving fairly only through reflection and self-control, and how costs and benefits interplay with the fast-slow dual system? Unfortunately, empirical data—often using reaction time as proxy for innateness—has provided conflicting answers, suggesting the reality is more complex (Piovesan & Wengström, 2009; Rubinstein, 2007; Cornelissen et al., 2012; Gospic et al., 2011; Rubinstein, 2007; Schulz et al., 2012; Sutter et al., 2003). Here, I propose the Value-Heuristic Framework (VHF), which predicts a fast decision (intuitive) when (fair or selfish) values are congruent with their corresponding heuristics, and a slow decision (contemplative) when values and heuristics are mismatched. The cost/benefit manipulation creates the condition where heuristics disagree with values. In chapter 4 of this dissertation, I detail the Values-Heuristics Framework (VHF) to explain the cognitive underpinnings of fairness decision-making. The VHF aims to provide a theoretical framework that can reconcile previous conflicting results in fairness decision-making.

In summary, my dissertation aims to understand three questions: how costs and benefits affect resource dividers' decisions and resource receivers' emotions and cognition, and whether acting fairly is intuitive or contemplative and how costs and benefits interplay with the fast-slow dual system. I plan to address these questions primarily using modified economic games. A simple modification to the cost-benefit ratios of the standard dictator game allows us to examine resource dividers' decisions and resource receivers' responses at varied cost/benefit ratios, and the temporal dynamics of fair decisions when values and heuristics are consistent or inconsistent. In addressing these questions, I aim to build towards a new theoretical framework, which can then be used to (a) reconcile past findings in the literature and (b) make predictions about the effect of cost benefit on people's fairness decision-making.

1.3 General Overview

The following chapters (Chapters 2 to 5) will describe the empirical work I conducted to examine the above questions. Chapter 2 discusses three studies to demonstrate that cost/benefit ratios have a complex effect on human fairness. Rather than simply boosting fairness when benefits are high relative to costs or impeding fairness when costs are high relative to benefits, Drawing on the even-split heuristic, I propose that cost/benefit ratios will have a reverse U-shaped effect on resource allocation strategies. When costs are higher than benefits, I concur that individuals are less likely to act fairly. In contrast, when costs are lower than benefits, individuals are also less likely to act fairly. My findings shed new light on human fairness decisions by reconciling two formerly competing perspectives.

In Chapter 3, I aim to understand what emotional responses and cognitive judgments people form when they receive fair vs. unfair treatment. In particular, I planned to test emotional responses and cognitive judgments following violations of fairness at varied cost/benefit ratios. Based on the inequality aversion theory, I expect to observe a higher positive emotional response when people receive the fair offer compared to when they receive the less-than-fair offer, or even the more-than-fair offer. For cognitive judgments, however, people might follow the calculation logic "the more you give, the better you are" and give a higher judgment cognitively when they received more money. In addition, due to the existence of the even-split heuristic, I expected to see both emotional and cognitive responses elevated following violation of the even-split heuristic compared to violation of uneven-split fairness. Through this approach, I provide insights to understand how costs and benefits affect receivers' emotions and cognition.

In Chapter 4, I propose the Value-Heuristic Framework (VHF), which predicts a fast decision (intuitive) when values are congruent with their corresponding heuristics (i.e., when costs are equal to benefits), and a slow decision (contemplative) when values and heuristics are mismatched (i.e., when costs are not equal to benefits). I tested the VHF hypotheses through 7 reaction time experiments, varying the features of the standard dictator game. Across these studies, I found strong evidence supporting the hypotheses derived from the VHF: people act fast when values and heuristics match, and slow when they do not. Furthermore, my results are robust for givers and receivers, numerous different operationalisations of need, and several methodological approaches. Collectively, my findings reconcile the conflicting results found in previous research, and provide a new dual-process framework for understanding fairness decision-making.

Building upon the insights of the above four chapters, in Chapter 5, I will formulate a conceptual framework that explains people's fair acts and the underlying mechanisms. Before concluding, I also will suggest future directions and an integrative understanding of the effect of costs and benefits on fairness decision-making.

Chapter 2 Decision Costs Moderate Fairness: Higher Costs Reduce Fairness But Lower Costs Don't Increase Fairness

2.1 Introduction

Philosophers, theologians, and behavioural scientists alike have long recognized that fairness is a vital glue of interpersonal interaction and societal functioning (De Waal, 2008; Nowak, Page & Sigmund, 2000). The factors that encourage humans to act fairly have long been discussed, and a widely believed idea is that fairness is cost/benefit dependent (Hamilton, 1964; Trivers, 1971, Nowak, 2006). Hamilton's rule is one of the earliest theories that try to capture this relationship. It proposes that an altruistic act happens only when it produces benefits, in terms of increased feelings of relatedness between the actor and the receiver, that outweigh the costs. Empirical studies have found that as the cost in time, effort, or money rises, the share of help falls (Stewart-Williams , 2007; Andreoni & Miller, 2002; 2008; also see Chapter 1, 1.2.1).

Hamilton's rule and its implications are based on a calculative approach and assume that an increase in costs relative to benefits always inhibits fair behaviour. This approach, however, largely ignores the effect of social norms and heuristics. Inequality aversion – the resistance to inequalities, and a concern for others – is widely thought to be instrumental to fair interactions in large-scale human societies. Given that in most resource sharing and allocation interactions the costs to the self are often equal to benefits to others, many people internalize the simple heuristic that "being fair" is the same as "sharing half of what I have". Evidence from multiple studies has emerged to support this even-split heuristic theory. For example, one study has found that when people make decisions about how to allocate resources from a common resource pool to members of their group, almost all group members first anchor their sharing choices on an "even-split" heuristic (Roch et al., 2000). In another study, people playing an ultimatum game were given a choice between a) a clearly unfair option (keep 17 and give 3), and b) one of three relatively fair options - either an exact even-split (keep 10 and give 10) or a nearly even-split (keep 11 and give 9, or keep 9 and give 11; Guth, Huck & Muller, 2001). Although all of these options are much fairer than the unfair option, people chose the exact even-split option far more often than either of the nearly even-split options, suggesting the strength of the even-split heuristic as an indicator of fairness.

In summary, the even-split heuristic theory and Hamilton's rule make contrasting predictions about the effect of costs and benefits on people's fairness decision-making in resource allocation. When the cost is lower than the benefit, Hamilton's rule predicts that people should act more fairly, but the even-split heuristic theory (and the results from Guth, Huck & Muller, 2001) suggests that the drive of the even-split heuristic may even supersede the weighing of costs and benefits, and thus people will act less fairly. I propose a modified version of the dictator game to examine this question and resolve the conflict between the two theories.

2.1.1 Experimental Manipulation of Fairness

Empirical evidence for testing claims about fairness often comes from experiments using the dictator game (Camerer, 2003). In the dictator game, one person (e.g., Dictator Dana) decides how to split money (usually tokenized as monetary units - MUs) between themselves and another player. The dictator role is randomly assigned, preventing any player from claiming any special privilege (other than the benefit of chance). Dana's decision is final: Once made, both players receive their allocated sums and the game ends. In this experimental paradigm, selfish, fair, and altruistic decisions are readily identifiable: Dana can keep all the money (i.e., a selfish/rational decision), they can split it between themselves and their partner (an even-split is a fair decision), or they can give their partner more than they take themselves, up to and including the entire amount (i.e., an altruistic decision). Furthermore, granting Dana and their partner anonymity and limiting the game to a single round minimizes the impact of outside social influences (e.g., fear of punishment or expectations of reciprocity).

A simple modification to the standard dictator game allows researchers to examine the effect of cost/benefit ratios on prosocial behaviour. For example, in one study, participants played a game in which the cost/benefit ratios varied from 3/1 to 1/4 (Andreoni & Miller, 2002). In the 3/1 condition, the dictator received $3 for every 1 unit they kept, whereas the recipient received $1 for every 1 unit they were given. Analogously, in the 1/4 condition, the dictator received $1 for every 1 unit they kept, whereas the recipient received $4 for every 1 unit they were given. Across studies using this modified dictator game paradigm, consistent with Hamilton's rule, people tend to give less money, on average, as cost/benefit ratios increase (Andreoni & Vesterlund, 2001; Andreoni & Miller, 2002; 2008; Andreoni, Brown, &Vesterlund, 2002; Almås et al., 2010).

However, using a similar modified dictator game with cost/benefit ratios varying from 1/3 to 3/1, Saez and colleagues (2015) drew a different conclusion on the relationship between cost/benefit ratios and fairness decisions. They focused on inequality aversion, operationalizing inequity as the absolute difference between self and other payoffs. They found that inequity was lowest at the 1/1 cost/benefit ratio, when the cost of giving was equal to the benefit to the recipient; inequity was higher when the cost/benefit ratios were either high or low. Consistent with the even-split heuristic theory, this result indicates that lower cost/benefit ratios (e.g., 1/3, 1/2) are not as efficient as an equal cost/benefit ratio (i.e., 1/1) in terms of maintaining fairness and equal payoffs.

2.1.2 A Direct Examination of Cost/Benefit Ratios on Fairness Decision-Making

In reviewing existing experiments, I find that researchers have tested the effect of cost/benefit ratios on the average donation amount (Andreoni & Miller, 2002; 2008; Andreoni, Brown, &Vesterlund, 2002; Andreoni & Vesterlund, 2001), or on the difference in payoffs between the self and the other (Saez et al., 2005). However, the average donation is not a direct way to measure fairness; the average of one person who gave nothing and one person who gave everything looks the same as the average of two people who both gave fairly. Examining the difference in payoffs also has issues, since its range varies across different cost/benefit ratio conditions. For example, sharing x units, the absolute payoff difference is 4x for both the 1/3 and the 3/1 cost/benefit ratio condition, whereas the absolute payoff difference is 2x in the 1/1 cost/benefit ratio condition. This asymmetry makes it easier to observe a larger difference in payoffs in the high or low cost/benefit ratio conditions than in the 1/1 cost/benefit ratio condition. In the current work, I propose a direct analytical approach to examine the effect of cost/benefit ratios on fairness without the issue of range difference.

A careful examination of prior dictator game results suggests that dictators, rather than making a single decision along a continuum (e.g., "How much should I give?), are largely selecting from a smaller number of discrete options (e.g., "Should I keep it all?", "Should I be fair?", and, sometimes, "Should I give it all?"). For example, a recent meta-analysis of dictator game studies has highlighted that the two most popular response options, by a wide margin, are giving exactly half and giving nothing (Engel, 2011). Specifically, across 328 dictator game studies (N = 20,813), 17% gave exactly half, and 36% of people gave nothing at all. Furthermore, because the definition of a fair choice changes when researchers manipulate cost/benefit ratios (as is done in some of the studies included in this meta-analysis), 17% likely underestimates the number of decisions participants actually intended to be fair: calculation difficulties may have made it more difficult for participants to identify the amount to give that would result in a fair outcome (e.g., compensating for a high cost/benefit ratio by giving more).

Building upon these findings, I propose a discrete framework in which participants' decisions are viewed as corresponding to fair (i.e., give the exact amount necessary to equalize payoffs), less-than-fair (relatively selfish decisions), or more-than-fair strategies (relatively altruistic decisions). Drawing on the discrete framework, I propose an inverse U-shaped effect of cost/benefit ratios on fair decision-making (see Figure 2.1). Following Hamilton's rule, as costs rise relative to benefits, fewer people will choose to give fairly. As costs drop relative to benefits, Hamilton's rule predicts that more people will choose to act fairly. However, I hypothesize instead, in line with the even-split heuristic theory, that a low (lower than 1/1) cost/benefit ratio will attract fewer people to act fairly compared to the 1/1 cost/benefit ratio condition, because the even-split heuristic outweighs the calculation of costs relative to benefits.

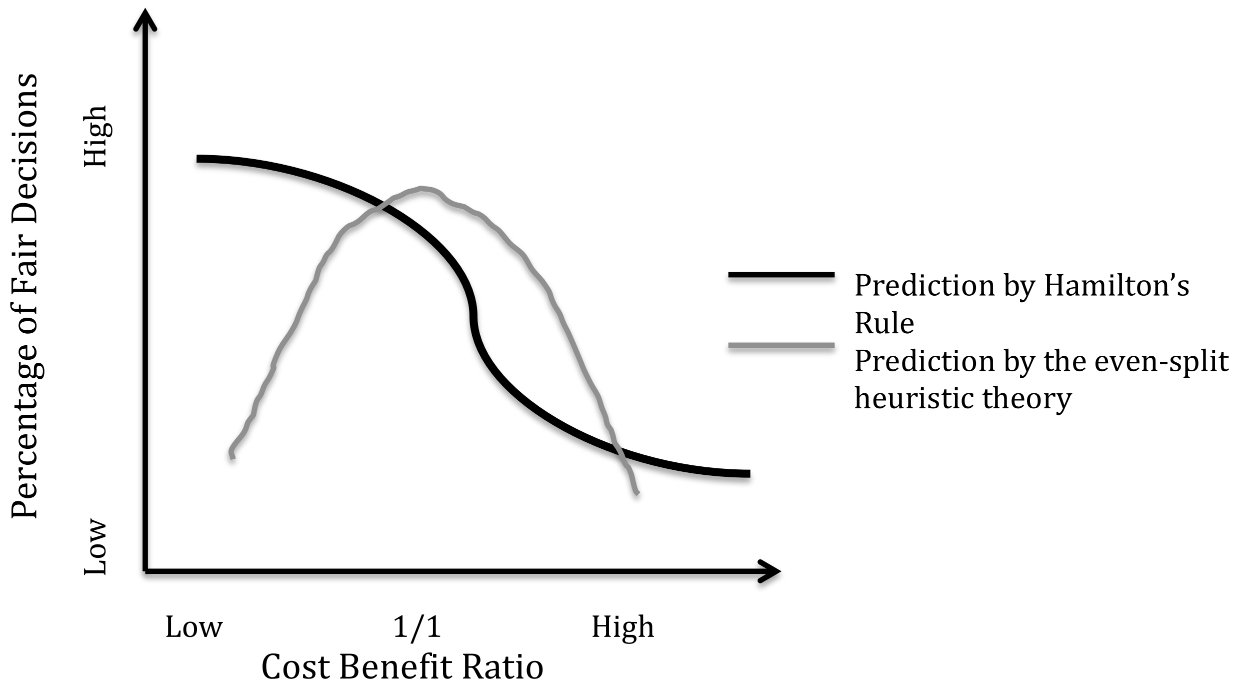

Figure 2.1. Predictions of the percentage of fair decisions at different cost/benefit ratios.

2.1.3 Present Studies

To test these hypotheses, I ran two studies with a modified dictator game that varied cost/benefit ratios. In Study 1, I examined the effect of low (1/3), control (1/1) and high (3/1) cost/benefit ratios on the frequency of fair, less-than-fair and more-than-fair decisions. In Study 2, I replicated Study 1 with a wider range of cost/benefit ratios (from 1/9 to 9/1).

2.2 Studies 1A and 1B: Categorical Cost/Benefit Ratios

I conducted two identical studies using a modified anonymous dictator game to test how differences in cost/benefit ratios affect people's proclivity to act fairly. My aims were to detect the hypothesized inverse U-shaped effect in Study 1A and replicate the effect in Study 1B.

2.2.1 Methods

Participants. I recruited 600 participants (I didn't collect age and gender information) from the United States through Amazon Mechanical Turk (AMT) in Study 1A, and another 600 participants (M_{Age} = 35, *SD* = 12; 62% female) in Study 1B to complete an online study. Sample sizes were selected by assuming a small to moderate effect size (Cohen's $d = .2$) and aiming to have 95% power to detect the effect. For the data analysis, I included 555 participants from Study 1A, and 573 from Study 1B who finished the whole experiment. At par with standard AMT wages, each participant was given a US $0.60 fee for participating. Participants were told that they would earn more money based on their decision in an economic task—an anonymous dictator game.

Materials and Procedure. The modified dictator game had three conditions: (a) a control condition with a 1/1 cost/benefit ratio (i.e., donations are unaltered), (b) a low (1/3) cost/benefit ratio condition (i.e., donations are tripled), and (c) a high (3/1) cost/benefit ratio condition (i.e., donations are divided by 3). At the beginning of the game, each dictator was endowed with 100 money units (MUs) while the recipient was given 0 MUs. In the control condition, an equal 50% split is considered a fair decision. However, in the low cost/benefit ratio condition the dictator can equalize outcomes by giving 25 MUs, so that both parties receive 75 MUs. Similarly, in the high cost/benefit ratio condition, the fairest outcome is to give 75 MUs, so that both parties end up with 25 MUs.

All participants were ostensibly randomly assigned to the dictator role, and were randomly assigned to one of the three cost/benefit conditions. I instructed the participants that, as the dictator, they had been endowed with 100 MUs and the recipient had been given 0 MUs. Participants were then asked to choose how much they wanted to share with their partner, and to input this sharing amount (x) into a textbox. The corresponding payoffs for him-/herself (i.e., 100-x) and the receiver (i.e., 3x in the low cost/benefit ratio condition, x in the 1/1 cost/benefit ratio condition, and x/3 in the high cost/benefit ratio condition) were computed as they typed, and presented on the screen before they confirmed their decision. Once the study was complete, payoffs were calculated by translating two MUs into one cent, and bonuses were paid through AMT.

2.2.2 Results

Frequency of Fair Decisions. I first counted how many people made each kind of decision. I found that 32% of participants in Study 1A and 39% in Study 1B made a fair decision (i.e., giving 50 MUs in the control cost/benefit ratio condition, giving 25 MUs in the low cost/benefit ratio condition, and giving 75 MUs in the high cost/benefit ratio condition), 61% of participants in Study 1A and 54% in Study 1B made a less-than-fair decision, and in both Study 1A and Study 1B 7% made a more-than-fair decision.

Cost/Benefit Ratios. I began my analyses by using logistic regression to predict the percentage of fair (or less-than-fair, more-than-fair) decisions (dummy-coded as 1; all other decisions dummy-coded as 0) from two dummy-coded cost/benefit ratio condition variables: {1,0} in the low cost/benefit ratio condition; {0,1} in the high cost/benefit ratio condition; {0,0} in the control condition. This method was applied to all decision percentage analyses in this manuscript.

In both studies, consistent with Hamilton's rule, analyses confirmed that a lower percentage of participants acted fairly in the high cost/benefit ratio condition than in the control or the low cost/benefit ratio conditions in both Study 1A and Study 1B (Table 2.1, Figure 2.2). However, Hamilton's rule would predict more fair decisions in the low cost/benefit ratio condition compared to the control condition. Contradicting this, and consistent with the even-split heuristic theory, I instead found no significant difference in the percentage of fair decisions between the control and the low cost/benefit ratio conditions in Study 1A, and indeed a lower percentage of fair decisions in the low cost/benefit ratio condition compared to the control condition in Study 1B. These results depict the effect of cost/benefit ratios on fair decisions to be an inverse U-shape: fair decisions are less frequent both when the cost is higher or lower than the benefit, compared to when the cost is equal to the benefit.

Complementing the results for fair decisions, compared to participants in the control condition, participants made more less-than-fair decisions (i.e., the relatively selfish decision compared to the fair decision) in the high cost/benefit ratio condition, and fewer less-than-fair decisions in the low cost/benefit ratio condition (in Study 1A; the difference was not significant in Study 1B; Table 2.1, Figure 2.2). This suggests that as costs rise relative to benefits, people shift away from fairness, and towards selfishness. However, as costs decline, people do not necessarily become less selfish (Study 1B). Even when they do (Study 1A), a comparison of effect sizes[1] shows that the effect of low costs shifting people away from selfishness is not as strong as the effect of high costs driving people towards selfishness, suggesting a loss aversion effect.

[1] The effect size comparison analysis followed this method: https://stats.stackexchange.com/questions/77269/statistical-comparison-of-2-independent-cohens-ds

Finally, I found a higher percentage of participants made more-than-fair decisions in the low cost/benefit ratio condition than in the control or the high cost/benefit ratio conditions in both Study 1A and Study 1B (Table 2.1, Figure 2.2). Thus, when costs are low relative to benefits, people are more inclined to act generously. In contrast, there was no significant difference in the percentage of more-than-fair decisions in the control condition compared to the high cost/benefit ratio condition in Study 1A or Study 1B, possibly due to a floor effect.

Table 2.1. Logistic regressions predicting percentage of each type of decision in Studies 1A and 1B

	Study 1A			Study 1B		
	B *(β) p-value*	SE	95% CI	B *(β) p-value*	SE	95% CI
Odds of Fair Decision						
Low (1/3) vs. Control (1/1)	.042 (.042) 0.843	0.211	-.371, .455	-.423 (-.410)*	0.204	-.825, -.024
High (3/1) vs. Control (1/1)	-2.118 (-2.154)***	0.301	-2.738, -1.553	-2.470 (-2.365)***	0.282	-3.048, -1.938
High (3/1) vs. Low (1/3)	-2.160 (-2.196)***	0.301	-2.780, -1.594	-2.047 (-1.961)***	0.282	-2.624, -1.514
Odds of Less-than-fair Decision						
Low (1/3) vs. Control (1/1)	-.644 (-.618)**	0.212	-1.063, -.230	-.107 (-.101) 0.61	0.21	-.519, .304
High (3/1) vs. Control (1/1)	1.707 (1.652)***	0.261	1.208, 2.234	2.506 (2.347)***	0.274	1.986, 3.066
High (3/1) vs. Low (1/3)	2.351 (2.276)***	0.263	1.849, 2.884	2.613 (2.448)***	0.276	2.090, 3.176
Odds of More-than-Fair Decision						
Low (1/3) vs. Control (1/1)	2.223 (3.863)***	0.543	1.269, 3.452	1.680 (3.081)***	0.431	.892, 2.606
High (3/1) vs. Control (1/1)	.811 (1.422) 0.184	0.61	-.330, 2.131	-1.215 (-2.201) 0.133	0.808	-3.128, .220
High (3/1) vs. Low (1/3)	-1.412 (-2.477)***	0.394	-2.242, -.678	-2.895 (-5.245)***	0.737	-4.725, -1.681

Note: Betas in this table represents the odds ratio difference rather than the direct percentage difference. Similarly, the statistical parameters in the other logistic regression model (Tables 2.2-2.4) are also based on odds ratios.

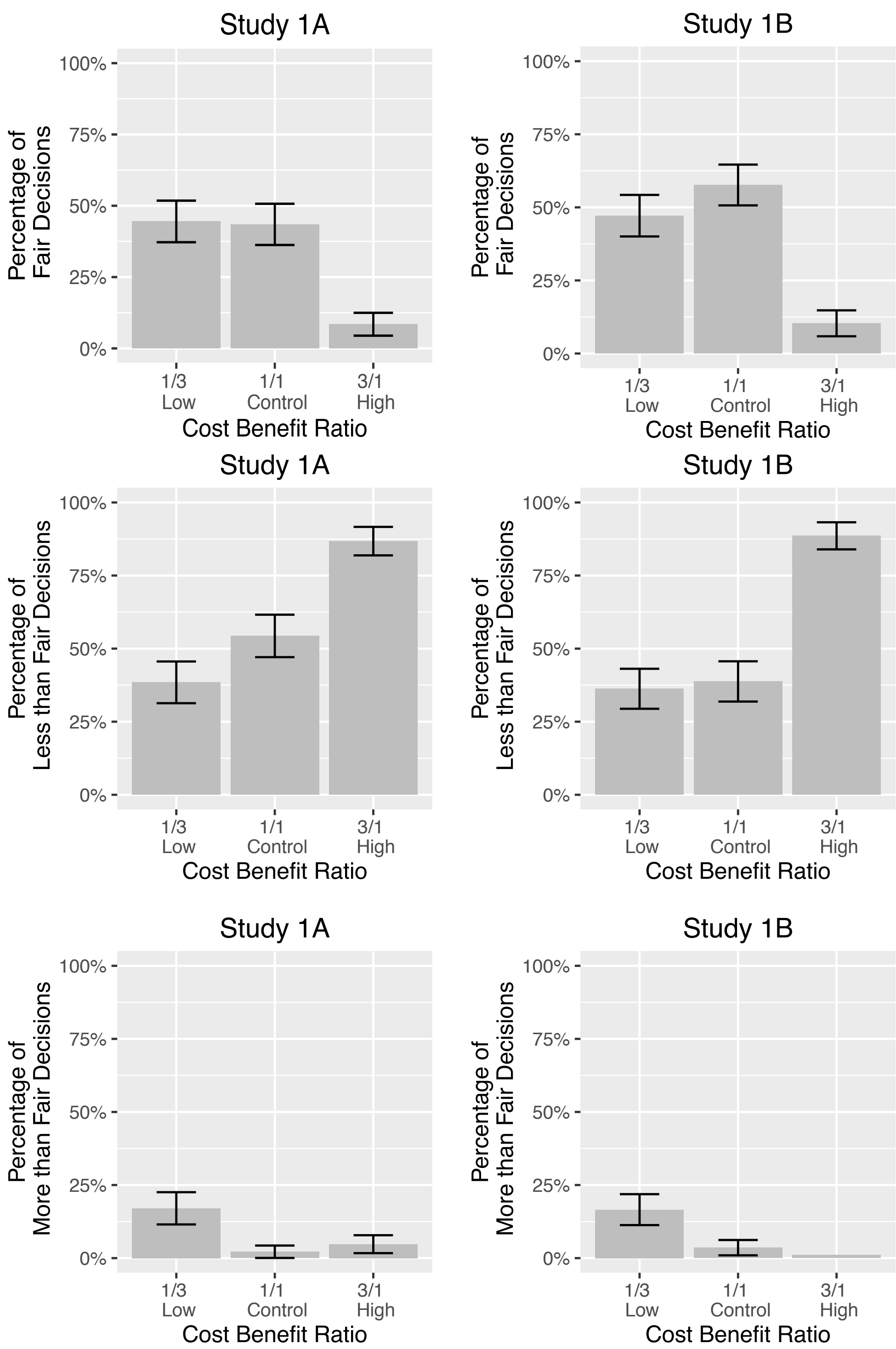

Figure 2.2. Percentage of each type of decision by cost/benefit condition in Study 1A and Study 1B. Error bars represent 95% confidence intervals.

2.3 Study 2: Continuous Cost/Benefit Ratios

The results show that higher costs relative to benefits lead to fewer fair decisions and more less-than-fair decisions, but lower costs relative to benefits do not lead to more fair decisions or fewer less-than-fair decisions. However, I only compared people's decision-making among a limited number of cost/benefit ratio conditions. In Study 2, I expanded the cost/benefit ratio conditions so that the cost/benefit ratio became a continuous variable. In this way, I could understand the general pattern of the effect more broadly and observe more subtle differences. I used a similar modified dictator game with 17 cost/benefit conditions to explore how people make fair decisions in a wider range of situations.

2.3.1 Methods

Participants. 1700 participants (M_{Age} = 34, *SD* = 10; 40% female) were recruited from AMT and were paid US $0.60 to participate online. For the data analysis, I included the 1688 participants who finished the whole experiment.

Materials and Procedure. The dictator game was similar to that in Study 1A and Study 1B. The difference was that Study 2 had 17 conditions: a control condition with a 1/1 cost/benefit ratio; 8 low cost/benefit ratio conditions with the ratio varying from 1/9, 1/8, 1/7… to 1/2; and 8 high cost/benefit ratio conditions with the ratio varying from 2/1, 3/1, 4/1… to 9/1. Dictators were asked to use a slider of 0 to 100 to indicate the sharing amount rather than inputting the value into a textbox. As they moved the arrow on the slider, the corresponding payoffs for him-/herself and the receiver were computed, and immediately presented on the screen.

2.3.2 Results

Frequency of Fair Decisions. I found that 24% of participants made a fair decision, 53% of participants made a less-than-fair decision, and 17% made a more-than-fair decision.

Categorical Cost/Benefit Ratios. I first replicated the analyses from Study 1. To do this, I averaged all 8 low cost/benefit ratio conditions together, and all 8 high cost/benefit ratio conditions together. In some cost/benefit ratio conditions, the fair decision is not a simple number. For example, when the cost/benefit ratio is 1/2, giving 33.33 delivers the fair payoff. In such conditions, I considered decisions to be fair if they were within 1 MU of the fair value. Results showed similar patterns to the findings in Study 1A and Study 1B: I found that a significantly lower percentage of participants acted fairly in both the high cost/benefit ratio and low cost/benefit ratio conditions, as compared to the control condition, thus showing signs of the inverse U-shaped effect I saw in Study 1 (Table 2.2, Figure 2.3).

In addition, I found a significantly higher percentage of participants made less-than-fair decisions in the high cost/benefit ratio condition, and a significantly lower percentage of participants made less-than-fair decisions in the low cost/benefit ratio condition, as compared to the control cost/benefit ratio condition. Finally, I again found a higher percentage of participants made more-than-fair decisions in the low cost/benefit ratio condition as compared to the control and the high cost/benefit ratio conditions.

These results again show that people elect to act less fairly due to high cost/benefit ratios, but also less fairly when cost/benefit ratios are low, suggesting that the even-split heuristic outweighs simple cost/benefit calculations. Effect size comparisons again showed that the effect of low costs shifting people away from selfishness is not as strong as the effect of high costs driving people towards selfishness.

Table 2.2. Logistic regressions predicting percentage of each type of decision in Study 2

	B *(β) p-value*	SE	95% CI
Odds of Fair Decision			
Low (1/3) vs. Control (1/1)	-.670 (-.779)**	0.214	-1.090, -.248
High (3/1) vs. Control (1/1)	-1.611 (-1.868)***	0.225	-2.052, -1.169
High (3/1) vs. Low (1/3)	-.941 (-1.090)***	0.13	-1.198, -.688
Odds of Less-than-Fair Decision			
Low (1/3) vs. Control (1/1)	-.630 (-.633)**	0.215	-1.050, -.207
High (3/1) vs. Control (1/1)	1.681 (1.684)***	0.221	1.249, 2.119
High (3/1) vs. Low (1/3)	2.311 (2.316)***	0.123	2.072, 2.556
Odds of More-than-Fair Decision			
Low (1/3) vs. Control (1/1)	2.335 (3.047)***	0.465	1.525, 3.386
High (3/1) vs. Control (1/1)	-1.064 (-1.384)*	0.537	-2.063, -0.091
High (3/1) vs. Low (1/3)	-3.399 (-4.424)***	0.29	-4.017, -2.871

Note: *$p < .05$, ** $p < .01$, *** $p < .001$

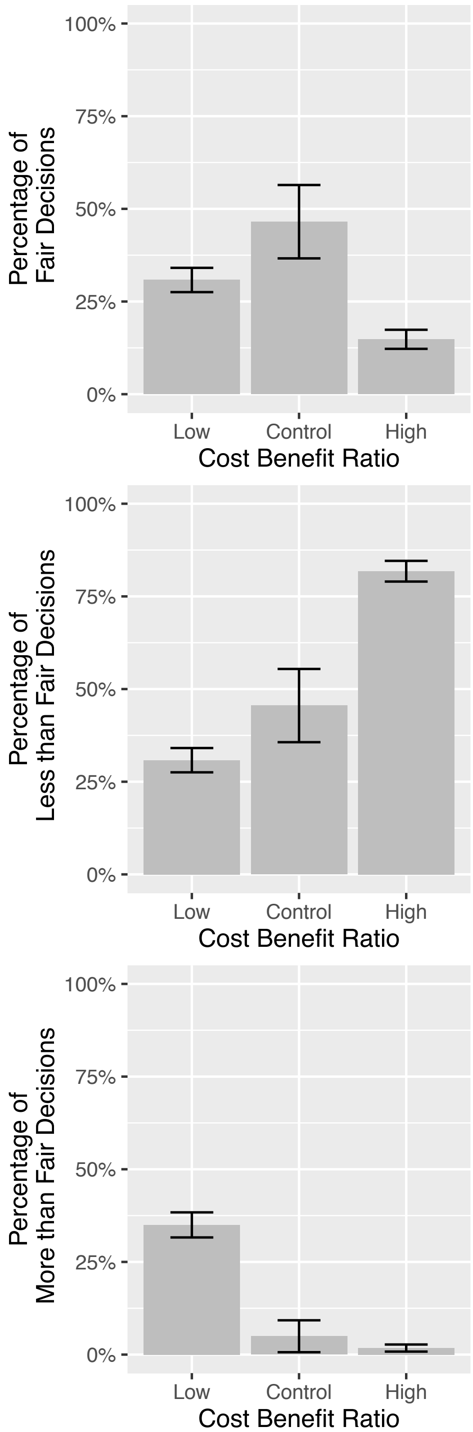

Figure 2.3. Percentage of each type of decision by cost/benefit condition in Study 2. Error bars represent 95% confidence intervals.

Continuous Cost/Benefit Ratios. I then examined cost/benefit ratios continuously, allowing us to test for more nuanced changes. I tested the effect of cost/benefit ratios on people's fair decisions in two models, mapping onto these two predictions: One where costs are higher than benefits and one where costs are lower than benefits. I predicted the percentage of fair (and less-than-fair, more-than-fair) decisions (dummy-coded as 1; other decisions dummy-coded as 0) from the high (or low) cost/benefit ratios, treated continuously. Here I treated the cost/benefit ratio as a continuous variable as previous research suggests that variables with more than 5 categories can be treated as continuous (Rhemtulla, Brosseau-Liard & Savalei, 2012).

When costs are higher than benefits (the right side of the proposed inverse U-shaped curve; see Figure 2.1), higher costs predicted fewer fair decisions ($b = -0.16$, $se = 0.05$, $CI95$ (-0.25, -0.07), $z = -3.44$, $p < 0.001$) and more less-than-fair decisions ($b = 0.13$, $se = 0.04$, $CI95$ (0.05, 0.22), $z = 3.16$, $p < 0.01$), but did not predict more-than-fair decisions ($b = 0.05$, $se = 0.12$, $CI95$ (-0.18, 0.30), $z = 0.44$, $p = 0.663$; see Figure 2.4). In contrast, when costs are lower than benefits (the left side of the inverse U-shaped curve), the size of the cost/benefit ratio did not predict the percentage of fair decisions ($b = 0.98$, $se = 0.63$, $CI95$ (-0.25, 2.22), $z = 1.57$, $p = 0.115$), unless I excluded the 1/9 cost/benefit ratio condition, in which case higher costs relative to benefits predicted more fair decisions ($b = 0.73$, $se = 0.67$, $CI95$ (0.42, 3.03), $z = 2.59$, $p <0.01$). Higher costs relative to benefits also predicted more less-than-fair decisions ($b = 1.38$, $se = 0.63$, $CI95$ (0.15, 2.60), $z = 2.21$, $p <0.05$), and a lower percentage of more-than-fair decisions ($b = -2.15$, $se = 0.67$, $CI95$ (-3.49, -0.86), $z = 3.21$, $p < 0.01$). These findings confirm the inverse U-shaped effect of cost/benefit ratios on fairness decision-making, and generally demonstrate that the changes in decision-making are gradual, rather than step-wise.

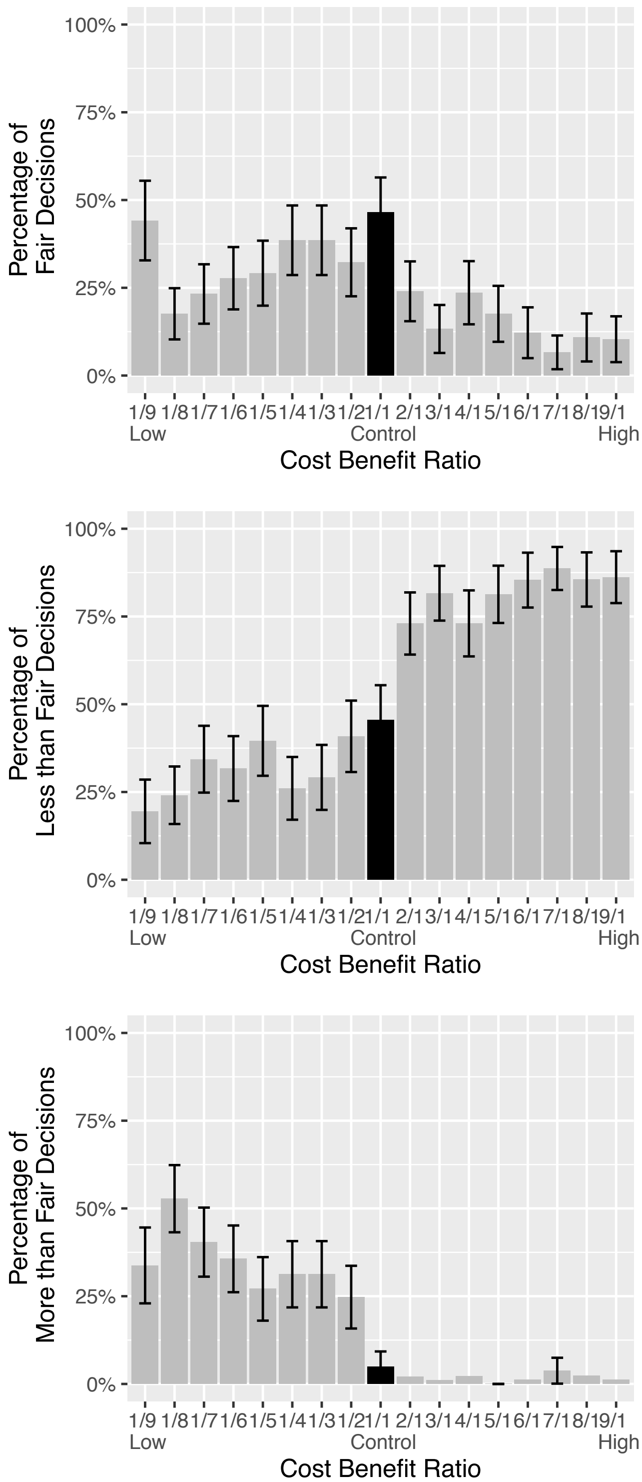

Figure 2.4. Percentage of each type of decision by cost/benefit condition in Study 2. Error bars represent 95% confidence intervals.

2.4 Discussion

2.4.1 Summary and Implications

In two studies, I investigated the effect of the balance of costs and benefits on people's fair decision-making in monetary allocations through the lens of a discrete decision framework. Taken together, these findings suggest an inverse U-shaped effect of cost/benefit ratios on fairness. On the one hand, I find that high costs keep people away from acting fairly and drive people to act less fairly. This finding fits with evolutionary and economic theories, which argue that people are less likely to act prosocially when it is personally costly (Hamilton, 1964; Trivers, 1971; Andreoni & Miller, 2002; 2008). On the other hand, low costs do not measurably increase fair allocations, and indeed sometimes decrease fair decisions. This pattern suggests the strong role of the even-split heuristic on fair decisions: The even-split heuristic drives people to intuitively act fairly. When the even-split heuristic does not apply (e.g., the cost/benefit ratio is not 1/1), even when making a fair decision would logically be more attractive (e.g., is low cost), fewer people make a fair decision.

This pattern helps to explain *when* people act fairly, and these results explain prior inconsistencies in results examining the impact of costs and benefits on fairness (Andreoni & Miller, 2002; 2008; Andreoni, Brown &Vesterlund, 2002; Andreoni & Vesterlund, 2001; Almås et al., 2010; Keltner et al., 2014). Both lower cost/benefit ratios and the even-split heuristic magnify fair strategies; when the cost/benefit ratio is 1/1, and people can rely on the even-split heuristic to produce a fair decision, people seem to make more fair decisions than they do with any other cost/benefit ratio. When I compare the boosting effect of low costs and the even-split heuristic on fairness, the even-split heuristic has a stronger effect (i.e., the fairness heuristic plays a stronger role than cost calculation). This may be because the use of heuristics preserves cognitive resources. There is a strong possibility that the even-split tend to be the most common "fair" divisions in real world resource allocation scenarios (though I do not know of empirical evidence to address this intuition). Widespread exemplars make the even-split fair decision easier to access (i.e., less effortful) than any other resource allocation option, thus driving more people to make the fair decision.

The current results also shed light on *why* people act fairly. The evolutionary perspective argues that fairness can provide fitness benefits because people return benefits if they are treated fairly (Burnham et al., 2005; Nowak, 2006). An alternative approach proposes that the development of new social norms is crucial to maintaining fairness in the rise of more complex societies (North, 1990) and emphasizes the internalization of heuristics through culture and education. The current work shows that the heuristics approach has a stronger impact on fairness decision-making than efficiency and cost/benefit calculations, thus reflecting the tension between biological evolutionary programming (where individual-level interests are central) and cultural evolutionary programming (where group-level interests are central).

In addition, these findings show an asymmetrical effect of cost/benefit ratios on the less-than-fair and the more-than-fair decision. Although more people made the less-than-fair decision in the control than in the low cost/benefit ratio condition, and more people made this decision in the high than in the control cost/benefit ratio condition, the effect size was significantly smaller in the former comparison than the latter. This pattern suggests a tendency towards loss aversion: When costs are higher than benefits, giving will decrease the pie, which might feel like a bigger loss. For example, to equalize the payoffs in the high cost/benefit condition, a dictator would have to give 75 MUs, so that both they and their partner would end up with 25 MUs, for a total of 50 MUs. This is a smaller pie than in the low cost/benefit condition, where both the dictator and their partner would end up with 75 MUs, for a total of 150 MUs. The fear of losing drives people from fairness to selfishness (i.e., giving less-than-fair). On the other hand, when costs are lower than benefits, giving will increase the pie, which may feel like a gain (though giving anything always results in a loss to the self). The anticipation of winning, however, has a weaker effect in shifting people away from selfishness to fairness. Decision patterns in the more-than-fair decision could also be explained by Hamilton's rule: People only make altruistic decisions (i.e., the more-than-fair decision) when costs are lower than benefits.

2.4.2 Limitations and Future Directions

In the current work, I tested people's fair decision-making using dictator games. The cost/benefit manipulation was conducted by modifying the multipliers without any explanation. This design is artificial and may cause confusion for participants. Further research can be done using a design that better mimics a real-world setting. For example, I could manipulate the attractiveness of fair decisions by changing the reputation or social economic status of the partner.

Another methodological issue with the current design is that the calculation complexity associated with cost/benefit ratios could affect the number of people who make fair decisions; people may be less likely to make a fair decision when calculating how to do so is complex. Although I tried to reduce the calculation complexity by showing participants both the giving amount and the final payoffs before they made their decisions, nevertheless people might have experienced some differences in difficulty depending on the cost/benefit condition. Additionally, people might have found it more difficult, and might have been more hesitant, to make the fair decision when the fair amount was not a round number. For example, in Study 2, somewhat fewer people chose to give fairly when the cost/benefit ratio was ½, and the amount needed to equalize payoffs was 33.3, than when the cost/benefit ratio was 1/3 or 1/4, and giving 25 or 20 was fair. The high number of fair decisions in the 1/9 cost/benefit ratio condition could be due to this reason: When fairness was very cheap (i.e., giving 10) and simple, many people were drawn to make the fair decision. In future work, manipulating the attractiveness of fair decisions using a method other than cost/benefit ratio (see above for suggestions) would help to address this issue.

The current work aimed to describe and predict how people act fairly at different cost/benefit levels. The question of why remains untouched. Further work can dig into the problem by looking at how individual differences in education, decision-making style, and personality etc. moderate people's fair decision-making.

2.4.3 Conclusion

In the present work, I examined the effect of cost/benefit ratios on fair decision-making. The findings highlight the role of the even-split heuristic and demonstrate that people are more tempted to make the fair decision when it follows the even-split heuristic than when costs are low. The current research provides insights to resolving the conflicting predictions made by Hamilton's rule, which emphasizes a self-centered and calculation-driven view, and the even-split heuristic theory, which centers on a social norm-enhanced view.

Chapter 3 Heuristics Matter: Examining Emotions and Cognition Under Fairness Decision-Making

3.1 Introduction

Humans have been spectacularly successful in limiting the impact of self-interest and in enforcing fairness norms during social interactions (Fehr & Fischbacher, 2003a, 2003b; Henrich et al., 2003). Among the factors that affect human propensity to act fairly, many researchers believe that the cost/benefit ratio of an action is critically important (Hamilton, 1964; Trivers, 1971). A growing body of research has proposed that high costs inhibit fair decisions and low costs boost fair decisions (e.g., Andreoni & Miller, 2008; 2002). However, how cost/benefit ratios affect the underlying psychological mechanisms behind fair and unfair treatment has largely remained unexamined. For instance, it is not well understood how the emotional reactions to and cognitive evaluations of fairness norm violations manifest differentially as a function of varying cost/benefit ratios.

In the present chapter, I aim to investigate empirically competing perspectives on the role of the cost/benefit ratio in people's evaluations of fair versus unfair treatment. Two research traditions are particularly useful in tackling this question. First, I build upon theory and research from the dual-system model tradition, which focuses in parallel on emotional and cognitive processes (fast and slow) that underlie decision-making. In accordance with this view, I suggest that it's important to understand both the emotional and cognitive aspects of people's reactions to fair versus unfair actions. Second, classic economic and evolutionary theories predict fairness violations lead to the most negative responses when being fair is cheap or easy—there is little excuse not to be fair in those cases. Emerging psychological theories, however, emphasize that people internalize the even-split fairness norm (i.e., the 50/50 split is fair when the cost is equal to the benefit), and argue that the violation of the even-split fairness triggers more negative responses compared to the violation of fairness norms in general, even when fairness is cheap or easy. Following results in Chapter 2 where the even-split heuristic shows a prominent impact on people's fairness decision-making, I argue that this second perspective better depicts the reality of people's reactions to fairness norm violations. To test how varying levels of cost/benefit ratios impact the emotional and cognitive reactions to fairness violations, I utilized a resource allocation paradigm and measured both the emotional response and the cognitive representations of receivers following offers from resource deciders at different cost/benefit ratios.

3.1.1 Emotional Responses to and Cognitive Representations of Fairness

A dual-system framework incorporating emotions and cognition is commonly proposed to explain people's decisions (Stanovich and West, 2000; Kahneman, 2003; Lieberman, 2000; Strack and Deutsch, 2004; Loewenstein and O'Donoghue, 2007; Evans, 2008). According to these theories, there are two dominant decision-making processes: One operating automatically and with emotional charge, while the other functions in a deliberate manner and demands greater cognitive capacity.

Emotions play a key role in maintaining fair interactions (Pillutla and Murnighan, 1996). Broad evidence indicates that receiving an unfair treatment is associated with negative emotional responses, such as anger, frustration, sadness, irritation, and contempt (Sanfey et al., 2003; Haselhuhn & Mellers, 2005). A group of researchers show that expressions of negative emotions can enforce fair economic exchange (Xiao & Houser, 2007). Furthermore, these negative emotions are thought to cause punishment of unfair partners, and thus to maintain a fair interaction (Pillutla and Murnighan, 1996). Several studies utilizing "ultimatum game" paradigms illustrate this general pattern. In the ultimatum game, two players are given the opportunity to split a sum of money. One player is deemed the decider, and the other, the receiver. The decider makes an offer as to how this money should be split between the two. The receiver then either accepts or rejects this offer. If accepted, the money is split as proposed, but if the responder rejects the offer, then neither player receives anything. Sanfey and colleagues (2003) found that unfair offers trigger higher negative emotions and this led to greater rejection of offers (with both people then receiving nothing). This is consistent with other research that report people are more emotionally aroused when rejecting, as opposed to accepting, unfair offers (van't Wout et al., 2006; Sanfey et al., 2003; Koenigs and Tranel, 2007). Taken together, these findings suggest that emotional arousal plays an important role in maintaining fairness.

The other side, cognitive judgements—deliberate assessments of all possible contingencies—have somewhat conflicting effects on maintaining fairness (e.g., Sanfey et al., 2003; van't Wout et al., 2006; Crockett et al., 2008; Tabibnia et al., 2008). One avenue of research suggests that cognitive judgements are utilized to inhibit immediate selfish urges to guide decisions based on moral and ethical principles (Rachlin, 2002; Moore and Loewenstein, 2004). Conversely, others believe cognitive judgements are used to inhibit punishment of unfair partners and steer behaviour towards self-interest, as punishment is normally costly to the self (Sanfey et al., 2003; Knoch et al., 2006). Thus, some of the work suggests cognitions make people act less selfishly, while others suggest cognitions make people act more selfishly. One reason for the incongruence of findings is that the majority of the focus has been on how cognition affects the decision-making about punishing an unfair treatment. To date, few studies have examined the cognitive representations of fair versus unfair treatment more broadly—and I believe zooming away from the punishment decision and understanding the cognitive representations will help explain the above inconsistencies. For example, a certain sharing offer may not lead to a behavioural punishment (i.e., rejection). It, however, could be sufficient to trigger some negative responses and thus provide us with insights to understand the cognitive representation of this treatment.

One related area of research to the issue of cognition in fairness is the work on the estimated welfare tradeoff ratio, which is a direct way to represent people's cognitive judgments (WTR; Sell et. al., 2009; Delton & Robertson, 2016, Krasnow et al., 2016). Sell and colleagues (2009) argue that evolutionary selection designed the cognitive program in humans to solve the following computational adaptive problem: How much weight should be placed on the welfare of the other as compared with the self? They further suggest that the ratio of these weights be expressed as a welfare tradeoff ratio between the self and individual. WTR captures how much the actor (e.g., A) values an anonymous other, and estimated WTR reflects another person's (e.g., B's) estimation of how much A values the anonymous other. In the WTR task, people (actor A) are asked to make a series of binary decisions between allocating a certain amount of money to him-/herself or a different amount of money to another person. In the estimated WTR task, another group of people (actor B) are asked to estimate the WTR of A based on different information or performance of A. Providing support to this metric, Krasnow and colleagues (2016) showed that people can make accurate estimations of others' WTRs based on their decisions in resource allocation. WTR and eWTR have been argued as a fundamental internal cognitive program to solve problems in daily interpersonal interactions (Sell et. al., 2009; Delton & Robertson, 2016, Krasnow et al., 2016). Based on existing theories, I chose estimated WTR as a cognitive and computational measurement of how much one is valued.

3.1.2 Cost and Benefit in Fairness

Within the corpus of research on cost benefit and fairness, most attention has centered on the effect of cost/benefit ratios on acting fairly. As described in Chapter 1 (1.2), the evolutionary and economics perspective suggest that high costs inhibit fair decisions and low costs boost fair decisions (Andreoni & Miller, 2002; 2008). Conversely, the egalitarian perspective suggests a strong inequality aversion. Following this perspective, empirical studies using the modified dictator game have found that mean inequality was lowest at the 1/1 cost/benefit ratio (Saez and colleagues, 2015). This result indicates that lower costs relative to benefits is not as efficient as equal costs relative to benefits in terms of maintaining fairness and equal payoffs.

Although the above research did not examine the effect of cost/benefit ratio on the internal processes of resource receiver, it does shed insights on possible directions of the effect. Building on the evolutionary and economic theory, giving less-than-fair can lead to more negative feelings and lower cognitive evaluation when giving is cheap as compared to giving is expensive. As more people will tend to act fairly at a low cost, violation of this expectation may trigger the negative responses. On the contrary, psychological theories suggest that people may have a stronger negative response when faced with the violation of fairness at the 50/50 split (when the cost is equal to the benefit). In economic-exchange tasks, fairness is typically defined as the equitable distribution of an initial stake of money between two people. A 50/50 share is preferred over other distributions when there is no reason to provide special treatment to one of the contending parties. In line with this, emerging empirical evidence has shown that people do indeed have an even-split heuristic (e.g., a split of 10 vs. 10; Güth, Huck, & Müller, 2001; Kiyonari, Tanida, & Yamagishi, 2000; Roch et al., 2000). This chapter aims to examine the competing hypotheses from the economics, evolutionary perspective and psychological perspective on how cost/benefit ratios impact fairness evaluations.

While previous work provides broad insight into understanding how people respond to fair and unfair treatment, this research has been limited by a number of factors. First, past studies designed fair outcomes to generally be more materially desirable than unfair outcomes. This is a major confound, as it is unclear whether the resulting negative emotions and judgments flow from a desire for fairness or a desire for material gains. Additionally, few studies have investigated precisely what cognitive representations people form when they receive different treatments. More importantly, no study has examined receivers' emotional and cognitive responses under fairness decision-making at different exchange rate.

3.1.3 Present Study

In the present work, I aimed to understand (a) what emotional response and cognitive representations do people form when they receive fair vs. unfair treatment, and (b) how these internal states are affected by varying cost/benefit ratios of the fair versus unfair actions. To test these hypotheses and validate the effects across specific tasks, I conducted the experiment using different economic games and varying cost/benefits ratio design as in Chapter 2. Particularly, I planned to use the dictator game, the private impunity game, the impunity game, and the ultimatum game. These games followed a similar resource allocation scenario as in the dictator game but varied in how much receivers could affect the final payoffs (see 3.2 Method for detailed descriptions of these tasks).

To disentangle self-interest and unfairness aversion, I planned to study peoples' responses to advantageous inequality (where participants received more than the fair amount) as compared to disadvantageous inequality (where participants received less than the fair amount). Particularly, I planned to compare people's emotions and cognitions when they receive a less-than-fair, fair, and more-than-fair offer.

Based on the inequality aversion theory and results from Chapter 2 which suggests a strong heuristics of the even-split fairness, I expected to observe a higher positive emotional response when people receive a fair offer compared to when they receive a less than or even more-than-fair offer. In addition, due to the existence of the even-split heuristic, I expected to see both emotional and cognitive responses elevated following violations of the even-split heuristic compared to violations of uneven-split fairness.

3.2 Methods

3.2.1 Participants

I recruited 252 participants from the U.S. through Amazon Mechanical Turk (AMT), with a mean age of 33 (SD = 9), female = 44%. The primary analyse was categorical regressions. Sample sizes were selected by assuming a medium effect size (0.25) and aiming to have 0.05 significant level and 0.90 power level to detect the effect among 3 conditions. For each condition, I had my sample size to 68. As each task was conducted in a 6-person group, I selected the sample size to be 84 for each cost/benefit condition. All participants completed the study online. In accordance with standard AMT wages, each participant was given $2 for participating. Participants were told that they and other participants would partake in a series of social interactions and would earn more money based on decisions by themselves and their partners. No deception was used at any point in this study, and the protocol was approved by the IRB committee at Harvard University.

3.2.2 Procedure

Experimental sessions were conducted by running real-time interactions on Sophie (https://www.sophie.uni-osnabrueck.de/). Each session was conducted on a group of six participants. The six participants would partake in five social interaction tasks. In the first task, each of the six participants played a WTR game and were assessed how much they valued a randomly paired anonymous participant. The WTR game was followed by four one-shot modified economic games: the dictator game, the private impunity game, the impunity game, and the ultimatum game. In each economic game, half of the participants (3 out of 6 in each group) played the decider's role; the other half played the receiver's (responder's) role. Role assignment was counter balanced such that (a) each participant played the decider's role in two economic games and the receiver's role in the other two games, (b) each participant was equally likely to be the decider (or the receiver) in any two of the four economic games, (c) participants would not be paired with the same other participant twice through all four economic games. After the economic game, I asked each participant to rate their emotions and to do the cognitive judgment task by inferring how much a decider valued their anonymous paired participant in the WTR game at the beginning (when the participant played the receiver's role in the previous economic game, the decider was their partner; when the participant played the decider's role in the previous economic game, the decider was another decider they did not interact with). The order of the four economic games was counter balanced between groups: Half of groups played in the order of DG – PI – IG –UG, and the other half played in reverse order.

WTR Game. In the WTR game, participants completed a task capturing how much they valued another anonymous participant (Delton & Robertson, 2016, Krasnow et al., 2016). Participants were asked to make 12 binary decisions between allocating a certain amount of money to him-/herself or a different amount of money to another person. Within each series of 12 decisions, the amount for the other participant was held constant, but the amount for him-/herself was random. For instance, the participant might first be asked to decide between keeping $0.15 or giving $1 to the other, then keeping $0.25 or giving $1 to the other, then keeping $0.35 or giving $1 to the other, and so forth. Deciders made their choices knowing that the experimenter would randomly select and pay out only 1 of these 12 decisions for each target at the end of the session (in addition to their other earnings).

Cost Benefit Manipulation. Participant played each economic game in pairs, with one participant playing the decider and the other receiver. Participants were randomly assigned to one of three cost/benefit conditions: 1/3, 1/1 or 3/1. They were instructed that each decider would be endowed with 100 tokens while the receiver would be given none. Deciders were then asked to use a sliding scale ranging from 0 to 100 to indicate the shared amount (x). The corresponding payoffs for him-/herself (i.e., 100-x) and the receiver (i.e., 3x in the 1/3 cost/benefit ratio condition, x in the 1/1 cost/benefit ratio condition, and x/3 in the 3/1 cost/benefit ratio condition) were computed as they moved the arrow on the slider, and immediately presented on the screen.

Economic Games. After all deciders made the sharing decision, receivers learned how much they received. In the dictator game, receivers would learn about their payoffs and get the offer. In the private impunity game, the receiver would learn about their payoffs and then choose either to accept or to reject the offer by the decider. If they accepted the offer, they would get the offer. If they rejected the offer, they would get nothing in this interaction. Importantly—and in contrast to the ultimatum game—deciders would get the remaining tokens regardless of receivers' decision to accept or to reject the offer, and were not even informed that receivers had a choice between 'accept' and 'reject.' Similar to the private impunity game, receivers in the impunity game would learn about their payoffs and decide either to accept or reject the offer, and the rejection had no effect on the decider's payoff. Differently, deciders in the impunity game knew all the information about the choice between "accept" and "reject", and the consequence of it. Receivers in the ultimatum game also had a choice between "accept" and "reject". However, if they rejected the offer, both the decider and the responder would get nothing in the interaction. Receivers' power level increases from the dictator game, the private impunity game, the impunity game to the ultimatum game.

Emotional Responses. While receivers learned about their payoffs and made a choice between "accept" and "reject", deciders were led to a page where they also learned about the sharing decision by another decider whom they did not interact with. After this, all participants were surveyed about their emotions. I used 6 questions to measure people's emotions after they learned about the decider's decision in the previous economic games: (1) How happy do you feel? (2) How angry do you feel towards partner? (3) How grateful do you feel towards partner? (4) How surprised do you feel? (5) How annoyed do you feel at partner? (6) How disgusted do you feel? Participants answered these questions using a Likert scale with1 representing not at all, and 7 representing very much.

Cognitive Judgement. Later, all participants were asked to estimate the WTR of deciders based on their decisions in the previous economic game. To assess the inferences about how much deciders valued their anonymous partner in the WTR game, I showed participants the same set of decisions that deciders were asked to make. Participants selected the choices they believed the decider had made. Participants earned $0.10 for every correct answer.

In all studies, once the decisions of all participants had been collected, payoffs were calculated, and bonuses were paid through AMT.

3.3 Results

All analysis was conducted in RStudio. I used regression modelling to test the difference in emotions and the cognitive judgment when people received different offers in economic games. In the analysis, I collapsed the 4 economic games as there was no significant difference in the effect across games. No rating score was outside of three standard deviations, so no data point was excluded.

To examine peoples' emotional responses to different offers, particularly in situations where the violation of fairness is in favor the self-interest, I compared the difference in average positive and negative emotions between the three offers: the less-than-fair offer ($M_{Positive}$ = 2.78, $SD_{Positive}$ = 1.72, $M_{Negative}$ = 3.31, $SD_{Negative}$ = 2.05), the fair offer ($M_{Positive}$ = 5.74, $SD_{Positive}$ = 1.28, $M_{Negative}$ = 1.26, $SD_{Negative}$ = 0.69), and the more-than-fair offer ($M_{Positive}$ = 5.20, $SD_{Positive}$ = 1.81, $M_{Negative}$ = 1.95, $SD_{Negative}$ =1.60). I tested the difference between the emotional responses between each outcome pair in the context of a regression analysis in which I predicted emotions from the dummy-coded decision pair (e.g., fair = 1 vs. less-than-fair = 0). This method was applied to all emotions comparisons between decision pairs in this manuscript.

Table 3.1 shows the difference in positive emotions between outcome pairs among the three decisions. For visualization, Figure 3.1 depicts the mean and the SE of the response for each of the three offers. Results show that participants felt happier if they received the fair offer than they received the less-than-fair, and the more-than-fair offer. In line with this result, Table 3.2 and Figure 3.2 show that participants felt less negative emotions when they received the fair offer, compared to both receiving the less-than-fair and the more-than-fair offer. These results support the idea that the violation of fairness triggers negative emotions, even when the violation is in favor of the self-interest.

Table 3.1. . Comparison of positive emotions among more-than-fair, fair and less-than-fair offers

Predictor	*B(β) p-value*	*SE*	*95% CI*
Fair vs. Less-than-Fair	2.963 (0.699)***	0.099	2.769, 3.158
More-than-Fair vs. Less-than-Fair	2.416 (0.383)***	0.255	1.915, 2.918
More-than-Fair vs. Fair	-0.547 (-0.121)**	0.197	-0.935, -0.159

Note. $^{**}p < .01$. $^{***}p < .001$.

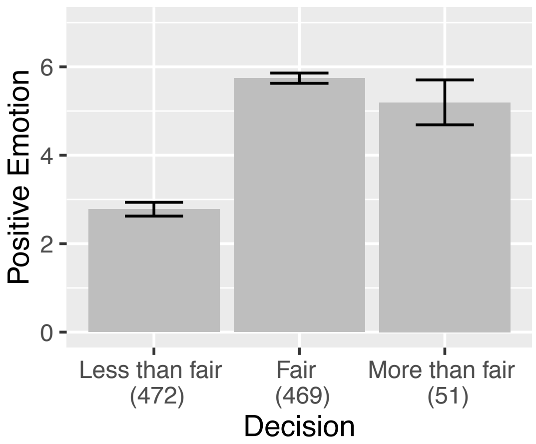

Figure 3.1. Comparison of positive emotions among more-than-fair, fair and less-than-fair offers. Error bars represent 95% confidence intervals.

Table 3.2. Comparison of negative emotions among more-than-fair, fair and less-than-fair offers

Predictor	*B(β) p-value*	*SE*	*95% CI*
Fair vs. Less-than-Fair	-1.868 (-0.52)***	0.1	-2.065, -1.672
More-than-Fair vs. Less-than-Fair	-1.184 (-0.172)***	0.297	-1.768, -0.601
More-than-Fair vs. Fair	0.684 (0.241)***	0.121	0.446, 0.922

Note. $^{***}p < .001$.

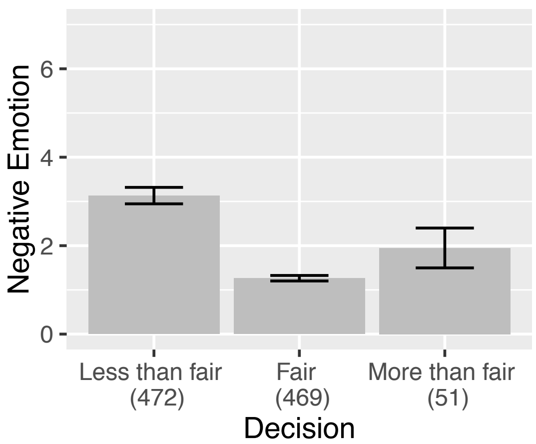

Figure 3.2. Comparison of negative emotions among more-than-fair, fair and less-than-fair offers. Error bars represent 95% confidence intervals.

For the cognitive judgment on different offers, I compared the estimated WTR between the three offers: the less-than-fair offer (*M* = 0.18, *SD* = 0.18), the fair offer (*M* = 0.32, *SD* = 0.17), and the more-than-fair offer (*M* = 0.38, *SD* = 0.2).

Table 3.3 and Figure 3.3 show the difference in estimated WTR between outcome pairs among the three decisions. Results show that participants estimated the highest WTR when they received the more-than-fair offer, and then the fair offer and the lowest WTR when they received the less-than-fair offer. These results confirmed that the cognitive judgment followed the calculative logic: If the decider is more generous, he/she is likely to value other people more.

Table 3.3. Comparison of estimated WTR among more-than-fair, fair and less-than-fair offers

Predictor	*B(β) p-value*	*SE*	*95% CI*
Fair vs. Less-than-Fair	0.137 (0.362)***	0.012	0.115, 0.16
More-than-Fair vs. Less-than-Fair	0.2 (0.306)***	0.027	0.146, 0.253
More-than-Fair vs. Fair	0.062 (0.106)*	0.026	0.012, 0.113

Note. * $p < .05$. *** $p < .001$.

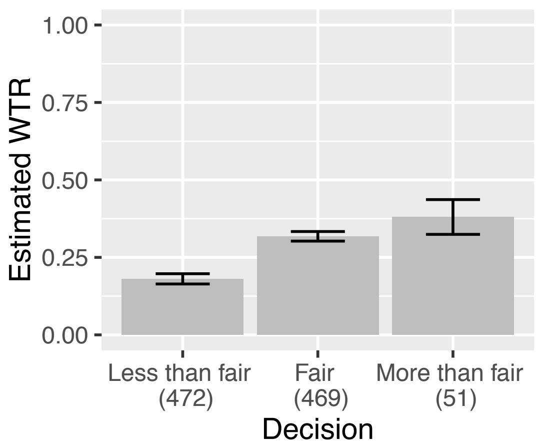

Figure 3.3. Comparison of estimated WTR among more-than-fair, fair and less-than-fair offers. Error bars represent 95% confidence intervals.

I then tested people's emotional response to the three offers: the less-than-fair, the fair, and the more-than-fair offer at different cost/benefit levels. I tested the difference between the emotional responses in each outcome pair in which I predicted emotions from the dummy-coded decision pair (e.g., fair = 1 vs. less-than-fair = 0) interacted with the cost benefit condition (e.g., 1/3 (1,0), 3/1 (0.1), and 1/1 (0)).

Table 3.4, Table 3.4 and Figure 3.4, Figure 3.5 show the difference in emotions among different cost/benefit ratios interacted with different offers. Results show that people felt less positive when they received the more-than-fair offer versus the fair offer in the 1/1 cost benefit condition compared to the 1/3 cost benefit condition. In line with this, people felt more negative when they receive less-than-fair or more-than-fair in the 1/1 than the 3/1 cost benefit ratio condition. This finding confirms the hypothesis that people's emotions are more sensitive to the violation of the even-split heuristics.

Table 3.4. Comparison of positive emotions among more-than-fair, fair and less-than-fair offers at different cost/benefit ratios

Decision	*Cost Benefit*	*B(β) p-value*	*SE*	*95% CI*
Fair vs. Less than Fair	1/3 vs. 1/1	-.310 (-.073) 0.223	0.254	-.810, .189
Fair vs. Less than Fair	3/1 vs. 1/1	-.179 (-.039) 0.482	0.255	-.679, .320
Fair vs. Less than Fair	3/1 vs. 1/3	.131 (.031) 0.619	0.264	-.387, .650
More than Fair vs. Less than Fair	1/3 vs. 1/1	.535 (.085) 0.37	0.597	-.638, 1.709
More than Fair vs. Less than Fair	3/1 vs. 1/1	.056 (.013) 0.955	0.999	-1.905, 2.018
More than Fair vs. Less than Fair	3/1 vs. 1/3	-.479 (-.076) 0.61	0.939	-2.324, 1.366
More than Fair vs. Fair	1/3 vs. 1/1	.846 (.187) +	0.449	-.036, 1.727
More than Fair vs. Fair	3/1 vs. 1/1	.236 (.087) 0.762	0.778	-1.293, 1.764
More than Fair vs. Fair	3/1 vs. 1/3	-.610 (-.135) 0.402	0.728	-2.041, .821

Note. $^{+}$ $p < .1$.

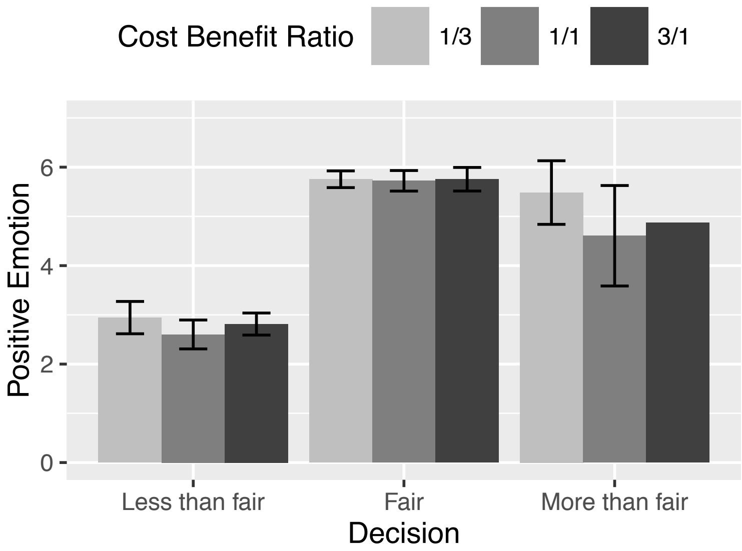

Figure 3.4[2]. Comparison of positive emotions among more-than-fair, fair and less-than-fair offers at different cost/benefit ratios. Error bars represent 95% confidence intervals.

Table 3.5. Comparison of negative emotions among more-than-fair, fair and less-than-fair offers at different cost/benefit ratios

Decision	*Cost Benefit*	*B(β) p-value*	*SE*	*95% CI*
Fair vs. Less-than-Fair	1/3 vs. 1/1	.224 (.063) 0.38	0.255	-.277, .726
Fair vs. Less-than-Fair	3/1 vs. 1/1	.534 (.138)*	0.255	.033, 1.035
Fair vs. Less-than-Fair	3/1 vs. 1/3	.309 (.086) 0.243	0.265	-.211, .830
More-than-Fair vs. Less-than-Fair	1/3 vs. 1/1	-.157 (-.023) 0.82	0.692	-1.517, 1.202
More-than-Fair vs. Less-than-Fair	3/1 vs. 1/1	-.399 (-.085) 0.73	1.157	-2.672, 1.874
More-than-Fair vs. Less-than-Fair	3/1 vs. 1/3	-.242 (-.035) 0.824	1.088	-2.380, 1.897
More-than-Fair vs. Fair	1/3 vs. 1/1	-.382 (-.134) 0.166	0.275	-.922, .159
More-than-Fair vs. Fair	3/1 vs. 1/1	-.933 (-.548)+	0.477	-1.870, .005
More-than-Fair vs. Fair	3/1 vs. 1/3	-.551 (-.194) 0.218	0.447	-1.429, .327

Note. $+ p < .1$. $* p < 0.05$.

[2] There was only one participant for the 3/1 cost/benefit ratio in the more than fair decision and thus no error bar was shown.

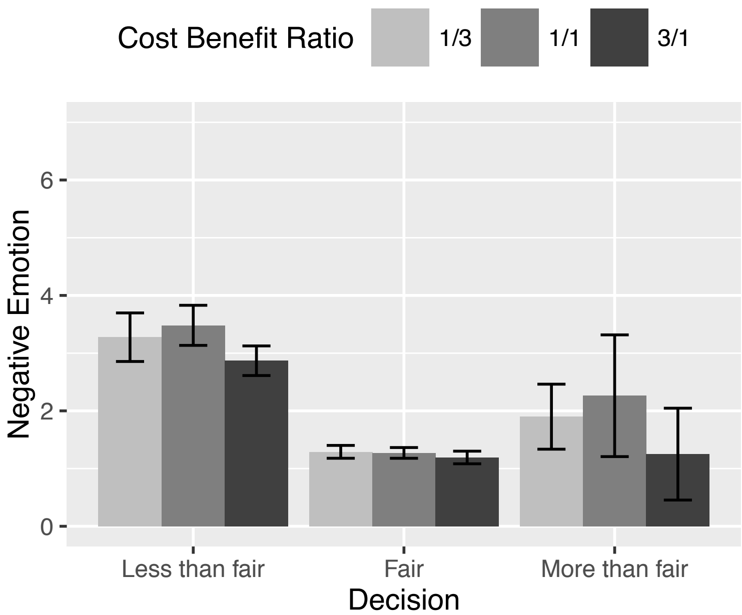

Figure 3.5. Comparison of negative emotions among more-than-fair, fair and less-than-fair offers at different cost/benefit ratios. Error bars represent 95% confidence intervals.

I then tested people's cognitive representations of the three offers: the less-than-fair, the fair, and the more-than-fair offer at different cost/benefit levels. Table 3.6, Figure 3.6 show the difference in estimated WTR between the even-split heuristic and the non-heuristic fairness with different offers. Results show that people estimated a higher WTR when receiving a fair offer than the less-than-fair offer in the 1/1 cost benefit ratio condition compared to the 1/3 or the 3/1 cost benefit ratio condition. This finding suggests that the cognitive judgment also follows the even-split heuristic and shows a more positive judgment in the even-split fairness situation than the non-heuristic fairness situation.

Table 3.6. Comparison of estimated WTR among more-than-fair, fair and less-than-fair offers at different cost/benefit ratios

Decision	*Cost Benefit*	*B(β) p-value*	*SE*	*95% CI*
Fair vs. Less-than-Fair	1/3 vs. 1/1	-.069 (-.181)*	0.029	-.127, -.011
Fair vs. Less-than-Fair	3/1 vs. 1/1	-.081 (-.199)**	0.029	-.139, -.023
Fair vs. Less-than-Fair	3/1 vs. 1/3	-.012 (-.032) 0.691	0.031	-.072, .048
More-than-Fair vs. Less-than-Fair	1/3 vs. 1/1	-.074 (-.114) 0.242	0.063	-.199, .050
More-than-Fair vs. Less-than-Fair	3/1 vs. 1/1	-.214 (-.480)*	0.106	-.422, -.006
More-than-Fair vs. Less-than-Fair	3/1 vs. 1/3	-.140 (-.214) 0.161	0.1	-.335, .056
More-than-Fair vs. Fair	1/3 vs. 1/1	-.005 (-.009) 0.925	0.058	-.119, .108
More-than-Fair vs. Fair	3/1 vs. 1/1	-.133 (-.379) 0.186	0.1	-.330, .064
More-than-Fair vs. Fair	3/1 vs. 1/3	-.128 (-.217) 0.176	0.094	-.312, .057

Note. $^{*}p < .05$. $^{**}p < .01$.

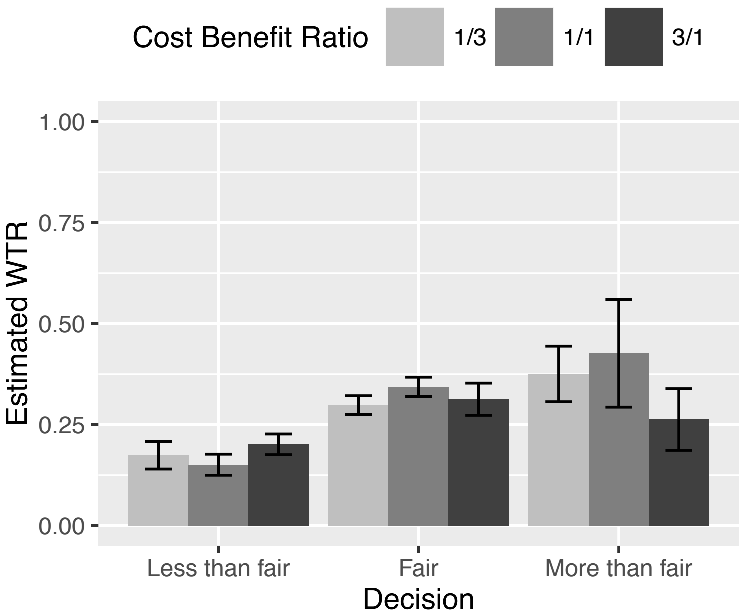

Figure 3.6. Comparison of estimated WTR among more-than-fair, fair and less-than-fair offers at different cost/benefit ratios. Error bars represent 95% confidence intervals.

3.4 Discussion

3.4.1 Summary and Implications

In this chapter, I explored the emotional and cognitive representations underlying fair and unfair treatment in different cost/benefit ratio situations.

Participants rated their own emotions and estimated the decider's WTR after they learned about how much they received in the economic games at different cost/benefit ratios. Following the discrete decision framework described in chapter 2, I created three categories based on the offer amount: the less-than-fair, the fair, and the more-than-fair offer. I then compared participants' emotions and cognition among the three offers. Taken together, the findings show that people's emotional responses and cognitive representations are substantially affected by how much they receive. However, emotional and cognitive responses are driven by slightly different forces. On the one hand, participants felt most positive and least negative when receiving the fair amount as compared to receiving the less than fair amount and even receiving More-than-Fair amount. This result suggests that the fairness concern is the main drive of people's emotional response. The violation of the fairness concern triggers more negative emotions even when the violation is compensated with more self-interest. On the one hand, participants estimated deciders to have the highest WTR when receiving more than the fair amount, then the fair amount and the lowest WTR when receiving less than the fair amount. This result suggests that people's cognitive representations and estimation of how much one is valued follow the straight logic of calculation. People think deciders value others more if they are more generous and give more, regardless of whether they are fair or not.

In terms of the effect of cost/benefit on people's internal states under fair and unfair treatment, I found that people felt more negative (and less positive) when the violation of fairness happened in the 1/1 cost/benefit ratio condition compared to the 1/3 or the 3/1 conditions. Here, the violation of fairness includes both giving less-than-fair and More-than-Fair. Similarly, people estimated the deciders to have a lower WTR when they receive the less-than-fair offer in the 1/1 as compared to the 1/3 or the 3/1 cost/benefit ratio conditions. There was no effect between the more-than-fair vs. fair interacted with the cost/benefit ratios. These findings have two important implications. First, both people's emotional response and cognitive representations are more sensitive to the 1/1 compared to the 1/3 or the 3/1 cost/benefit ratio conditions. Second, in line with the effect that the more-than-fair (vs. the fair) offer triggers negative emotions but is not efficient in triggering lower estimated WTR, I found that the more-than-fair offer triggers more negative emotions in the 1/1 compared to the 1/3 and the 3/1 cost benefit ratio conditions, but doesn't have an impact on people's eWTR in different cost/benefit conditions.

The current design puts in conflict monetary payoff and the fairness norm: When experiencing advantageous inequality (i.e., receiving the more-than-fair offer), there is one source of positive affect and one source of negative affect. The positive affect results from the ego-based pleasure of receiving a relatively good outcome, whereas the negative affect follows the feeling of being unfairly advantaged. In most existing studies on fairness, the fair decision is in line with the monetary better-off decision (Van den Bos et al., 1997, 1998). Studies that did separate the self-serving purpose and the fair concern suggest that some people prefer an equitable outcome over an advantageous inequitable outcome (e.g., Austin, McGinn, & Susmilch, 1980; Van den Bos et al., 1997, 1998). Results from the current chapter provide an explanation of the underlying psychological mechanisms (emotions and cognition) that lead to the aversion of advantageous inequality. Concerning disadvantageous inequality, people formed more negative emotions and lower cognitive judgment when they received the less-than-fair offer compared to receiving the fair offer. Importantly, people showed higher negative emotions but also higher cognitive judgment when they received the more-than-fair offer as compared to receiving the fair offer. These results suggest that negative emotions rather than cognitive judgment contribute to the aversion of advantageous inequality.

My results help to reconcile conflicting hypotheses regarding cost/benefit ratios and receivers' responses under resource allocation. The economic and evolutionary perspective suggests that giving less-than-fair can trigger more negative feelings when the cost of giving is low. Psychological theories concerning social norms argue that people internalize the simple fairness norm of sharing 50/50 and that the violation of the even-split fairness triggers more negative responses compared to the violation of fairness even when the cost is lower. This chapter examined how cost/benefit affect receivers' internal states under resource allocation and found that people's emotional and cognitive responses follow the social norm of even-split fairness. Particularly, people have more negative emotions and lower cognitive judgment when the even-split fairness is violated compared to the non-even-split fairness is violated.

3.4.2 Limitations and Future Directions

In the current chapter, I used direct emotional ratings and eWTR to represent people's emotions and cognitions, respectively. These are rather simplified measurements based on self-report. Future research could deepen this line of research by using more objective ways to measure people's emotions and cognitions. For example, further research could look into people's brain activation underlying resource allocation at different cost/benefit ratios and focus on the emotion and cognition involved areas.

Using the current method, the variation of people's emotions and cognition are mainly explained by the different amount in their offers. Only a very small portion of the variation is explained by the interaction with cost/benefit ratios. This shows that although people's responses to fair and unfair treatments vary based on the cost benefit ratios, the effect size is small. This leaves a concern on how impactful the effect of cost/benefit ratios is on receivers' psychology. Further research could use different cost/benefit manipulation, varied paradigms to test this question and verify the effects in different cultures.

3.4.3 Conclusion

In the present work, I explored the emotions and cognitions of receivers underlying resource allocation at different cost benefit ratios. The findings are consistent with the implications following the fairness norm: People internalize the fairness norm and develop a strong negative response when the violation of the norm happens. The fairness norm is in the format that the even-split is fair as the cost is equal to the benefit in most resource allocation interactions. The current research resolves the conflicting hypothesis on how cost benefit affect receivers' psychology and highlights the even-split fairness norm.

Chapter 4 Playing Fair vs. Being Fair: The Value-Heuristics Model of Fairness Decision-making

4.1 Introduction

Philosophers, writers, theologians, biological and social scientists have grappled for centuries with the question of whether humans are innately driven by self-interest or fairness (Arrow, 1980; Camerer, & Fehr, 2006; Henrich et al., 2001). Growing empirical evidence has suggested that humans act fairly in many circumstances. In particular, people resist inequitable outcomes and prefer fair pay-offs, sometimes even when the unfair outcomes are in their favour (Dawes et al., 2007; Dawes, 2012; Engelmann & Strobel, 2004; Henrich et al., 2005; Henrich et al., 2006; Tricomi et al., 2010). Yet what remains unclear is the underlying mechanism for this behaviour: Are people predisposed toward acting fairly, or are they intuitively selfish, behaving fairly only through reflection and self-control?

Arguments for both selfish and fair decisions being intuitive have drawn on social science, economic perspective and evolutionary theory for support. For instance, proponents of the selfish disposition thesis have argued from the economic perspective for a rational, self-serving basis of human nature—the "*homoeconomicus*" (Ackerloff, 1970; Arrow, 1980; Williamson, 1985). In their view, to achieve a fair decision, people must override their selfish impulses, and do so in order to avoid the penalties associated with breaking social norms of fairness. Likewise, others have drawn on evolutionary theory, arguing that natural selection will favour the outcome in which an individual makes a selfish offer (i.e. offering nothing to someone else) when allocating resources if there is no way to penalize the selfish behaviour (Killingback and Studer, 2001).

In contrast, supporters of the fairness disposition perspective draw on social learning arguments, arguing that humans learn norms of fairness as children and internalize them, turning them into intuitions (Balliet, Parks, & Joireman, 2009; Rand, Greene, & Nowak, 2012). They have also used evolutionary theory, pointing to the survival benefits of fairness through mechanisms like kin selection, reciprocal altruism, reputation seeking, and group selection (Nowak 2006). Consistent with the view of fairness promoting evolutionary fitness, growing evidence from studies using economic games has documented that fair strategies generate more personal benefits than selfish strategies (Nowak, Page, Sigmund, 2000; Rand et al., 2013).

As the above highlights, empirical data to date have supported both the self-focused (Ackerloff, 1970, Arrow, 1980, Williamson, 1985) and fairness-focused perspectives (Killingback and Studer, 2001; Nowak, Page, Sigmund, 2000; Rand et al., 2013), leaving a major question of how to reconcile these sets of contradictory findings. Here, I aim to resolve the paradox by proposing and empirically testing a new framework, called the Values-Heuristics Framework of Fairness Decision-Making (VHF for short), which is built on empirical results from Chapter 2 and 3, and theories in studies of fairness and cognition. I provide empirical support for the VHF by using a series of reaction time-based experiments to test key hypotheses derived from its framework.

4.1.1 Using Temporal Dynamics to Understand Innateness of Behaviour

The selfish disposition thesis suggests that the decision to take a personal loss in order to make a fair allocation is a slow, effortful one—because it goes against people's selfish predispositions. On the contrary, the fairness disposition perspective hypothesizes that people are naturally fair, and thus fair decisions should be fast and intuitive. Recently, researchers have begun to empirically examine the competing perspectives by studying the *temporal dynamics* of fair behaviours. Much of the work has been guided by dual-process perspectives that view thinking as involving both fast and slow cognitive systems (Cornelissen et al., 2012; Chaiken & Trope, 1999; Evans, Dillon and Rand, 2015; Gospic et al., 2011; Kahneman, 2011; Piovesan & Wengström, 2009; Rubinstein, 2007; Schulz et al., 2012; Sloman, 1996; Stanovich & West, 2000; Sutter et al., 2003). Results to date have been mixed. On the one hand, some evidence suggests that behaving fairly is indeed slow and contemplative, in line with the notion that fairness goes against one's selfish instincts (Piovesan & Wengström, 2009; Rubinstein, 2007). However, other evidence suggests that a fair decision can be fast and intuitive (Cornelissen et al., 2012; Gospic et al., 2011; Rubinstein, 2007; Schulz et al., 2012; Sutter et al., 2003).

The conflicting results have not yet been reconciled, but there are clues in related literatures. One potential insight comes from a recent theory that used the dual-process perspective to reconcile the conflicting response time results of another common prosocial interaction: cooperation. Similar to fairness decision-making, choosing to cooperate also requires individuals to incur a personal cost to benefit others. Rand and colleagues have proposed the social heuristics hypothesis (Rand et al., 2014) to explain why (and for whom) intuition favours human cooperation. The SHH proposes that people internalize strategies that are typically advantageous and successful in their daily social interactions. For some people, these are cooperative strategies; for others, these are selfish strategies. People then bring these fast, intuitive responses with them into atypical social situations, such as most laboratory experiments. Slower, more reflective processes may then override these generalized automatic responses, causing people to shift their behaviour to take advantage of a particular context. By showing that selfish and cooperative decisions are both quick, the SHH suggests the existence of both selfish and cooperative predispositions.

Although SHH explains some of the variation in response times for cooperative behaviour, it does not fully account for cross-cultural differences in reaction times. SHH suggests the cooperative strategy is advantageous in most cultures, suggesting the cooperative intuition as the mainstream. Yet this thesis conflicts with many studies which have been done in numerous cultures that have reported that selfish decisions are faster than cooperative ones (Fiedler et al., 2013; Goeschl, & Diederich, 2014; Lohse, Piovesan & Wengström, 2009).

A second source of insight to explain the conflicting results on the intuitiveness of fairness is a group of studies that take into account decision conflict: They argue for a positive correlation between response time and the decision conflict that occurs when selfish and cooperative motives are equally strong (Evans, Dillon and Rand, 2015). Critically, these studies show that both extreme selfish (i.e., keep everything) and extreme cooperative decisions (i.e., give away everything) involve less conflict—and occur more quickly—than more nuanced, intermediate decisions (i.e., keep some and give away some). As with SHH, by showing that extreme selfish and cooperative decisions are both quick, the decision conflict perspective suggests the existence of both selfish and cooperative predispositions. Although decision conflict theory explains some of the mixed findings for cooperative decision-making response times, it does not fully account for the mixed findings for fairness decision-making response times. I propose that the extreme fair decision (i.e., splitting 50/50) reflects a strong and clear motive to be fair (compared to decisions between the extreme selfish and the extreme fair decision, e.g., splitting 30/70), and thus the level of conflict involved in making extreme fair decisions should be as low as it is with extreme selfish decisions. Both extreme fair and extreme selfish decisions should be equally fast according to the decision conflict theory, whereas results have found that fair decisions are faster than selfish decisions in some studies, and slower in other studies (Cornelissen et al., 2012; Chaiken & Trope, 1999; Evans, Dillon and Rand, 2015; Gospic et al., 2011; Kahneman, 2011; Piovesan & Wengström, 2009; Rubinstein, 2007; Schulz et al., 2012; Sloman, 1996; Stanovich & West, 2000; Sutter et al., 2003).

Collectively, both SHH and decision conflict theory provide strong theoretical starting points for understanding the dynamics of fairness decisions—but neither completely explains the empirical data for fairness decision-making. More importantly, the focus of both theories is on explaining cooperative vs. selfish decisions, rather than looking at fairness decisions. Although fairness and cooperation are both prosocial decisions, they differ in many respects (e.g., fairness focuses on a single actor whereas cooperation involves two parties), and thus may be explained by different processes. Indeed, to our knowledge, no existing theory has been able to explain the conflicting results in studies of response time in fairness versus selfish decision-making.

4.1.2 Values-Heuristics Framework

In the present paper, I draw inspiration from SHH and other dual-process models to propose the Values-Heuristics Framework (VHF) to explain the cognitive underpinnings of fairness decision-making. The VHF aims to provide a theoretical framework that can reconcile previous conflicting results in fairness decision-making, and provide a framework to explain the mechanism of the even-split heuristic I observed in Chapter 2 and 3.

Our model makes a distinction between two related constructs key in guiding human behaviour: Values (e.g. conscious, guiding principles about how the world works and how one should act) and heuristics (e.g. intuitive, quick cognitive shortcuts that guide behaviour without conscious processing; they are internalized to lessen cognitive load). Human societies have developed social *values* to guide social behaviour (Keltner et al., 2014; Lind, 2001). I propose that when it comes to fairness, individuals hold two main kinds of *values*, which are abstract endorsements of either selfish or fairness ideals. These values are translated into *heuristics*, which are simple and specific rules that individuals employ in daily life to quickly take actions that are consistent with their values (Kiyonari, Tanida, & Yamagishi, 2000; Lind, 2001; Roch et al., 2000). In other words, due to context, culture, and experience, some people develop and primarily act in alignment with fairness heuristics, while others develop and primarily act in alignment with selfish heuristics.

Values and heuristics typically match one another—a heuristic should reflect a quick, simple rule for behaviour that falls in line with the value. For example, an individual who holds primarily selfish values (e.g., "Take care of yourself first") would have internalized heuristics that produce fast, self-interested decisions in a resource allocation game (e.g., keep everything for myself). Likewise, an individual who holds primarily fair values (e.g., "Be fair to everyone") would have internalized heuristics that produce quick, fair decisions in a resource allocation game (e.g., split the money evenly).

There is growing reason to suspect that both fair and selfish values—and the heuristics that derive from them—are evolutionarily adaptive, and thus ripe for appearing in consequential numbers within the population. A recent meta-analysis of dictator game studies has highlighted that the two most popular response options are giving nothing and giving exactly half (Engel, 2011). Specifically, across 328 dictator game studies (N = 20,813), 36% of people gave nothing at all and 17% gave exactly half.

On the fairness side, studies have shown that fair decisions can be evolutionarily advantageous (i.e., lead to better payoffs; Rand et al., 2013), suggesting that people are likely to develop a fairness value and the corresponding heuristic. Indeed, numerous studies using resource allocation paradigms have documented people's preferences towards the fairness value. A commonly used paradigm is the ultimatum game, in which one person (the proposer) is given some resources (i.e., money) and decides how much to share with another person (the responder). The responder can choose to accept or reject the offer. If the responder accepts, the offer goes ahead. If the responder rejects, neither player gets anything. Results from most ultimatum games show that the majority of proposers offer 40 to 50% of the total sum (i.e., make fair offers), and about half of all responders reject offers below 30% (i.e., reject unfair offers; Bolton and Zwick, 1995; Fehr, & Gächter, 1999; Güth, et al., 1982; Thaler, 1988). This suggests that people act fairly and may be aware that acting fairly is an advantageous strategy (i.e., a fair offer is less likely to be rejected than an unfair one). Certainly, the fact that some responders would rather get nothing than accept an unfair offer is strong evidence for a deeply held fairness value. Correspondingly, a wide range of studies have shown that people make fair decisions in a fast and intuitive manner, which is consistent with there being a heuristic related to fairness (Manapat et al., 2013; Rand et al., 2014; Rand et al., 2013; Rand, Greene, & Nowak, 2012).

On the selfish side, in competitive environments where individual-level interests are central, or social values allow or promote selfishness, selfish rather than fair strategies may produce superior results for individuals and thus become internalized (Ellingsen et al., 2013; Gächter, Herrmann, & Thöni, 2010; Herrmann, Thöni, & Gächter, 2008; Killingback and Studer, 2001). The dictator game meta-analysis mentioned earlier suggests that many people hold selfish values (Engel, 2011). Evidence of fast and intuitive selfish decisions in a wide range of fairness decision-making scenarios provides evidence for selfish heuristics (Rubinstein, 2007).

Collectively, this body of work suggests that both fairness and selfish values exist within society, with some individuals primarily guided by values centered on self-interest, while others are primarily guided by values centered on fairness. The specific value that a person holds—or the relative strength of selfish versus fairness values a person has—depends on the experiences a person has, shaping their understanding of the world and other people. The values each person holds are conscious; however, to accelerate their deployment, people build up fast heuristics that typically guide decision-making.

4.1.3 Value-Heuristic Incongruence

Our current work tries to understand the temporal dynamics of fairness decision-making by building on two existing theories that study the temporal dynamics of cooperation: SHH and the decision conflict theory. SHH argues for a cooperative heuristic, suggesting that cooperative decisions are quick, but that selfish decisions take longer because contemplation is needed to override these cooperative heuristics (Rand et al., 2014). The decision conflict approach argues for both selfish and cooperative heuristics by reasoning that both extreme selfish and cooperative decisions are less conflicted, therefore faster than intermediate decisions (Evans, Dillon and Rand, 2015).

I theorize that people's heuristics have developed to reflect underlying values. Importantly, I propose that when these heuristics are used, an evaluative process occurs: People consider whether the heuristic reflects the underlying value that led to the heuristic's development. When a situation appears to be aptly handled by a heuristic, I expect individuals' decisions to be quick and intuitive. However, at times, one may encounter a situation where a basic heuristic does not seem to fit current situational demands, or a novel situation to which no existing heuristic can be readily applied. In these cases, the VHF predicts that individuals may fall back to slower, more cognitively taxing and contemplative processing to determine a course of action that best aligns with their values.

For example, empirical evidence suggests a specific heuristic for fairness: The even-split heuristic (e.g., a split of 50%/50%; Güth, Huck, & Müller, 2001; Kiyonari, Tanida, & Yamagishi, 2000; Roch et al., 2000; also see Chapter 2 and Chapter 3). For those who value fairness, their intuition might be "share half of what I have". However, there are contexts where a simple even-split does not result in equitable outcomes. For instance, using the modified dictator game with varied cost/benefit ratios, when costs are not equal to benefits, the even-split does not lead to the fair payoff. In real-life setting where an intermediary will take a percentage to facilitate the transfer, giving half of one's money to someone else will result in the receiver getting less than the giver. In such cases, I propose that people can override the imprecise even-split heuristics and reach a fairer decision, and that this process occurs through conscious, attention-demanding cognition, and thus is slow to complete. SHH suggests that a slower decision results in more selfish behaviour. In contrast, the VHF suggests that a slower decision may result in greater generosity, if a person's underlying value is fairness instead of selfishness. See Figure 4.1 for a demonstration of VHF.

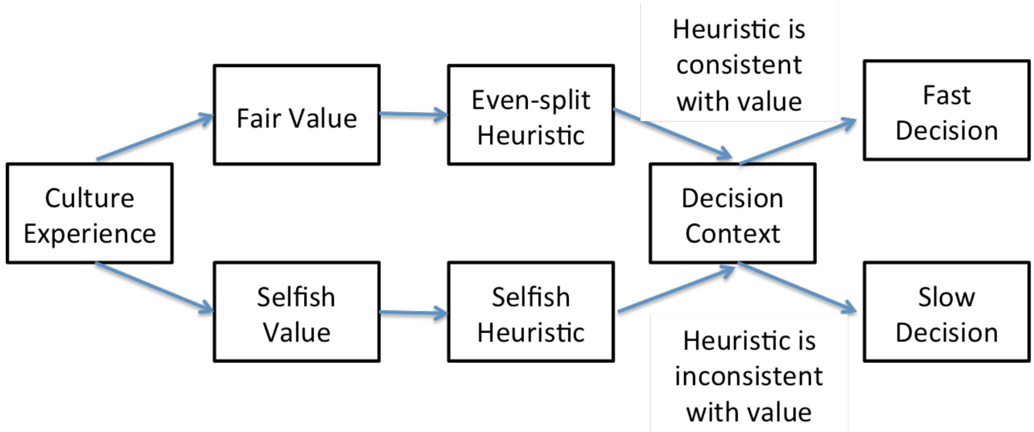

Figure 4.1. Culture experience leads to values. Heuristics derive from values. You take your heuristics with you to a decision context. If they are consistent with your values in that decision context, then you can make a fast decision. Otherwise, your decision will take longer.

In sum, the VHF expands the SHH and the decision conflict perspective in several ways (see Table 4.1). First, the VHF explains the process underlying reflective decisions. SHH provides evidence for cooperative heuristics but does not explain when and why cooperation can be slow and contemplative. Drawing on cognitive findings, I suggest that whether heuristics and values are consistent or not will be the key to determining the reaction time of a decision. Second, the VHF goes beyond the decision conflict perspective by revealing how the interaction between heuristics and values shapes response time when the level of conflict is constant.

Table 4.1. A comparison of social heuristic hypothesis, decision conflict theory and the value-heuristic framework

	Social Heuristic Hypothesis	Decision Conflict Theory	Value-Heuristic Framework
Theory	Cooperative decisions are advantageous in life so people internalize cooperation	When people have an extreme motive, they experience less conflict and make decisions faster.	When values and heuristics are conflicting, people need time to override the heuristic to arrive at a value-consistent decision.
Fast Decisions	Cooperative Decisions	Decisions with low conflict (extremely cooperative or selfish decisions)	Decisions in situations where values and heuristics are consistent (can be either fair or selfish decisions)
Slow Decisions	Selfish Decisions	Decisions with high conflict (intermediate decisions)	Decisions in situations where values and heuristics are inconsistent
Limitations	It cannot explain why some studies show that cooperative decisions are slow when cooperation is advantageous in that culture.	It cannot explain why response time is different when the level of motive conflict is the same.	

4.1.4 Present Studies

To test our model, I used the modified dictator game adopting from Chapter 2 and 3 with three cost/benefit ratio conditions. In the 1/1 cost/benefit ratio condition, an even 50% split produces equal payoffs to both sides and is considered fair. However, in the 1/3 and 3/1 conditions, the even-split heuristic (giving 50 out of 100) no longer yields payoffs that satisfy the fairness value. To equalize outcomes in the 1/3 cost/benefit ratio condition, the dictator would need to give 25 MUs, so that both parties receive 75 MUs. In the 3/1 cost/benefit ratio condition, the fairest outcome is to give 75 MUs, so that both parties end up with 25 MUs. By manipulating cost/benefit ratios, I created both a condition where the even-split heuristic results in a fair outcome (i.e., the 1/1 cost/benefit ratios) and conditions where the even-split heuristic is no longer consistent with the value of fairness (i.e., the 1/3 and the 3/1 cost/benefit ratio condition).

Based on existing evidence, I theorize that decisions about how much to give do not fall along a continuum (Engel, 2011; Andreoni & Miller, 2002; Andreoni, & Vesterlund, 2001). Instead, dictators tend to choose from a smaller number of discrete options: the completely selfish decision (giving 0 MUs), the even-and-fair decision (i.e., giving 50 MUs in the 1/1 cost/benefit ratio condition), the even-but-not-fair decision (i.e., giving 50 MUs in the 1/3 and the 3/1 cost/benefit ratio conditions), and the not-even-but-fair decision (i.e., giving 25 MUs in the 1/3 condition, and 75 MUs in the 3/1 cost/benefit ratio condition). While the allocation of 100 MU's yields 100 possible options for participants, the majority of participants will select one of the four above decisions.

The present work was guided by three central hypotheses derived from VHF. First, both the selfish and the even-and-fair decisions would be fast and intuitive, as both are readily handled by pre-existing heuristics corresponding to selfish and fair values, respectively. Second, in situations where decisions that followed the simple fair heuristic conflicted with the underlying value of fairness (i.e., even-but-not-fair decisions), I expected that people would need more time to consider how their behaviour aligns with fair values, and thus the decision-making process would require more cognitive processing. Finally, I hypothesized that the not-even-but-fair decision would take even more time than the even-but-not-fair decision. Whereas the even-but-not-fair decision resolves the value-heuristic conflict by sticking with the heuristic, the not-even-but-fair decision resolves the conflict by re-aligning with the underlying value. This requires more cognitive processing, and thus takes longer.

I conducted 7 studies to test these hypotheses. In Study 1, I tested the response time of both value-heuristic match and mismatch decisions using a modified dictator game with varied cost/benefit ratios. In Study 2, I measured the values underlying each decision and investigated the link between values and heuristics. Study 3 aimed to rule out the idea that the conflict difference between decisions fully explains the response time difference by replicating the above response time dynamics after controlling for conflict level. Study 4 used a slight modification to the dictator game procedure, in order to replicate the results with a better control of calculation difficulty differences. Study 5 investigated how long it took the receiver to process a decision, instead of how long it took the giver to make a decision. Study 6 used a different design to test VHF: Instead of manipulating the cost/benefit ratio, Study 6 introduced the fairness value-heuristic mismatch by manipulating the dictator's social economic status (SES) relative to the receiver's SES. Finally, Study 7 used a time constraint method (Rand et al., 2014) to support a causal link between intuition and the even-split heuristic decision, and between contemplation and the fairness value-consistent decision.

4.2 Study 1: Examining the Response Time of Different Decisions

4.2.1 Methods

Participants. The same recruitment and payment strategy was used for all 7 studies. I recruited 600 participants (555 of whom completed all procedures; M_{Age} = 32, *SD* = 10; 37% female) from the U.S. through Amazon Mechanical Turk (AMT). Sample sizes were selected by assuming a small to moderate effect size (0.02 – 0.15) with the degrees of freedom for the numerator as 3 (I planned to compare response time among 4 decisions) and aiming to have 0.95 power level to detect the effect in regression models. The same method of determining the sample size was applied to all other studies in this manuscript. All participants completed the study online. In accordance with standard AMT wages, each participant was given a US $0.60 fee for participating. Participants were told that they would earn more money based on their decision in an economic task—an anonymous dictator game.

Materials and Procedure. In Study 1, each participant was connected with a partner (a computer programmed confederate), and then was ostensibly randomly assigned to the dictator role. Each participant was randomly assigned to one of the three cost/benefit ratio conditions: the 1/3, the 1/1 or the 3/1 cost/benefit ratio condition. I instructed the participants that, as the dictator, they would be endowed with 100 money units (MUs) while the receiver would be given 0 MUs. Dictators were asked to decide how much to share, and input this sharing amount (x) into a textbox. The corresponding payoffs for him-/herself (i.e., 100-x) and the receiver (i.e., 3x in the 1/3 cost/benefit ratio condition, x in the 1/1 cost/benefit ratio condition, and x/3 in the 3/1 cost/benefit ratio condition) were computed as they typed, and immediately presented on the screen. The simultaneous presentation of the final payoffs for both the self and the partner helped to reduce the effect of varied calculation difficulties among different cost/benefit conditions. Response time (how long it took each participant to make their decision) was recorded as the number of milliseconds between the *onset moment*, when the decision screen was displayed, and the *submission moment*, when participants clicked a button to submit the MUs they had chosen to donate. I did two more identical studies serving as replication and validation of Study 1 (see Supplementary Materials for more details).

In all studies, once the decisions of all participants had been collected, payoffs were calculated by translating two MUs into one cent, and bonuses were paid through AMT.

The Research Ethics Committee from Psychology Department at the University of Cambridge (Reference code: Pre.2013.139) approved all studies in Chapter 2 and Chapter 4.

4.2.2 Results

Selfish, Even and Fair Decisions. I first calculated the percentage of each kind of decision (i.e., the selfish, the even-and-fair, the even-but-not-fair, the not-even-but-fair, and all remaining other decisions)[3]. I found that 10% of participants made the selfish decision (i.e., giving 0 MUs); 33% made the even-and-fair decision (i.e., giving 50 MUs in the 1/1 cost/benefit ratio condition); 10% made the even-but-not-fair decision (i.e., giving 50 MUs in the 1/3 and the 3/1 cost/benefit ratio condition); 23% made the not-even-but-fair decision (i.e., giving 25 MUs in the 1/3 cost/benefit ratio condition, and giving 75 MUs in the 3/1 cost/benefit ratio condition); 24% made all remaining other decisions. This result show that the majority of participants (76%) either acted in accordance with selfish values (10%), or with fairness values or their corresponding heuristic, or both (66% of all the participants).

Response Times. To examine whether people are intuitively selfish or intuitively fair, I compared the difference in average response time between the four main decision strategies: the selfish decision (M = 9.51, SD = 6.54), the even-and-fair decision (M = 9.92, SD = 6.16), the even-but-not-fair decision (M = 11.25, SD = 6.24),

[3] Here I reported the scaled percentage. For example, 82 participants out of the 555 who completed the procedures made the selfish decision. The percentage of selfish decisions was 82/555 = 15%. 94 participants made the even-and-fair decision. Only participants in the 1/1 cost benefit condition (n = 191) could make the even-and-fair decision so the percentage of even-and-fair decisions was 94/191 = 49%. Similarly, I calculated the percentage of even-but-not-fair decisions to be 15%, the percentage of not-even-but-fair decisions to be 34%, and the percentage of other decisions to be 36%. In this way, the percentage summed up to be 150% so I multiplied this percentage by 2/3 to adjust the sum to be 100%. The same calculation was applied to the decision percentage result in all studies.

and the not-even-but-fair decision (M = 17.25, SD = 9.60). I tested the difference between response times in each decision pair in the context of a regression analysis in which I predicted response time from the dummy-coded decision pair (e.g., Even-and-fair = 1 vs. Selfish = 0), including only the people who made one of the two decisions. Response times were log (base 10, as in Rand, Greene & Nowak, 2012) transformed to account for a heavily right-skewed distribution. This method was applied to all response time comparisons between decision pairs in this manuscript.

Table 4.2 shows the logged response time difference between decision pairs among the four decision categories. For visualization, Figure 4.2 depicts the mean and the SE of raw response time for each of the four decision categories. Results show that participants took the shortest time to make the selfish and the even-and-fair decisions. These results support the idea that people have both selfish and even-and-fair heuristics, which I hypothesize are derived from self-focused and fairness-focused values.

On average, participants took slightly longer to make the even-but-not-fair decision compared to the even-and-fair decision or the selfish decision. These results provide more evidence for the even-split heuristic: when the even-split heuristic fails to reflect the fair value, following this heuristic is still relatively fast and intuitive, though the value-heuristic incongruence does seem to cause some hesitation.

Finally, I found that the slowest decision was the not-even-but-fair decision. This suggests that when applying the heuristic does not reflect a person's fairness value, arriving at a value-consistent decision needs contemplation and reflection. This result challenges the assumption from SHH that on average contemplative decisions always shift towards selfish behaviours that are most advantageous in context. I show that, on average, contemplation can still produce fair behaviours that may not support self-interest.

Table 4.2. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs in Study 1

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	.046 (.043)	0.081	-.114, .206
Even-but-not-fair vs. Selfish	.243 (.208)*	0.098	.049, .437
Not-even-but-fair vs. Selfish	.603 (.447)***	0.085	.436, .770
Even-but-not-fair vs. Even-and-fair	.197 (.179)*	0.089	.021, .373
Not-even-but-fair vs. Even-and-fair	.557 (.439)***	0.078	.404, .711
Not-even-but-fair vs. Even-but-not-fair	.360 (.272)***	0.096	.171, .550

Note. *$p < .05$. ***$p < .001$.

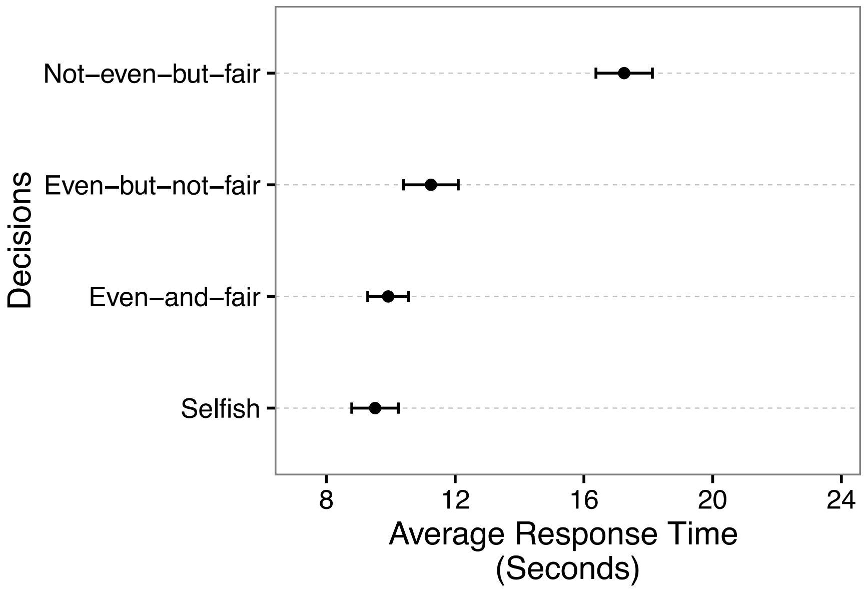

Figure 4.2. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions in Study 1.

Figure 4.3 depicts the response time breaking down by decisions and cost/benefit ratios. It illustrates the pattern that the even-but-not fair decision in both the high and low cost/benefit ratio condition was slower than the even-and-fair decision and faster than the not-even-but-fair decision in both high and low cost/benefit ratio condition.

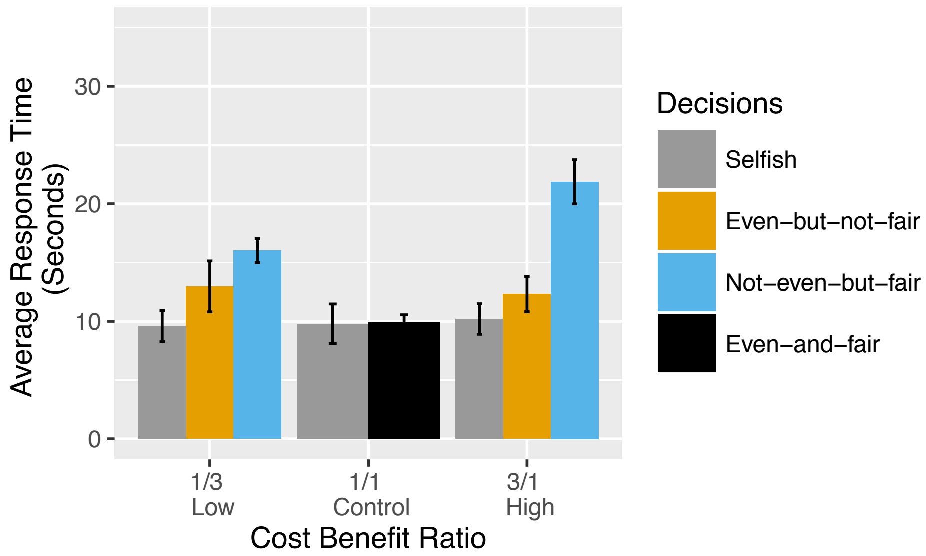

Figure 4.3. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions at different cost/benefit ratios in Study 1.

Two replications, reported in the Supplementary Materials (see Appendix), also found similar results: selfish and even-and-fair decisions were faster than even-but-not-fair decisions, which were faster than not-even-but-fair decisions.

4.3 Study 2: Examining the Values of Different Decisions

In Study 1, I found that people tended to make the selfish and the even-and-fair decision quickly, but were slower when making the even-but-not-fair decision, and even slower when making the not-even-but-fair decision. I hypothesized, and the results from Study 1 were consistent with the proposition that a fair or a selfish decision is fast when corresponding values and heuristics are matched, and slow when values and heuristics are conflicted. To test our hypothesis, I needed to empirically demonstrate that decision-making was indeed tapping into overarching values.

Study 2 aimed to do just this by measuring the values underlying different decisions. I expected participants who made the even-and-fair, the even-but-not-fair, and the not-even-but-fair decisions to have higher fairness values and lower selfish values than those who made the selfish decision. For those who held fairness values, the corresponding heuristic was to make an even-split. When the even-split heuristic failed to reflect the underlying value (i.e., deliver equal payoffs to both sides), those who held stronger fairness values would take more time to arrive at the decision that is in line with fairness values.

4.3.1 Methods

Participants, Materials and Procedure. 600 participants (571 of whom completed all procedures, M_{Age} = 20, *SD* = 12, 44% female) were recruited from MTurk and were asked to play the dictator game with different cost/benefit ratios as in Study 1. Unlike in Study 1, dictators were asked to use a slider of 0 to 100 to indicate the sharing amount (x) rather than inputting the value into a textbox. The corresponding payoffs for him-/herself and the receiver were computed as they moved the arrow on the slider, and immediately presented on the screen. After finishing the task, participants were instructed to answer questions about their values.

I used two ways to measure participants' values. One was using direct questions about how much they valued fairness, "The fairness value (i.e., treating other people fairly and expecting other people to treat me fairly) is important to me", and how much they valued self-interest, "Pursuing personal benefit is an important value to me" (Scale of 1 = *not at all* to 5 = *very much*). The second was using an established questionnaire—the Schwartz Value Survey (SVS; Schwartz, 1994; scale of -1 = *the opposite* to 9 = *extremely strong*). In SVS, Valuing Benevolence is defined as preserving and enhancing the welfare of those with whom one is in frequent personal contact, and valuing Universalism is defined as understanding, appreciation, tolerance, and protection for the welfare of all people and for nature. I chose these two dimensions as approximate measures of valuing fairness. In contrast, valuing Achievement is defined as valuing personal success through demonstrating competence according to social standards, and valuing Power is defined as valuing social status and prestige, control or dominance over people and resources. I chose these two as estimated measures of valuing self-interest.

4.3.2 Results

Selfish, Even and Fair Decisions. I found that 15% of participants made the selfish decision; 33% made the even-and-fair decision; 9% made the even-but-not-fair decision; 19% made the not-even-but-fair decision; 23% made all remaining other decisions. These percentages are nearly identical to those in Study 1. Similarly, this result shows that the majority of participants (77%) either acted in accordance with selfish values (15%), or with fairness values or their corresponding heuristic, or both (62% of all the participants).

Response times. I first replicated the regression analysis of Study 1, predicting the log (base 10) transformed response time as a function of dummy-coded decision pairs. Results show the same pattern as in Study 1, that the selfish (M = 13.36, SD = 10.40) and the even-and-fair decisions (M = 16.19, SD = 7.69) were fast whereas the even-but-not-fair (M = 21.08, SD = 11.58) and the not-even-but-fair decisions (M = 22.36, SD = 11.29) were slow (Table 4.3). For visualization, see Figure 4.4 (and see Figure 4.5 for visualization breaking done in cost/benefit ratios).

Table 4.3. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs in Study 2

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.323 (0.286)***	0.073	0.18, 0.467
Even-but-not-fair vs. Selfish	0.535 (0.371)***	0.103	0.331, 0.738
Not-even-but-fair vs. Selfish	0.614 (0.478)***	0.076	0.464, 0.763
Even-but-not-fair vs. Even-and-fair	0.211 (0.218)**	0.079	0.055, 0.367
Not-even-but-fair vs. Even-and-fair	0.29 (0.316)***	0.062	0.167, 0.413
Not-even-but-fair vs Even-but-not-fair	0.079 (0.077)	0.086	-0.091, 0.249

Note. $^{***}p < .001$.

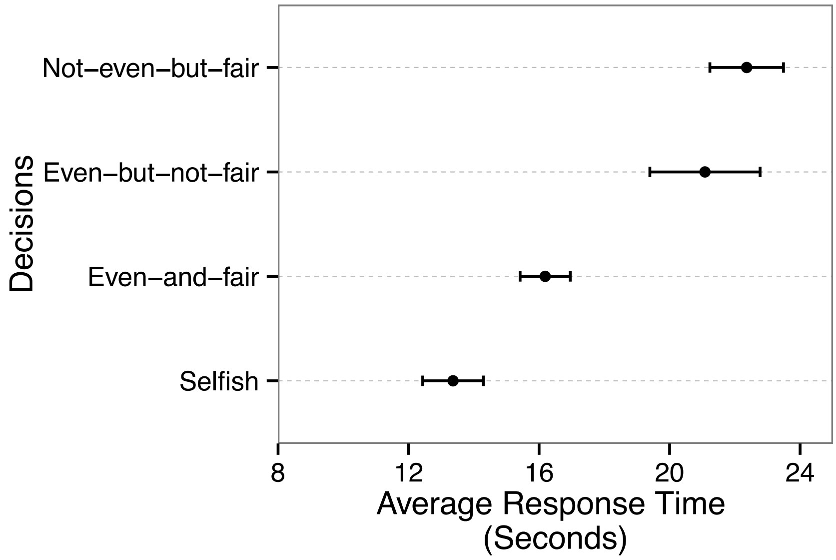

Figure 4.4. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions in Study 2.

The difference in how participants inputted the sharing amount (i.e., text box vs. slider) may contribute to the general difference in response time between Study 1 and Study 2.

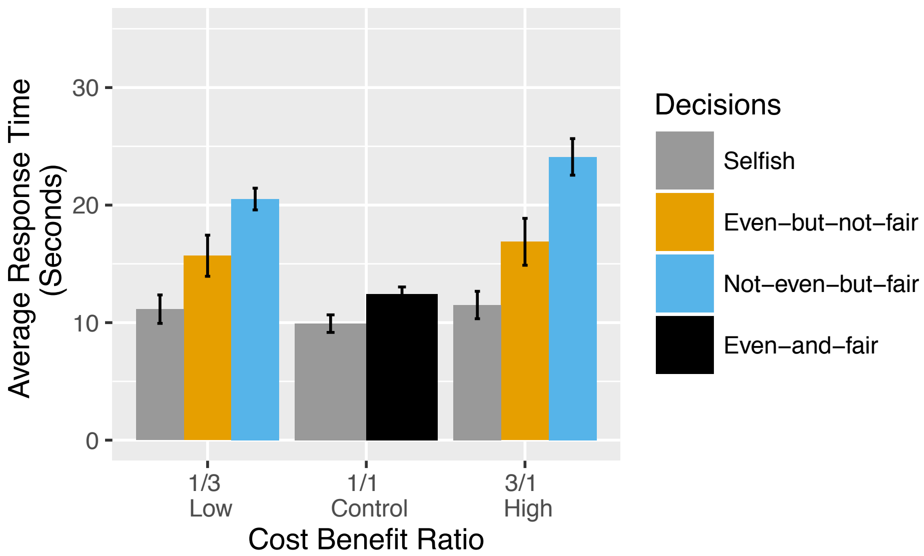

Figure 4.5. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions at different cost/benefit ratios in Study 2.

Values. Next I assessed whether participants' decisions matched the values that they had endorsed. I tested this in the context of a regression analysis in which I examined the association between values (fairness and self-interest; z-scored) and the dummy-coded decision pair (e.g., Even-and-fair = 1 vs. Selfish = 0). This association represents the degree to which participants who made each decision differed in their endorsement of fairness/self-interest values. The same analysis was applied to comparing underlying values between decision pairs throughout this manuscript.

Table 4.4 shows the difference between types of decision makers in valuing fairness and self-interest. Figures 4.6-4.7 depict the mean and SE of valuing fairness and self-interest in each of the four decisions. These results revealed that selfish decision makers valued fairness less (M_f= 3.44, *SD* = 1.00) and valued self-interest more (M_{si}= 3.86, *SD* = 0.90) than any fair decision makers: even-and-fair (M_f= 4.24, *SD* = 0.75; M_{si} = 3.33, *SD* = 1.05), even-but-not fair (M_f = 4.10, *SD* = 0.71, M_{si} = 3.1, *SD* = 1.03), not-even-but-fair (M_f = 4.23, *SD* = 0.67, M_{si} = 3.25, *SD* = 0.96). I also examined the differences in values between those who made intermediate decisions and those who made selfish or fair decisions (see Supplementary Materials for detailed analysis).

Table 4.4. Regression results examining z-scored valuing fairness and self-interest as a function of dummy-coded decision pairs in Study 2

Outcome	Valuing Fairness			Valuing Self-interest		
Predictor	*B(β)*	*SE*	*95% CI*	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.848 (0.378)***	0.143	0.565, 1.13	-0.728 (-0.359)***	0.131	-0.986, -0.47
Even-but-not-fair vs. Selfish	0.872 (0.385)***	0.163	0.551, 1.194	-0.841 (-0.379)***	0.16	-1.157, -0.525
Not-even-but-fair vs. Selfish	0.932 (0.423)***	0.137	0.661, 1.202	-0.729 (-0.372)***	0.126	-0.977, -0.481
Even-but-not-fair vs. Even-and-fair	0.025 (0.013)	0.158	-0.287, 0.336	-0.113 (-0.056)	0.17	-0.448, 0.223
Not-even-but-fair vs. Even-and-fair	0.084 (0.044)	0.139	-0.19, 0.358	-0.001 (-0.001)	0.134	-0.266, 0.264
Not-even-but-fair vs Even-but-not-fair	0.059 (0.034)	0.146	-0.23, 0.348	0.112 (0.058)	0.16	-0.205, 0.428

Note. $^{***}p < .001$.

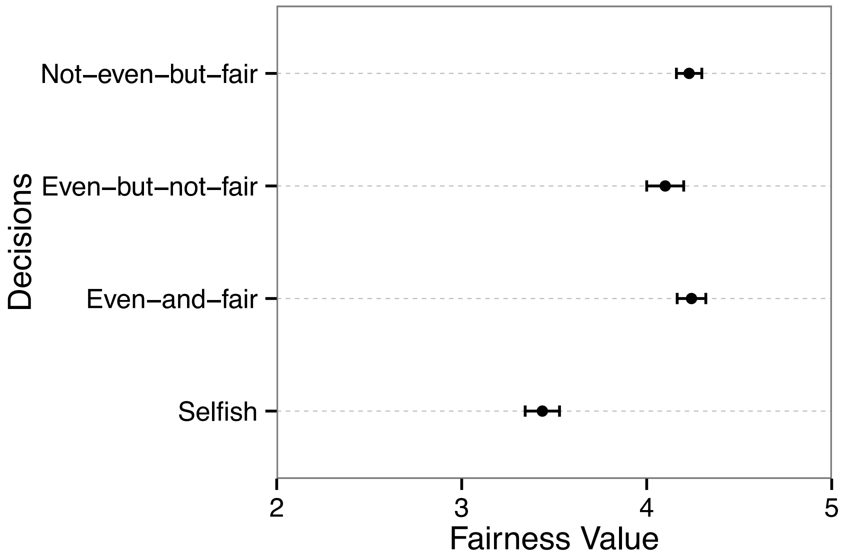

Figure 4.6. Mean and SE of fairness values for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions.

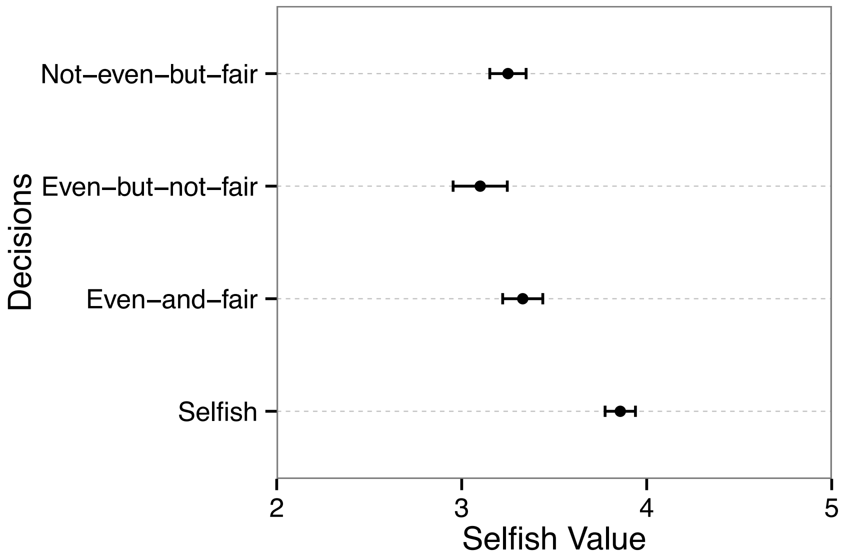

Figure 4.7. Mean and SE of selfish values for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions.

Results from SVS revealed a similar pattern: Selfish decision makers trended towards valuing Benevolence (M_B = 6.67, *SD* = 1.45) and Universalism (M_U = 6.22, *SD* = 1.47) less, and Power (M_P = 4.95, *SD* = 1.76) more-than-fair decision makers:

even-and-fair (M_B = 7.37, *SD* = 1.09; M_U = 6.95, *SD* = 1.21; M_P = 4.42, *SD* = 1.89), even-but-not fair (M_B = 7.27, *SD* = 0.95; M_U = 7.12, *SD* = 1.07; M_P = 4.20, *SD* = 1.80), not-even-but-fair (M_B = 7.20, *SD* = 1.05; M_U = 6.85, *SD* = 1.22; M_P = 4.18, *SD* = 1.73; see Tables 4.5-4.6). I did not observe any difference between selfish and fair decision makers in valuing Achievement, however (selfish: *M* = 6.37, *SD* = 1.35; even-and-fair: *M* = 6.56, *SD* = 1.24; even-but-not fair: *M* = 6.43, *SD* = 1.26; not-even-but-fair: *M* = 6.36, *SD* = 1.36). For visualizing, see Figures 4.8-4.9.

Table 4.5. Regression results examining z-scored fairness-related values (Benevolence and Universalism) as a function of dummy-coded decision pairs in Study 2

Outcome	Benevolence			Universalism		
Predictor	*B(β)*	*SE*	*95% CI*	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.568 (0.261)***	0.142	0.289, 0.847	0.543 (0.255)***	0.138	0.27, 0.815
Even-but-not-fair vs. Selfish	0.485 (0.202)**	0.179	0.133, 0.838	0.675 (0.285)***	0.173	0.334, 1.016
Not-even-but-fair vs. Selfish	0.426 (0.201)**	0.139	0.153, 0.7	0.467 (0.221)***	0.138	0.195, 0.74
Even-but-not-fair vs. Even-and-fair	-0.082 (-0.046)	0.146	-0.372, 0.207	0.132 (0.071)	0.153	-0.169, 0.434
Not-even-but-fair vs. Even-and-fair	-0.142 (-0.082)	0.122	-0.383, 0.1	-0.075 (-0.041)	0.13	-0.332, 0.181
Not-even-but-fair vs Even-but-not-fair	-0.059 (-0.034)	0.142	-0.339, 0.221	-0.208 (-0.111)	0.153	-0.511, 0.095

Note. $^{***}p < .001$.

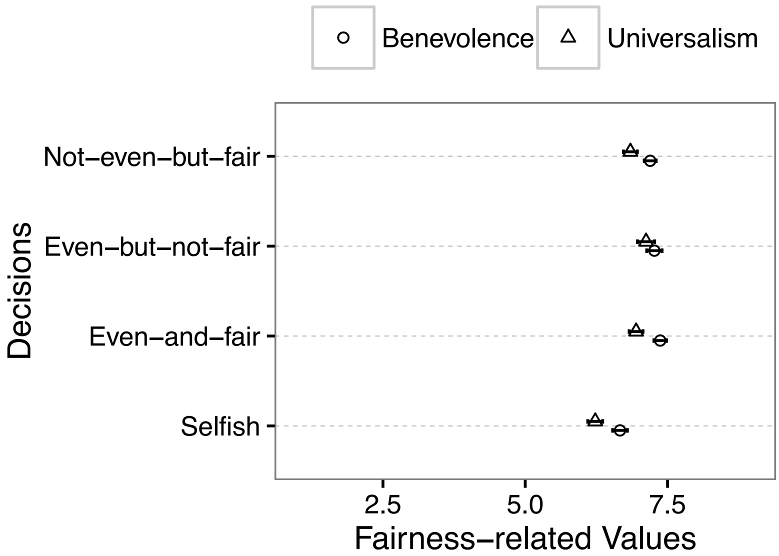

Figure 4.8. Mean and SE of Benevolence and Universalism for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions.

Table 4.6. Regression results examining z-scored selfish-related values (Achievement and Power) as a function of dummy-coded decision pairs in Study 2

Outcome	Achievement			Power		
Predictor	*B(β)*	*SE*	*95% CI*	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.14 (0.072)	0.131	-0.117, 0.398	-0.284 (-0.146)*	0.129	-0.538, -0.029
Even-but-not-fair vs. Selfish	0.041 (0.019)	0.161	-0.276, 0.358	-0.4 (-0.19)*	0.157	-0.709, -0.091
Not-even-but-fair vs. Selfish	-0.01 (-0.005)	0.135	-0.276, 0.256	-0.413 (-0.218)***	0.123	-0.656, -0.169
Even-but-not-fair vs. Even-and-fair	-0.099 (-0.053)	0.155	-0.406, 0.207	-0.116 (-0.056)	0.171	-0.454, 0.222
Not-even-but-fair vs. Even-and-fair	-0.15 (-0.078)	0.137	-0.421, 0.121	-0.129 (-0.068)	0.135	-0.396, 0.138
Not-even-but-fair vs Even-but-not-fair	-0.051 (-0.025)	0.166	-0.378, 0.277	-0.013 (-0.007)	0.161	-0.33, 0.305

Note. * $p < .05$. $^{***}p < .001$.

Figure 4.9. Mean and SE of Achievement and Power for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions.

Collectively, the above results revealed that selfish decision makers more strongly endorse values of self-interest and power than do fair decision makers; in contrast, fair decision makers more strongly endorse values centering on fairness and cooperation than do selfish decision makers. These results are consistent with the VHF model, which hypothesizes that people act according to their values.

4.4 Study 3: Examining the Conflicts of Different Decisions

The above two studies have established how the congruency of one's heuristics and values affects response time in fairness decision-making. According to the decision conflict theory (Evans, Dillon and Rand, 201515), however, the level of conflict between opposing values is the key factor that leads to the different response times. More specifically, both extremely selfish (i.e., keep all) and extremely cooperative (i.e., give all) decisions involve lower conflict level than intermediate decisions (i.e., keep some, give some), and thus should have shorter response times. According to this theory, the longer response times in the even-but-not-fair and the not-even-but-fair decisions compared to the even-and-fair and the selfish decision should be explained by a higher level of conflict, and there would be no reason to expect a difference in response time between the even-but-not-fair and the not-even-but-fair decisions.

In contrast, the VHF proposes that selfish, even-and-fair, even-but-not-fair and not-even-but-fair decisions all reflect underlying values and therefore involve a low level of conflict. Consequently, I suggest that conflict differences are not the main driver behind the response time difference among the four decisions. Support for classifying these four discrete decisions as extreme, and "other" decisions (e.g., sharing 20 or 80) as intermediate, comes from the value endorsements in Study 2. For fairness values, even-and-fair, even-but-not-fair and not-even-but-fair decision makers endorsed fairness-related values more than "other" decision makers, who endorsed fairness-related values more than selfish decision makers (see Supplementary Materials for details). For selfish values, even-and-fair, even-but-not-fair and not-even-but-fair decision makers endorsed selfish-related values less than "other" decision makers, who endorsed selfish -related values less than selfish decision makers. The fact that "other" decision makers reported intermediate levels of value endorsement supports the idea that they might experience more conflict than people who make decisions consistent with fairness or selfish values (i.e., our four discrete decision categories).

Based on this, I tested three hypotheses in Study 3. First, I reasoned that the selfish, the even-and-fair, the even-but-not-fair, and the not-even-but-fair decisions fall into the extreme decision category, whereas other decisions fall into the intermediate category. Therefore, I expected that our four discrete decision categories would involve lower conflict than all other decisions, but there was no reason to expect that they would differ from each other in the level of conflict. Second, I expected to replicate the results in Evans and colleagues' paper (2015) that extreme decisions occur faster than intermediate ones, and that response time is positively correlated with the conflict level. Finally, I aimed to show that conflict was not the main driver of the response time differences among the four extreme decisions by showing that the response time dynamics were instead in line with predictions from the value-heuristic model after controlling for the conflict level.

4.4.1 Methods

Participants, Materials and Procedure. As in Studies 1 and 2, I recruited 600 participants (590 after excluding participants who did not complete all procedures, M_{Age} = 33, *SD* = 11; 41% female) from MTurk and asked them to partake in the dictator game with different cost/benefit ratios. Participants used the slider as in Study

2 to indicate the sharing amount. After finishing the task, participants were instructed to answer questions about the conflict they experienced during their decision.

As Evans et al. (2015) suggested, I defined *general conflict* using the question: “How conflicted do you feel about your decision?” (Scale of 1 = *not at all*, to 5 = *very much*). For an alternate way of measuring conflict, which showed similar results, please see Supplementary Materials.

4.4.2 Results

Selfish, Even and Fair Decisions. Replicating our findings from Studies 1-2, I found that 17% of participants made the selfish decision, 33% made the even-and-fair decision, 9% made the even-but-not-fair decision, 20% made the not-even-but-fair decision, and 21% made all remaining other decisions. Similar to our earlier studies, this result shows that the majority of participants (79%) either acted in accordance with selfish values (17%), or with fairness values or their corresponding heuristic, or both (62% of all the participants).

Conflict in Decisions. To test our first hypothesis, that the four discrete decision categories are all lower in conflict than other decisions—and likely are all similar in conflict level to one another—I built a regression model predicting the z-scored conflict level as a function of dummy-coded decision pairs. As hypothesized, I found a lower level of conflict for selfish (M = 2.06, SD = 1.38), even-and-fair (M = 1.74, SD = 1.29), even-but-not-fair (M = 2.33, SD = 1.33), and not-even-but-fair (M = 1.80, SD = 1.16) decisions than for other, intermediate decisions (M = 2.75, SD = 1.40); Table 4.7). Furthermore, there were few significant differences in the conflict levels among the four extreme decisions. See Figure 4.10 for visualization.

Table 4.7. Regression results examining z-scored conflict as a function of dummy-coded decision pairs

Predictor	*B(β)*	*SE*	*95% CI*
Other (1) vs. Selfish (0)	0.691 (0.241)***	0.154	0.387, 0.995
Other vs. Even-and-fair	1.015 (0.334)***	0.176	0.669, 1.362
Other vs. Even-but-not-fair	0.418 (0.121)+	0.232	-0.038, 0.874
Other vs. Not-even-but-fair	0.953 (0.335)***	0.158	0.643, 1.263
Even-and-fair vs. Selfish	-0.324 (-0.117)+	0.179	-0.676, 0.028
Even-but-not-fair vs. Selfish	0.273 (0.084)	0.232	-0.185, 0.731
Not-even-but-fair vs. Selfish	-0.262 (-0.101)	0.16	-0.578, 0.053
Even-but-not-fair vs. Even-and-fair	0.597 (0.212)*	0.238	0.127, 1.067
Not-even-but-fair vs. Even-and-fair	0.062 (0.025)	0.171	-0.276, 0.4
Not-even-but-fair vs. Even-but-not-fair	-0.535 (-0.196)*	0.213	-0.956, -0.114

Note. $^{+}p < .10.$ $^{*}p < .05.$ $^{***}p < .001.$

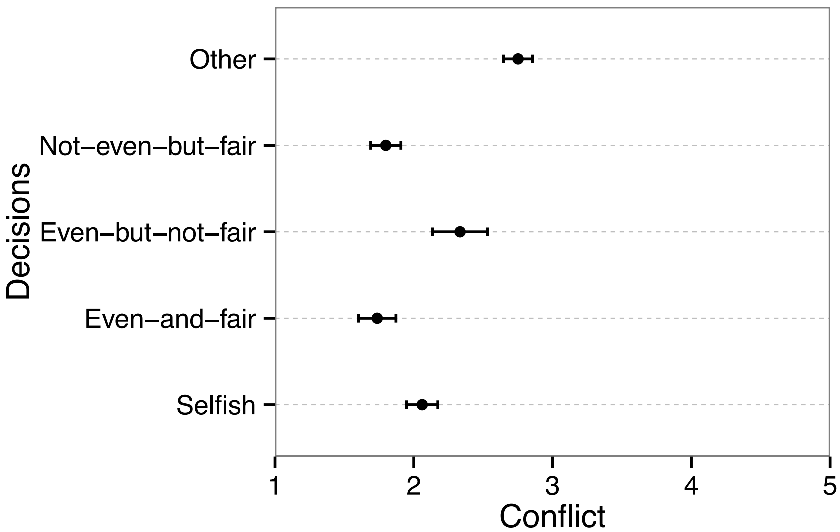

Figure 4.10. Mean and SE of conflict for selfish, even-and-fair, even-but-not-fair, not-even-but-fair, and all other decisions.

Response Times. To test our second hypothesis, that greater conflict is indeed related to slower reaction time, I did a correlational analysis between the response time and the conflict level. Replicating Evans and colleagues' (2015), our results show a positive correlation between response time and the conflict level, $r = 0.172$, $t(581) = 4.199$, $p < 0.001$.

Finally, I tested our third hypothesis, that this relationship between conflict and response time is not sufficient to explain the response time dynamics among the four extreme decisions. To test this hypothesis, I did the same regression analysis on response time as in Studies 1 and 2, but this time I controlled for conflict by adding it as an extra predictor (z-scored). Even with this control, our results strongly mirrored the findings in Studies 1 and 2. In particular, and as shown in Table 4.8, the selfish ($M = 11.40$, $SD = 8.61$) and even-and-fair decisions ($M = 12.44$, $SD = 5.54$) were the fastest, followed by not-even-but-fair decisions ($M = 18.13$, $SD = 10.14$). Not-even-but-fair decisions ($M = 21.26$, $SD = 8.54$) were the slowest.

Table 4.8. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs and conflict in Study 3

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.163 (0.148)*	0.071	0.023, 0.302
Conflict	0.041 (0.103)	0.026	-0.01, 0.091
Even-but-not-fair vs. Selfish	0.479 (0.333)***	0.097	0.287, 0.671
Conflict	0.053 (0.12)	0.03	-0.006, 0.113
Not-even-but-fair vs. Selfish	0.747 (0.572)***	0.067	0.616, 0.879
Conflict	0.062 (0.123)	0.026	0.011, 0.112
Even-but-not-fair vs. Even-and-fair	0.34 (0.345)***	0.082	0.178, 0.501
Conflict	0.008 (0.023)	0.029	-0.049, 0.065
Not-even-but-fair vs. Even-and-fair	0.58 (0.556)***	0.061	0.46, 0.699
Conflict	0.031 (0.072)	0.025	-0.018, 0.08
Not-even-but-fair vs. Even-but-not-fair	0.263 (0.25)**	0.083	0.099, 0.427
Conflict	0.047 (0.123)	0.03	-0.013, 0.108

Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

I also measured conflict in a different way and found the same temporal dynamics after controlling for conflict (please see Supplementary Materials for more details).

The above results support the decision conflict perspective by showing that extreme decisions involve a lower conflict and take longer to reach than intermediate ones. Importantly, these results reveal how the congruence between heuristics and values shapes response time when the level of conflict is constant: Given a particular level of conflict, the congruency between heuristics and values leads to a fast decision process, whereas an incongruence leads to a slower decision process, consistent with the idea that contemplation is needed to override the heuristic and to reach a value-consistent decision.

4.5 Study 4: Reducing the Calculation Complexity Difference of Different Decisions

One possible issue in the design of our first three studies is that the difference in response times among the even-and-fair, the even-but-not-fair, and the not-even-but-fair decisions may be an artefact of a difference in calculation difficulties. It can be argued that rather than relying on an instinctive tendency to give 50 MUs, participants who valued fairness spent extra time to calculate which exact amount was fair when the cost/benefit ratio was not 1/1.

To address this issue, I conducted Study 4 using the same modified dictator game as in Studies 1-3, but with a modification that allowed participants to make their decision without doing any calculations. In particular, I displayed to participants all possible payoffs for themselves and the recipient simultaneously on screen and asked participants to choose one of them.

4.5.1 Methods

Participants, Materials and Procedure. I recruited 600 participants (588 of whom completed all procedures, M_{Age} = 36, *SD* = 13, 53% female) and instructed them to play the modified dictator game as in Studies 1-3. On the MUs sharing screen, participants were presented with all the sharing options (from giving 0 MUs to giving 100 MUs with an increase of 5 MUs between two adjacent options), and the corresponding payoffs to him-/herself and the partner. The presentation of options in ascending or descending order was counter-balanced.

4.5.2 Results

Selfish, Even and Fair Decisions. I found that 12% of participants made the selfish decision, 36% made the even-and-fair decision, 8% made the even-but-not-fair decision, 28% made the not-even-but-fair decision, and 17% made all remaining other decisions. Similar to our earlier studies, I found that the majority of participants (83%) either acted in line with selfish values (12%), with fairness values, their corresponding heuristic, or both (71%).

Response times. Similar to the findings in Studies 1-3, I found that participants took an equally short time to make the selfish (M = 12.06, SD = 7.20) and the even-and-fair decisions (M = 11.55, SD = 8.29). Participants again took longer to make the even-but-not-fair decision (M = 15.23, SD = 7.45), and the longest time on average to make the not-even-but-fair decision (M = 19.98, SD = 10.65; see Figure 4.11-4.12 and Table 4.9) [4].

Table 4.9. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs in Study 4

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	-0.083 (-0.081)	0.069	-0.218, 0.052
Even-but-not-fair vs. Selfish	0.249 (0.232)**	0.084	0.083, 0.416
Not-even-but-fair vs. Selfish	0.5 (0.44)***	0.062	0.377, 0.622
Even-but-not-fair vs. Even-and-fair	0.332 (0.277)***	0.091	0.152, 0.513
Not-even-but-fair vs. Even-and-fair	0.583 (0.48)***	0.064	0.456, 0.709
Not-even-but-fair vs Even-but-not-fair	0.25 (0.202)**	0.085	0.083, 0.417

Note. ** $p < .01$. $^{***}p < .001$.

[4] Note that responses in Study 4 are slower than those in Study 1. I believe this difference is due to the difference in how the sharing amount was indicated (i.e., chosen from a list vs. typed).

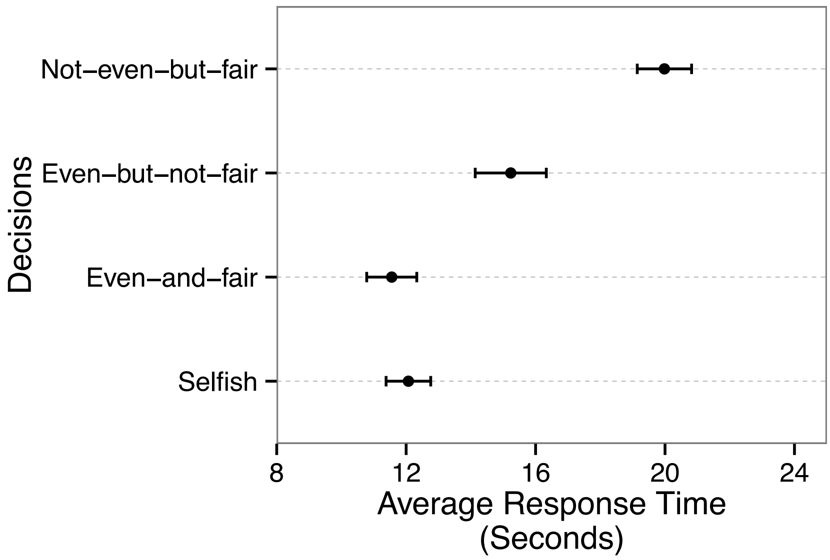

Figure 4.11. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions in Study 4.

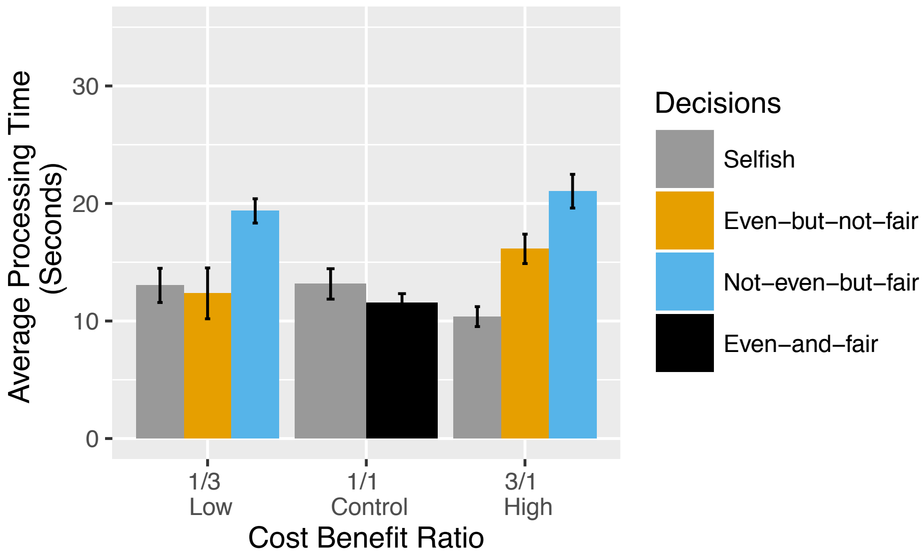

Figure 4.12. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions at different cost/benefit ratios in Study 4.

4.6 Study 5: Examining Receivers' Processing Time of Different Decisions

Studies 1-4 have provided empirical evidence to support VHF by revealing the temporal dynamics underlying fairness decision-making. However, in the studies so far, I only examined the time it took for dictators to make decisions; in Study 5 I turned our attention to receivers. I reasoned that decisions that took dictators longer to make should also take receivers longer to process. The VHF proposes that both the selfish and the fair value-heuristic pairs are common within the population, thus I suggest that receivers could process both the selfish and the even-split decisions quickly. Furthermore, when the even-split heuristic deviates from the fair value in context, receivers should take a longer time to process a value-consistent decision made by the dictator.

Importantly, this switch in perspective further allows us to eliminate the influence of calculation. In this study, participants acted as receivers and thus were not involved in any active calculation processes. Instead, the response time represents the time participants took to process the decision made by the dictator.

4.6.1 Methods

Participants, Materials and Procedure. I recruited 1,200 participants (1,016 of whom completed all procedures; M_{Age} = 36, *SD* = 13, 53% female). Participants were instructed to play the modified dictator game as in Studies 1-4, but were ostensibly randomly assigned to the receiver role. They were directed to a page where they needed to wait, ostensibly for their partners (computer-programmed confederates) to decide how much to share with them. The dictator was programmed to make one of the five discrete "decisions": selfish, even-and-fair, even-but-not-fair, not-even-but-fair, or altruistic[5]. Each participant was randomly assigned to receive one of the five offers.

On the sharing page, participants viewed the amount the dictator gave to them, the corresponding payoffs to the dictator and themselves, and then clicked a button to direct to the next page. I recorded how long each participant viewed the sharing page.

[5] The altruistic decision was programmed to be giving all 100 MUs when participants were receivers in Study5. I chose not to report participants' processing time of altruistic decisions in the thesis for the following two reasons: 1. The current thesis focuses on fairness instead of altruism. 2. In studies where participants were dictators, few people gave 100MUs (2% in Study1, 2,4,7 and 3% in Study3, 6) so I eliminated the programmed altruistic decisions in Study5 to be consistent with other studies.

4.6.2 Results

Response times. I did the same response time regression analysis as in the previous 4 studies. As shown in Table 4.10 and Figure 4.13 (see Figure 4.14 for results breaking down in cost/benefit ratios), viewing the even-and-fair decision (M = 8.96, SD = 3.94) took the shortest time and the selfish decision (M = 10.29, SD = 5.82) was the next quickest. This result is different from what I found in Studies 1 and 2, where both the selfish and the even-and-fair heuristics resulted in equally fast responses. This suggests that in a situation where a windfall property is shared, receivers may have a stronger heuristic for an even-and-fair decision than for a selfish decision. As in the previous studies, receivers took longer to process the even-but-not-fair decision (M = 10.89, SD = 5.07) compared to the even-and-fair decision or the selfish decision, and longer still to process the not-even-but-fair decision (M = 12.84, SD = 5.94).

Table 4.10. Regression results examining log10-transformed processing time as a function of dummy-coded decision pairs in Study 5

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	-0.107 (-0.132)*	0.043	-0.19, -0.023
Even-but-not-fair vs. Selfish	0.074 (0.097)*	0.036	0.003, 0.145
Not-even-but-fair vs. Selfish	0.228 (0.27)***	0.04	0.149, 0.306
Even-but-not-fair vs. Even-and-fair	0.181 (0.237)***	0.042	0.099, 0.263
Not-even-but-fair vs. Even-and-fair	0.334 (0.399)***	0.046	0.243, 0.425
Not-even-but-fair vs Even-but-not-fair	0.153 (0.194)***	0.04	0.074, 0.233

Note. $^{*}p < .05$. $^{***}p < .001$.

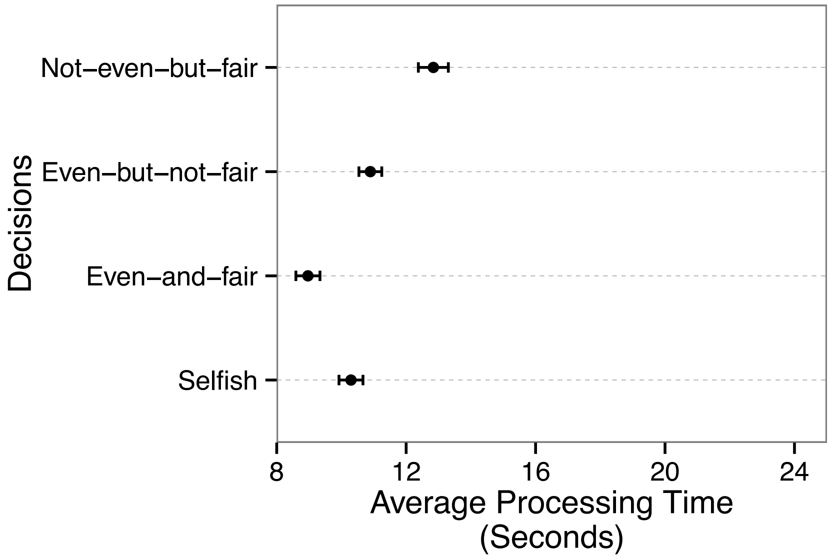

Figure 4.13. Mean and SE of processing time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions in Study 5.

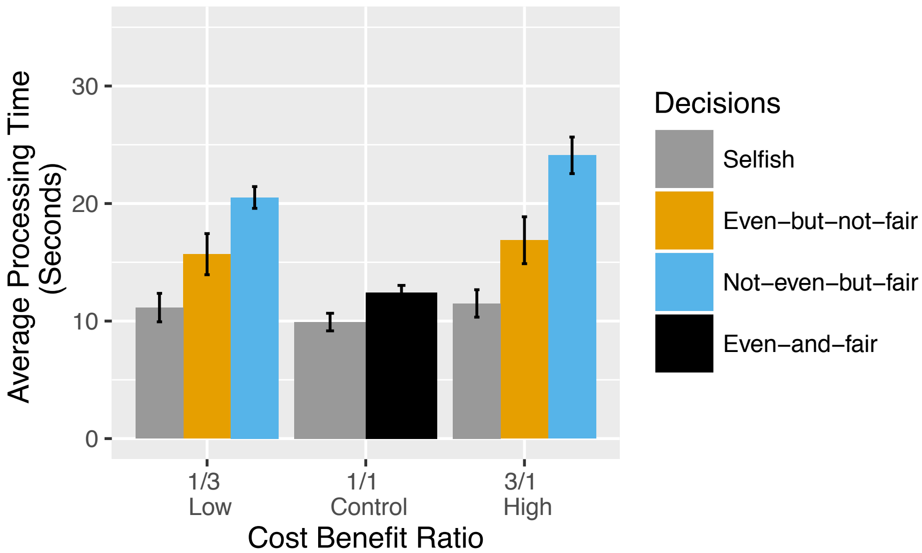

Figure 4.14. Mean and SE of processing time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions at different cost/benefit ratios in Study 5.

Study 5 had several benefits. First, it successfully replicated findings from Studies 1-4[6]. Second, the study showed that the predictions of the VHF apply to receivers as well as dictators. Third, the design allowed us to eliminate the influence of calculation.

4.7 Study 6: Varying Decision Attractiveness by Manipulating the Social-economic Status Difference between the Dictator and the Receiver

The first five studies provided empirical evidence to support VHF from both the dictator's and the receiver's perspective. There are two potential limitations: First, the paradigm is quite artificial and is far removed from real world situations; and second, the possibility of calculation differences in thinking through ratios of 1/3 and 3/1 may still be the driving force behind our findings, though I have attempted to rule out this possibility through a number of modifications to our designs in Studies 4-5.

Thus, in Study 6, I aimed to replicate these findings using a different modified dictator game that was (a) more realistic and (b) had no calculation difference across the conditions. To do so, I introduced the incongruence between the even-split heuristic and the fairness value not by different cost/benefit ratios, but by manipulating relative socioeconomic status (SES). I reasoned that a dictator would be acting fairly to give less than half of the original endowment to a partner who is higher in SES than they are (similar to the 1/3 cost/benefit ratio condition) . Likewise, a dictator would be acting fairly to give more than half to a partner who is lower in SES than they are, thus compensating for the discrepancy in SES (similar to the 3/1 cost/benefit ratio condition). If the dictator and receiver are equal in SES, it is fair to give evenly (similar to the 1/1 cost/benefit ratio condition).

First, I ran a pilot study to test our assumptions about what was a fair allocation when the receiver was higher or lower in SES. I recruited 200 participants from the U.S. through Amazon Mechanical Turk (197 of whom completed all procedures; M_{Age} = 33, *SD* = 10, 41% female). Participants were instructed to imagine they were doing a task to divide 100 MUs between themselves and their partner. Each

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[6] Note that processing time in Study 5 is shorter than the decision time in Studies 1-4. I suggest this difference is due to the difference in tasks. Participants in Study 5 didn't need to make any calculations or decisions. Instead they only needed to view the outcome.

participant was asked to answer the question "What money split do you think is fair for both you and your partner?" about three scenarios where their partner's SES was higher, the same as, or lower than theirs. I presented the three scenarios to participants in a random order.

Results revealed that people think it is fairer to give more money to someone with the same SES as themselves ($M = 41.56$, $SD = 17.64$) than to someone with higher SES ($M = 32.86$, $SD = 21.02$, $t\ (367) = -4.367$, $p < 0.001$, $95\%\ CI = (-12.610, -4.780)$, $d = 0.45$), and to give more money to someone with lower SES ($M = 46.44$, $SD = 21.59$) than to someone with the same SES as themselves ($t\ (365) = 2.417$, $p < 0.05$, $95\%\ CI = (0.910, 8.534)$, $d = 0.25$).

4.7.1 Methods

Participants, Materials, and Procedure. I recruited 600 participants (534 of whom completed all procedures and whose SES allowed for our manipulation; 29 participants answered their SES was on the lowest rung and were told that their partner's SES was lower than theirs, and 10 participants answered their SES was on the highest rung and were told that their partner's SES was higher than theirs; $M_{Age} = 32$, $SD = 10$, 49% female) who were ostensibly randomly assigned to the dictator role and were randomly assigned to one of the three SES comparison conditions: high-receiver-SES in which the receiver's SES was higher than the dictator's, same-receiver-SES in which the receiver's SES was the same as the dictator's, or low-receiver-SES in which the receiver's SES was lower than the dictator's. To make the SES assignment more realistic, I asked participants to rate their own social status via the SES ladder measurement (MacArthur Scale of subjective SES; Adler, Epel, Castellazzo, & Ickovics, 2000). For this measure, participants see a picture of a ladder and are presented with the following prompt: "For this question I would like you to think of the ladder below as representing where people stand in the United States in terms of education, income, and job status, where the people who are the worst off are on the bottom, and the people who are the best off are on the top. Where would you place yourself relative to the people who are the best off and the people who are the worst off in terms of education, income, and job status?" (9-point scale). After connecting to their partner (a computer programmed confederate), participants were told whether their partner's SES was higher, lower than, or the same as their own.

Following the same approach as Study 1, participants were asked to input their sharing amount (x) into a blank box. The corresponding payoffs for him-/herself (i.e., 100-x) and the receiver (i.e., x) were presented simultaneously when they entered the sharing amount. Response time (how long it took each subject to make their decision) was recorded as the time between the moment of the onset of the decision screen and the moment when the participant clicked a button to submit the MUs they shared with the receiver.

Giving 0 MUs was regarded as a selfish decision across all three SES conditions. For the same-receiver-SES condition, giving 50 MUs was considered as the even-and-fair decision. For the high-receiver-SES condition, giving less than 50 MUs (but more than 0 MUs) was considered as the not-even-but-fair decision, and giving 50 MUs was regarded as the even-but-not-fair decision. For the low-receiver-SES condition, giving more than 50 MUs was considered as the not-even-but-fair decision and giving 50 MUs was regarded as the even-but-not-fair decision.

This design again created a situation where the even-split heuristic can be different from the fair value-consistent decision. Meanwhile, the calculation processes were identical in the three SES comparison conditions since what was required was more a feel for what would be fair rather than active fraction calculations.

4.7.2 Results

Selfish, Even and Fair Decisions. I found that 9% of participants made the selfish decision, 29% made the even-and-fair decision, 28% made the even-but-not-fair decision, 17% made the not-even-but-fair decision, and 18% made all remaining other decisions. As in our previous studies, I found that the majority of participants (84%) either acted in line with selfish values (8%), with fairness values, their corresponding heuristic, or both (76%).

Response times. I then conducted regression analyses to compare the log (base 10) transformed response times of decision pairs for the four decisions. As shown in Table 4.11 and Figure 4.15, participants took the shortest time to make the selfish decision (M = 10.04, SD = 5.67). The even-and-fair decision (M = 13.08, SD = 6.82) was slower than the selfish decision. Although I did not observe a significant difference in response time between the even-and-fair, the even-but-not-fair and the not-even-but-fair decisions, I observed the same pattern as in our previous studies: the even-but-not-fair decision (*M* = 13.61, *SD* = 7.26) is slower than the even-and-fair decision, and the slowest decision on average is the not-even-but-fair decision (*M* = 15.02, *SD* = 9.26).

Table 4.11. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs in Study 6

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.256 (0.246)**	0.085	0.088, 0.424
Even-but-not-fair vs. Selfish	0.283 (0.25)***	0.077	0.132, 0.434
Not-even-but-fair vs. Selfish	0.36 (0.281)***	0.101	0.162, 0.559
Even-but-not-fair vs. Even-and-fair	0.027 (0.026)	0.072	-0.116, 0.17
Not-even-but-fair vs. Even-and-fair	0.104 (0.088)	0.095	-0.084, 0.293
Not-even-but-fair vs. Even-but-not-fair	0.078 (0.065)	0.081	-0.082, 0.237

Note. $^{**}p < .01$. $^{***}p < .001$.

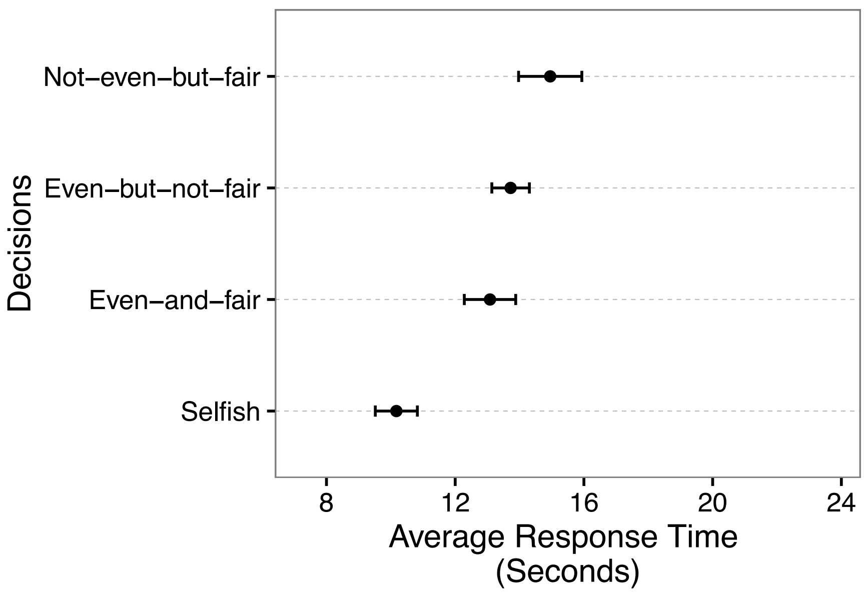

Figure 4.15. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions in Study 6.

Figure 4.16 shows the response time results breaking down in cost/benefit ratios. Here response time of the not-even-but-fair decision in the low-receiver-SES was shorter than that of the even-but-not-fair-decision. This difference could be due to that people felt empathetic towards lower SES partners and found it easy to give them more (i.e., more than the even-split).

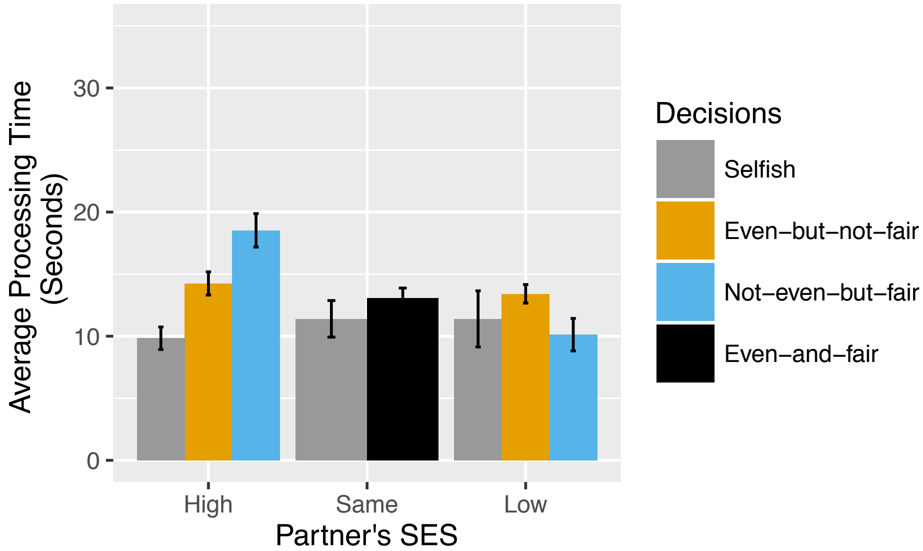

Figure 4.16. Mean and SE of response time for selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decisions at different cost/benefit ratios in Study 6.

The design in Study 6 introduced a relatively realistic money allocation situation, and ruled out the calculation difference in different conditions. Importantly, Study 6 extended the predictions of the VHF to a different type of conflict between heuristics and values, introduced by SES difference.

4.8 Study 7: Testing the Causal Link between Contemplation and Fair Decisions

The first six studies have provided correlational evidence to support the Value-Heuristic Framework. In Study 7, I aimed to test the causal link between intuition and the even-split decision, and between contemplation and the not-even-but-fair decision. Using the same modified dictator game with varied cost/benefit ratios, I tested how thinking fast and thinking slowly affected people's fair behaviour in a causal way.

4.8.1 Methods

Participants, Materials and Procedure. As in Studies 1-5, I used the dictator game with three cost/benefit ratio conditions. I recruited 1,200 participants (1,112 of whom completed all procedures; M_{Age} = 34, *SD* =12, 47% female) who were always (ostensibly randomly) assigned the role of dictator and then randomized into one of the three cost/benefit ratio conditions. In addition, each participant was randomly assigned to a “thinking fast” or a “thinking slow” condition. In the ”thinking fast” condition, participants were told to “make the decision quickly, use your feelings, and ‘go with your gut.’”; in the “thinking slow” condition, participants were told to “make the decision by setting your feelings aside, carefully weigh all options, and use logic and careful reasoning.”

4.8.2 Results

Manipulation Check. I first examined whether the “thinking fast” and the “thinking slow” instructions had the desired effect on response times. To do so, I used a regression model with the log (base 10) transformed response time as the outcome, and the dummy-coded fast-slow condition pair (i.e., the “thinking fast” condition = 0 and the “thinking slow” condition = 1) as the predictor.

I found that participants in the “thinking slow” condition (M = 24.25, SD = 14.85) had a longer response time compared to participants in the “thinking fast” condition (M = 17.07, SD = 10.46, B = 0.39, β = 0.269, SE = 0.042, *95% CI* = (0.308, 0.472), $p < 0.001$). These results suggest that our manipulation was successful, at least in creating differences in time taken to reach a decision.

Selfish, Even and Fair Decisions. I found that 14% of participants made the selfish decision, 27% made the even-and-fair decision, 9% made the even-but-not-fair decision, 17% made the not-even-but-fair decision, and 33% made all remaining other decisions. Similar to our earlier studies, I found that the majority of participants (67%) either acted in line with selfish values (14%), with fairness values, their corresponding heuristic, or both (53%).

Response Times. I then tested whether the “thinking fast” and the “thinking slow” strategies affected the frequency of each of the four decision types. To do so, I built logistic regression models with the dummy coded decision variable as the outcome (e.g., for the comparisons with the selfish decision makers, I coded all selfish decisions as 1, and non-selfish decisions as 0), and the dummy coded fast/slow condition pair as the predictor (thinking fast = 0, thinking slow = 1). The association between the outcome and the predictor represented the odds ratio of the frequency difference of selfish decisions between the “thinking slow” and the “thinking fast” conditions.

Table 4.12 and Figure 4.17 show that fewer even-but-not-fair decisions and more not-even-but-fair decisions were made in the “thinking slow” condition as compared to the “thinking fast” condition. These results are consistent with the idea that following intuition, which is faster, induces more decisions based on the even-split heuristic, whereas taking time to reflect, which is slower, induces more value-consistent decisions. For selfish and even-and-fair decisions, no difference in frequencies was observed between the “thinking slow” and the “thinking fast” conditions, which is consistent with the idea that neither of these decisions has a conflict between heuristics and values.

Table 4.12. Table 4.12. Regression results examining the percentage of the selfish, even-and-fair, even-but-not-fair, and not-even-but-fair decision as a function of dummy-coded fast (0)-slow (1) pairs

Outcome	*B(β)*	*SE*	*95% CI*
Selfish	0.056 (0.072)	0.154	-0.245, 0.357
Even-and-fair	0.166 (0.246)	0.183	-0.193, 0.527
Even-but-not-fair	-0.783 (-1.37)***	0.231	-1.247, -0.34
Not-even-but-fair	0.386 (0.521)*	0.168	0.058, 0.718

Note. $^{*}p < .05$. $^{***}p < .001$.

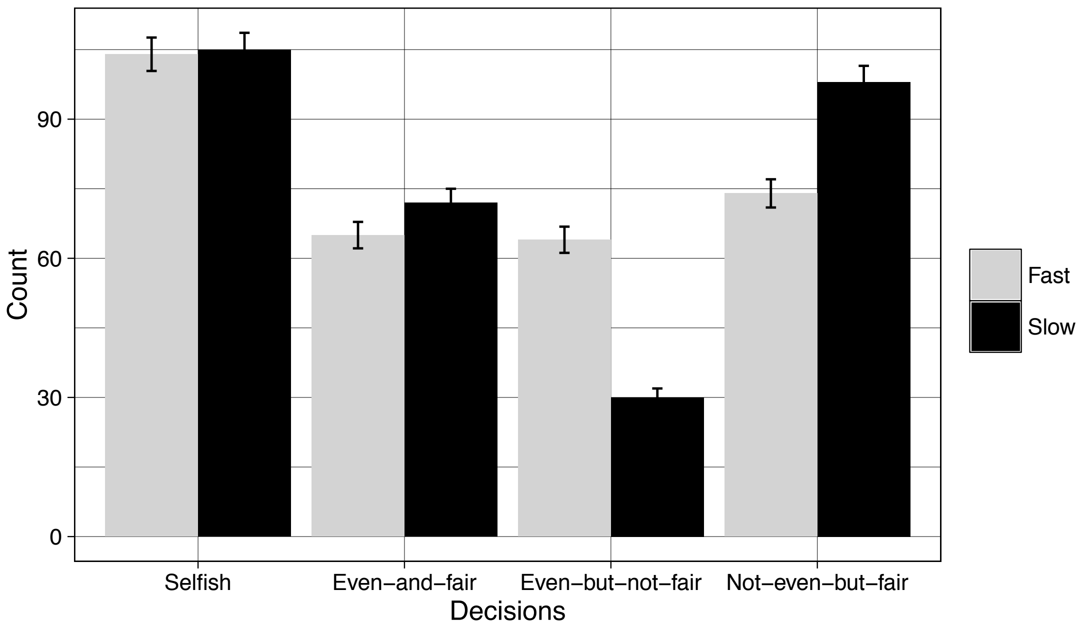

Figure 4.17. Comparison of the frequency of the selfish, even-and-fair, even-but-not-fair, and the not-even-but-fair decision between the “thinking fast” (n = 307) and the “thinking slow” condition (n = 305).

4.9 Discussion

4.9.1 Results Summary and Implications

In the current set of seven studies, I explored the cognitive underpinnings of fairness decision-making in humans. I proposed the Values-Heuristics Framework to explain when and why fair behaviours are intuitive, and examined predictions from this framework by looking at the reaction time of selfish and fair decisions across modified dictator games. The Values-Heuristics Framework is consistent with the idea that people acquire either selfish or fairness values through natural and cultural evolution. Those values are translated into simple heuristics, which serve as shortcuts in daily life to facilitate quick actions. Importantly, the model predicts that in situations where heuristics are not congruent with underlying values, people often deploy a contemplative process to arrive at a value-consistent decision.

The current results provide empirical evidence to support the Values-Heuristics Framework. When participants needed to choose how much to share, a non-negligible number of people made a selfish decision (8-17%), while the majority made a decision that reflected the even-split heuristic or its underlying fairness value (53-76%). It is well documented that both selfish and fair strategies can be evolutionarily advantageous according to environment constraints (Rand et al., 2014; Rand, Greene, & Nowak, 2012). Results here are in line with the hypothesis that both selfish and fairness values appear in considerable numbers within the population, though it is important to note that at least in the United States, there appears to be a stronger emphasis on fairness than selfishness (as reflected in the higher frequency of, and in receivers' faster processing of, fair rather than selfish decisions).

I first tested the fairness value-heuristic mismatch by manipulating cost/benefit ratios in a dictator game. I observed that participants took an equally short amount of time to make either the selfish decision of giving nothing, or the even-and-fair decision of sharing half. These results are consistent with the idea that people deploy selfish and even-split heuristics to reflect their underlying values. I also found that participants took longer to make the even-but-not-fair decision (i.e., giving an equal split, which results in unequal payoffs), and the longest time to make the not-even-but-fair decision (i.e., giving a non-equal split that results in equal payoffs). These results support our hypothesis that contemplation often leads to a value-consistent decision when heuristics deviate from values. Across studies 2-5, I replicated these findings. More than that, Study 2 established the link between the selfish decision and holding selfish values, and the link between the even/fair decision and holding fairness values. Study 3 replicated the above response time dynamics controlling for the impact of conflict between values—an alternative explanation proposed by decision conflict theory. Study 4 replicated the results with a better control of calculation difficulty differences.

In Study 5 I tested whether differences in decision times were reflected in the time taken by receivers to mentally process the amount they were given. Receivers took slightly longer to process a selfish decision than to process the even-and-fair decision. This suggests that givers and receivers might think slightly differently in evaluating these two decisions. When deciding how to share a windfall, both the selfish heuristic and the even-split heuristic are common; when receiving a share of a windfall, people appear to expect to be treated in a fair way rather than in a selfish way. However, I still found that the not-even-but-fair decision, in which heuristics conflict with values, took the longest time to process.

In Study 6, I manipulated the fairness value-heuristic mismatch by manipulating the receiver's SES relative to the dictator's rather than manipulating cost/benefit ratios. I found that a similar pattern of results emerged: People tended to be fastest for selfish and even-and-fair decisions, and slowest for not-even-but-fair decisions (e.g., giving more than half to someone who is lower in SES, or giving less than half to someone who is higher in SES).

Finally, in Study 7 I used a time constraint method (Evans, Dilton, & Rand, 2015; Rand et al., 2014) to build a causal link between intuition and the even-split heuristic decision, and between contemplation and the fairness value-consistent decision. When heuristics and values were congruent, people in the slow and fast thinking conditions did not differ in how often they made each decision. However, when heuristics and values were mismatched, people in the fast thinking condition made decisions consistent with heuristics (i.e., even-but-not-fair or selfish decisions), while people in the slow thinking condition made decisions consistent with values (i.e., not-even-but-fair decisions).

A strength of our work is the variations I made to the standard dictator game from study to study to rule out potential confounds—in particular, the impact of calculation complexity in making a decision. I also used both explicit cost/benefit ratios and relative SES as a more naturalistic, calculation independent manipulation. Further, I examined the effect from both the dictator's and the receiver's perspectives—finding the two to be quite similar in terms of what decisions take the shortest and longest times to reach/process. Finally, I ruled out key alternative explanations, such as decision conflict. These findings suggest that the predictions of the Values-Heuristics Framework are not restricted to narrow operationalization.

Collectively, our work examines the underlying trade-offs in using heuristics versus costly cognition to make decisions. Our results are strongly consistent with the notion that people hold a core even-split heuristic—likely originating from even splits typically reflecting the fairness value in daily life. However, heuristics are specific and simple; an even-split heuristic cannot always reflect the fairness value since there can be numerous factors that affect what is fair. For example, fairness depends on need (i.e., relative SES), whether resources are paid out symmetrically (i.e., varied cost/benefit ratios), and numerous other factors (e.g., treating someone with a good reputation the same as someone with a bad reputation does not seem fair). I show that the deliberative process allows people to consider whether the simple heuristic fits current situational demands and reflects its underlying value correctly. When the heuristic conflicts with its underlying value in the current context, more deliberation is needed to make a fair decision, and in fact many people may stick to the deeply implanted simple heuristic and never arrive at a value-consistent decision (though they do seem to be more hesitant than those who deploy the heuristic when it matches its underlying value). This finding suggests that people should take their time when making decisions if they want to ensure that their decisions align with their core values; encouraging decision-makers to follow their instincts may lead them to an unintended decision, which deviates from their values.

Our results help to reconcile conflicting findings regarding intuition and fairness. Previous work tried to determine whether fair decisions are fast and intuitive using designs varying from resource allocation paradigms where the fair decision is a simple even-split (Rubinstein, 2007; Sutter et al., 2003) to paradigms where the fair decision is different from a simple 50/50 split (Piovesan and Wengström, 2009).

Different contexts led to different temporal dynamics underlying fairness decision-making.

Our results shed light on circumstances in which fair decisions are fast (i.e., when situations are consistent with already internalized heuristics) and when they are slow (i.e., when situations demand a fresh evaluation of value-consistent options), unifying discrepant results from prior research. Indeed, the VHF explains conflicting results from previous studies. In studies that have found fast responses to rejecting unfair offers in an ultimatum game (Sutter et al., 2003) or sharing fairly in an ultimatum game (Rubinstein, 2007), the fair decision has been a simple even-split. On the contrary, in studies where the even-split decision was not available, choosing fair allocations (e.g., 42/45, 48/46) has taken more time than choosing selfish allocations (Piovesan and Wengström, 2009).

The VHF has also expanded existing theories that try to resolve the inconsistencies in temporal dynamics of cooperative decision-making. SHH argues that both heuristics and reflection aim to arrive at self-serving strategies. The cooperative heuristics has been internalized because the cooperative strategy is advantageous in most daily life situations. However, when the cooperative heuristic deviates from the contextual beneficial strategy, SHH proposes that reflection will override intuition and shift to strategies that are advantageous in context. The VHF argues that social and cultural norms of cooperation and fairness have been rooted deeply in the population and have shaped people's decision-making. The VHF predicts, and empirical evidence from the current studies show that contemplation can produce fair behaviours even when they do not support self-interest.

These results could also be explained by decision conflict theory[7], but the VHF goes further, providing an explanation for the response time differences in decisions with a similar level of conflict. The VHF suggests that people who value selfishness or fairness internalize the selfish or fairness heuristics, and make fast extreme decisions. People without those values should never acquire such heuristics (or acquire them to a lesser degree), and make slow intermediate decisions. In the current studies, I found that people who made one of four discrete decisions (selfish,

[7] In particular, people may feel less conflicted in making the 50/50 split than making a split similar to that (but not exactly 50/50), thus taking a shorter time in the former decision than the latter.

even-and-fair, even-but-not-fair, not-even-but-fair) had either a firm selfish value or a firm fairness value, thus bearing low conflicts between the selfish and the fairness motives. Those decisions fall into the extreme decision category based on Evans' work (Evans, Dillon and Rand, 2015). People who made other decisions showed an intermediate level of selfish and fairness values, and high conflicts between selfish and fair motives. I found that these intermediate decisions were slower than extreme decisions, replicating Evans et al. (2015). However, this was true only when extreme decisions stuck to heuristics (i.e., selfish, even-and-fair, and even-but-not fair decisions). Extreme decisions that successfully overrode the imprecise heuristic, and reached the value-consistent decision (i.e., the not-even-but-fair decision) were slower than intermediate decisions (see Supplementary Materials for detailed analysis). The VHF shows that not only the conflict between selfish and prosocial (i.e., fair or cooperative) motives influences response time, but also the interaction between heuristics and values plays an important role in social dilemma decision-making.

4.9.2 Limitations and Future Directions

The current studies were conducted in the context of a dictator game, and shared the same issue as being artificial and far removed from real world situations as studies in previous chapters. Also, in real life decisions, costs and benefits are often not monetary. Further research is needed to test predictions from the VHF when the cost is time, pain, emotional investment etc. Besides, after our controlling, calculation complexity may still remain different due to the cost/benefit manipulation design. Future research could test stress or emotions as an alternative to measure the attractiveness of each decision. Another limitation of the current research is that all participants were from the US. Previous research has shown that the understanding of fairness varies across culture (Henrich et al., 2001), thus cross-cultural work is needed to understand the extent to which the results generalize.

I created two different situations where the even-split heuristic conflicted with the fairness value. Additional work should attempt to create inconsistency between the giving-nothing heuristic and the selfish value (i.e., where decisions other than intuitively selfish decisions actually generate more personal benefits). An example of this context is a modified public goods game where contributing generates more personal benefits than keeping all the money for oneself. More specifically, when the multiplier for money contributed to public goods is bigger than the total number of people to share the public goods, contributing will likely increase payoffs to oneself.

4.9.3 Conclusion

In the present work, I explored the cognitive underpinnings of fairness decision-making in humans. Our findings are consistent with two types of heuristics in resource allocation decision-making — refusing to share or splitting goods evenly. These two decisions can be made quickly when heuristics reflect the respective selfish or the fairness value correctly. When making a fair decision is more complex than a simple even-split, however, individuals who value fairness spend more time trying to work out how to produce equivalent results for both parties. Our studies highlight the importance of the interaction between the even-split heuristic and the fairness value.

The current research highlights a common resource allocation case in which the decisions I make may actually drift away from the values I hold. The conflict between the intuitive behaviour and the values I hold (or that I believe I hold, or want to hold) exists broadly in different circumstances in life. For example, in interpersonal relationships, people may unknowingly and unintentionally stereotype a minority group member, though they do not believe themselves to be racist, homophobic or sexist. People absorb what they see and what they experience, and internalize those unorganized thoughts into heuristics, which strongly shape behaviour. Sometimes these heuristics do not fit the current situation, which can result in behaviour that deviates from a person's core values. It is crucial to understand when I would do better to trust our intuition and when I should spend the time to reflect more deeply.

Chapter 5 General Discussion

The primary aim of my work has been to understand how cost/benefit ratios of sharing and heuristics affect people's fairness decision-making. I tacked this question by examining how both factors affect people's resource allocation decisions, the resource receivers' emotions and cognition when they receive fair or unfair treatment, whether people are intuitively fair or unfair, and how the cost/benefit ratios of sharing affect it.

My empirical work, presented in Chapters 2 to 4, described how I addressed each of these aspects. In this chapter, I will first summarize my main findings. On the basis of these findings, I will formulate the *Even-split Heuristic Hypothesis* to explain people's behaviours. Finally, I will discuss four main limitations in my dissertation and suggest some possible future directions for research in this topic.

5.1 Summary of Main Findings

Studies in Chapter 2 examined how the cost and benefit of sharing, and the even-split fairness norm affect deciders' resource allocating decisions. Results from Study 1 showed that when fairness was expensive (costs were high), people dropped out of acting fairly. When fairness was cheap (costs were low), more people acted fairly than when fairness was expensive. However, when costs were equal to benefit, and thus a fair decision matched the even-split heuristic, people were drawn to acting fairly. Study 2 confirmed these results using the modified dictator game with continuously varying cost/benefit ratios. My results confirmed that when costs were higher than benefits, the increase of cost/benefit ratios predicted fewer fair decisions. However, when costs were lower than benefits, the decrease of cost/benefit ratios predicted fewer fair decisions Together, these findings illustrate a reverse U-shaped effect of cost/benefit ratios on fairness: People became less fair when the costs were both high and low relative to the benefits. This result indicates an important role of the even-split heuristic: When the cost is equal to the benefit, fairness fits the even-split heuristic and this drives people to make fair decisions.

Chapter 3 tested receivers' emotional responses to and cognitive judgements of fair and unfair treatment at different cost/benefit ratios. The findings revealed that participants' positivity was greatest when receiving the fair amount, least when receiving the less-than-fair amount, and in between for the more-than-fair amount..

Examining the effect of cost/benefit ratios, I found that people's emotions and cognition are more sensitive to the violation of fairness norms when the costs are equal to the benefits compared to when the costs are higher or lower than the benefits. People felt more negative (and less positive) when the violation of the fairness norm happened in the 1/1 cost/benefit ratio condition compared to the 1/3 or the 3/1 cost/benefit ratio conditions. Here, the violation of fairness includes both giving less than fair and more than fair. Similarly, people estimated the deciders to have a lower welfare trade-off ratio when they received the less-than-fair offer in the 1/1, as compared to the 1/3 or the 3/1 cost/benefit ratio conditions. These findings indicate that people's emotional responses and cognitive representations are more sensitive to the violation of the fairness norm when it fits the even-split heuristic than when it does not.

Findings from Chapters 2 and 3 suggested an even-split heuristic: More people tended to make the fair decision, and people felt more negative about receiving an unfair offer, when the costs equalled the benefits than when the costs were higher, or lower than the benefits. Chapter 4 tested the even-split heuristic using a fast-slow dual process framework. Based on this, I proposed the Value-Heuristic Framework to explain previous findings. Results in Chapter 4 showed that participants took the shortest time to make the fair decision when it fit the even-split heuristic (i.e., the even-and-fair decision when giving an equal split that results in equal payoffs). I also found that participants took longer to make the even-but-not-fair decision (i.e., giving an equal split, which results in unequal payoffs), and the longest time to make the not-even-but-fair decision (i.e., giving a unequal split that results in equal payoffs).

5.2 Towards the Even-split Heuristic Hypothesis

The findings presented in Chapters 2 to 4 provide convergent evidence for the formation of the *Even-split Heuristic Hypothesis,* which predicts that people make heuristic decisions rather than economically efficient decisions in fairness decision-making. In particular, when the fair decision fits the even-split heuristic, people are more inclined to act fairly, feel more negative if they are not treated fairly, and make the fair decision faster, compared to when the fair decision is cheaper but the heuristic is not applicable.

Results in Chapter 2 lend support to the notion that the even-split heuristic increases the chance of people to act fairly. In particular, I found that more people acted fairly when fairness fits the even-split heuristic than when fairness is cheap. Similarly, Chapter 3 supports the hypothesis by showing that receivers have more negative responses towards the violation of the even-split heuristic fairness than the non-heuristic fairness violation. Results in Chapter 4 provide evidence to show that people's fair decisions are fast when the even-split heuristic is applicable. All the evidence confirms the even-split heuristic in fairness decision-making.

Dainel Kahneman and Amos Tversky are the pioneers to research on topics about heuristics of judgment. A heuristic is a rule-of-thumb. It is a shortcut to solving a problem without exerting our limited cognitive resources to do so. Researchers have identified a great number of judgment heuristics, such as representativeness, availability, and anchoring, along with a dozen systematic biases, including nonregressive prediction, neglect of base-rate information, overconfidence, and overestimates of the frequency of events that are easy to recall (Kahneman, 2013). All of these heuristics can lead to judgements that are incorrect or illogical under certain conditions.

A core concept behind the majority of heuristics is accessibility: the ease (or effort) with which particular mental content comes to mind. While this topic has not been empirically investigated, there is a strong possibility that even splits tend to be the most common "fair" divisions in most real world resource allocation scenarios. This makes the even-split fair decision easier to access than any other splitting option. The *Even-split Heuristic Hypothesis* is built on existing theories of heuristics of judgement. It argues that people internalize the even-split decision as a heuristic in fairness decision-making because it is the most accessible. This heuristic then guides people to make fair decisions in a fast but not necessarily precise way. Empirical evidence from the current work confirms the existence and function of the even-split heuristic. This heuristic drives people to make more fair decisions, makes people feel negative when the it is violated. When the heuristic is precise and fits the underlying value, people make the fair decision fast; otherwise people make the fair decision slowly.

Some existing theories can also be applied to explaining the current data. For example, the social heuristics hypothesis (SHH) proposes that people internalize strategies that are typically advantageous and successful in their daily social interactions (Rand et al., 2014). People then bring these fast, intuitive responses with them into atypical social situations, such as most laboratory experiments. Following SHH, people internalize the even-split decision because it fits the fairness norm and is advantageous in their daily social interaction (Rand et al., 2013). However, SHH also emphasizes that slower, more reflective processes may then override these generalized automatic responses, causing people to shift their behaviour to take advantage of a particular context. It emphasizes the negative role of deliberation on fairness and prosociality. This hypothesis misses an important piece of the role of deliberation, however. In most research settings, the fairness decision-making is very simple. For example, in the typical dictator game, the fair decision is to share 50/50 and it fits the simple even-split heuristic. In real life, however, the cost to the giver may differ from the benefit delivered to the recipient because of overheads or exchange rates. In this setting, fairness needs deliberation to overcome the initial simple heuristic to reach the real fair decision. Our data confirms this hypothesis and shows that contemplation can lead to the non-heuristic fairness and highlights the positive effect of deliberation on obtaining a fair outcome.

A second source of insight to explain the current decision-making process is a group of studies that take into account decision conflict: They argue for a positive correlation between response time and the decision conflict that occurs when selfish and prosocial motives are equally strong (Evans, Dillon and Rand, 2015). According to this theory, people may feel less conflicted when giving is cheap and attractive and thus need a shorter time to make the fair decision. However, I found that being fair is faster when the cost equals the benefit than when the cost is lower than the benefit. More importantly, as discussed in Chapter 4, I demonstrated that people made the even-split (unfair) decision faster than the non-even-split (fair) decision but there was no difference in the conflict level between the two decisions. The *Even-split Heuristic Hypothesis* provides a new approach to understand how people make fairness decisions when the conflict level is constant.

Both SHH and the decision conflict theory provide strong theoretical starting points for understanding the dynamics of fairness decisions—but neither completely explains the empirical data for fairness decision-making. SHH emphasizes the negative impact on deliberation of fairness. The *Even-split Heuristic Hypothesis* and current empirical results point out the positive effect of deliberation on fairness. The decision conflict theory argues for how the conflict level affects people's response time. The *Even-split Heuristic Hypothesis* makes predictions on response time when there is no difference in the conflict level.

Meanwhile, my work introduced a new heuristic in decision-making. In particular, my work designed a situation where the efficient decisions (i.e., when the costs are lower than the benefits) and the heuristic decisions exist using cost/benefit ratios manipulations. This design put the efficient decision and the heuristic decision in conflict and showed that more people make the heuristic decisions. These findings provided the empirical evidence for the *Even-split Heuristic Hypothesis,* which emphasizes the role of heuristics in fairness decision-making. Importantly, these findings shed light on the argument about the proximate causes of fairness. The evolutionary perspective argues that fairness can provide fitness benefits because people return benefits if they are treated fairly (Burnham et al., 2005; Nowak, 2006). This view emphasizes the important role of efficiency and the cost/benefit calculation. An alternative approach proposes that the development of new social norms is crucial to maintaining fairness in the rise of more-complex societies (North, 1990) and emphasizes the heuristic and internalization by culture and education. The current work shows that the heuristics approach has a more prominent impact on fairness decision-making than the efficient returning-benefit approach.

Collectively, the above discussion has highlighted my reasoning for the *Even-split Heuristic Hypothesis* and has provided evidence from Chapters 2 to 4 for its formulation of the conceptual framework. However, the framework is limited to the economic game setting. Substantial research effort will be needed to gather more empirical evidence and develop further the hypothesis.

5.3 Major Limitations and Future Directions

I have discussed the limitations of each study in Chapters 2 to 4. This section stresses a few of the most important caveats, which may drive future directions.

In the current work, I proposed the *Even-split Heuristic Hypothesis* to explain the temporal dynamics of fairness decision-making. It states that when the fair decision fits the even-split heuristic, people make the fair decision faster, compared to when the fair decision is cheaper but the heuristic is not applicable. As stated in

Chapter 4, the difference in calculation complexity between the value-heuristics consistent and inconsistent conditions can be a confounding factor that contributes to the difference in response time. In particular, the fair decision that fits the even-split heuristic (i.e., sharing 50MUs out of 100MUs) is considered to be easier in calculation than the fair decision that does not fit the even-split heuristic (i.e., sharing 25 or 75MUs out of 100 MUs). In Chapter 4, I took several approaches to reduce the effect of calculation complexity differences. For example, when participants made the decision on how much to share, the corresponding payoffs to the self and the other were presented simultaneously so that participants did not need to do the calculation themselves. In study 5, participants were the receivers and their task was to view the payoffs to themselves and their partners thus no calculation was needed. In study 6, I manipulated the difference in SES between the partner and the participant to create the value-heuristics inconsistent condition. Using this manipulation, the calculation complexity was the same for value-heuristics consistent and inconsistent conditions. I observed the same patterns in response time. Similar to study 6, future work can create the value-heuristics inconsistency by manipulating participants' need, virtue, or effort. For example, we can vary partners' reputation. The hypothesis is that for the neutral reputation partner, participant may think it is fair to share half (i.e., the even-split heuristic), for the good reputation partner, participant may think it is fair share more than half (to reward him), and for the bad reputation partner, participant may think it is fair share less than half (to punish him). Another approach to address the issue of calculation complexity difference is to measure how long people take to do the calculation task. In the model that examines the effect of cost/benefit ratios on response time, using the calculation time as covariates will help to reduce the effect of calculation complexity on response time.

Another limitation of the current work is that I used the definition of equality (vs. equity) as the definition for fairness in most studies. In the current work, fairness was simplified to mean having egalitarian outcomes without either side claiming any special privilege. However, fairness judgments for many people are largely calibrated to notions of deservingness and meritocracy. Social psychologists have conducted experiments on fairness decision-making and developed the psychological equity theory, which suggests an empirical evidence-based law: Equalizing the ratio of each person's gain to his worth (Furby 1986; Mellers, 1982; Mellers and Baron 1993; Walster et al., 1978). In particular, the worth is context dependent and various researches have suggested measuring it in terms of social status, merit, effort and need. For example, a study in developmental psychology has found that as children enter adolescence, they increasingly view inequalities reflecting differences in individual achievements as fair (Almås et al., 2010). The simplified version of fairness does not capture these variations and can thus be problematic. For example, to someone who feels fairness should be based on notions of deservingness or meritocracy, no division of monetary units is actually fair. Whether the money goes to someone who was arbitrarily selected to be the decider, to the receiver, or between the two of them, none are actually fair since no one has earned anything.

In study 6 (Chapter 4) of the current work, I considered people's need and treated fairness as equity. In this study, I defined fairness as giving more than half if the partner was worse off, and as giving less than half if the partner was better off than the participant. Except for this single study, I treated fairness simply as equality assuming neither side has any special privilege. Because of this, the arguments I made about fairness may not be able to explain the real thought process in the decision-making. This limitation points to future directions of research on fairness. While most researchers still adopt the simple paradigms of economic games, more studies can research on equity rather than equality and can be done on paradigms that consider different definitions of fairness according to the context and people.

Another limitation of the current work is related to the samples I used. All studies presented here used MTurk samples. Although MTurk is a valuable source of data collection and has a sample that is more representative than the university samples, there are rising concerns (Paolacci & Chandler, 2014; Rand et al., 2013). Rand and colleagues found that participants on MTurk are vastly more experienced than subjects in conventional physical laboratories. Through a survey, Rand and colleagues (2013) reported that the median MTurk worker reported participating in 300 academic studies in total, 20 of which occurred in the past week. In contrast, the median physical lab subject reported participating in 15 academic studies in total, only 1 of which occurred in the past week. Furthermore, Rand and colleagues argued that the experience level of participants moderated the relationship between cooperative behaviours and response time. Following this argument, participants' experience level could moderate the relationship between fairness decision-making and response time in my studies. Future work can be done with a more diversified sampling approach, including participants from different online platforms, universities, and communities. Furthermore, future studies can survey on participants' exposure to similar experiment designs and exclude experienced participants to reduce the effect of experience.

Regarding the limitation of sample bias, future work can extend the current research to a much larger population with the assistance of technology. The development of technology makes it possible to access behavioural data, such as digital prints on social media websites or bank transactions via credit cards. This opens a door for future research. For example, bank transactions contain information about how much and how often people donate to charities (via bank transactions). Future researchers can study how overheads of different charities impact people's donating decisions. They can study people's real life transactions on a large sample size to understand which strategy, emphasizing low overheads (i.e., low costs) or priming the even-split heuristic, is more sufficient in encouraging people to donate more.

Although the current research has several limitations, it bears broad social impacts. Findings from the current research help to resolve the question: how to encourage more people to act fairly. Previous research suggests mixed answers to this question. On the one hand, the economic approach emphasizes efficiency and argues that lower costs and higher benefits of giving encourage more people to act fairly. On the other hand, the social norm perspective stresses that education and cultural norms enforce people to internalize the fairness norm to guide their decision-making. The current research shows the prominent effect of the even-split heuristic on enforcing people to act fairly. This result provides empirical evidence for the cultural norm and social heuristic perspective. The current work also sheds light on daily life decision-making. The saying "follow your heart" is popular and indicates that intuition reflects people's deeper value. Results from the current work, however, suggest that contemplation leads people to decisions that reflect their inner value while heuristics can result in biased decisions.

5.4 Conclusions

This dissertation attempts to advance research in the area of social psychology concerning the effect of cost/benefit ratios on fairness decision-making. I have aimed to examine this question from the angles of resource allocating by deciders, emotions and cognition by receivers, and the temporal dynamics. Based on the evidence from my three studies, I put forward the conceptual framework of *Even-split Heuristic Hypothesis* for explaining the effect of cost/benefit ratios and social norms on fairness. It argues that the even-split heuristic guides people's decision-making in fairness: it makes more people act fairly, makes people feel more negative if treated unfairly, and makes the fair decision fast.

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Appendix Supplementary Materials for Chapter 4

Study 1

Replication Studies

To ensure the robustness of findings in Study 1, we did two other replication studies. We recruited 600 participants (555 completed the whole procedure; we didn't collect age and gender information) from MTurk, who were asked to play the modified dictator game as in Study 1. We replicated the regression analysis of Study 1, predicting the log (base 10) transformed response time as a function of dummy-coded decision pairs. Results show the same pattern as in Study 1, that the selfish (M = 11.40, SD = 8.62) and the even-and-fair decisions (M = 12.44, SD = 5.54) were fast whereas the even-but-not-fair (M = 18.13, SD = 10.14), and the not-even-but-fair decisions (M = 21.26, SD = 8.54) were slow (Table S4.1).

Table S4.1. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs in Study 1 Replication 1

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	.031 (.032)	0.059	-.085, .148
Even-but-not-fair vs. Selfish	.448 (.328)***	0.091	.268, .627
Not-even-but-fair vs. Selfish	.629 (.521)***	0.063	.505, .752
Even-but-not-fair vs. Even-and-fair	.416 (.329)***	0.097	.225, .608
Not-even-but-fair vs. Even-and-fair	.597 (.505)***	0.069	.462, .733
Not-even-but-fair vs Even-but-not-fair	.181 (.141)+	0.104	-.025, .388

Note. + $p < .10$. *** $p < .001$.

Similarly, we recruited 600 participants (573 completed the whole procedure. M_{Age} = 32, SD = 10; 37% female) from MTurk, who were asked to play the modified dictator game as in Study 1. We replicated the regression analysis of Study 1, predicting the log (base 10) transformed response time as a function of dummy-coded decision pairs. Results show the same pattern as in Study 1, that the selfish (M = 10.29, SD = 5.48) and the even-and-fair decisions (M = 12.44, SD = 5.54) were fast whereas the even-but-not-fair (M = 17.40, SD = 9.00), and the not-even-but-fair decisions (M = 21.26, SD = 8.52) were slow (Table S4.2).

These findings replicate results from Study 1 and provide solid evidence for the predictions from the VHF.

Table S4.2. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs in Study 1 Replication 2

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair vs. Selfish	.105 (.099)	0.07	-.032, .242
Even-but-not-fair vs. Selfish	.310 (.263)***	0.078	.155, .464
Not-even-but-fair vs. Selfish	.557 (.448)***	0.071	.418, .696
Even-but-not-fair vs. Even-and-fair	.204 (.204)*	0.084	.038, .371
Not-even-but-fair vs. Even-and-fair	.452 (.384)***	0.082	.289, .614
Not-even-but-fair vs Even-but-not-fair	.247 (.212)**	0.092	.065, .429

Note. * p < .05. ** p < .010. *** p < .001.

Study 2

Values in Extreme and Intermediate Decisions

We compared the extent to which extreme decision makers and intermediate decision makers differed in how much they endorsed fairness-related values (fairness, Benevolence, Universalism) and selfish-related values (selfishness, Achievement and Power). We tested this in the context of a regression analysis in which we examined the association between value endorsement (z-scored) and the dummy-coded intermediate-extreme decision pair (e.g., Intermediate: 1 vs. Extreme: 0). The association represented the difference in values between this decision pair.

Table S4.3 shows the difference in valuing fairness- and selfish-related between people who made extreme decisions (i.e., selfish, even-and-fair, even-but-not-fair, not-even-but-fair) and people who made intermediate decisions (i.e., all other decisions). These results revealed that, intermediate decision makers reported a higher valuing on fairness, and a lower valuing on self-interest than selfish decision makers; and a lower valuing on fairness, and a higher valuing on self-interest than the fairness decision makers.

Table S4.3. Regression results examining z-scored valuing fairness and self-interest as a function of dummy-coded decision pairs

Outcome	Valuing Fairness			Valuing Self-interest		
Predictor	B(β)	SE	95% CI	B(β)	SE	95% CI
Other vs. Selfish	0.504 (0.246)***	0.115	0.279, 0.73	-0.524 (-0.253)***	0.116	-0.752, -0.296
Other vs. Even-and-fair	-0.343 (-0.17)**	0.119	-0.578, -0.109	0.204 (0.097)	0.126	-0.044, 0.452
Other vs. Even-but-not-fair	-0.368 (-0.172)**	0.138	-0.64, -0.096	0.317 (0.128)*	0.16	0.001, 0.632
Other vs. Not-even-but-fair	-0.427 (-0.218)***	0.115	-0.653, -0.202	0.205 (0.1)+	0.122	-0.035, 0.446

Note. + p < .10. * p < .05. ** p < .010. *** p < .001.

Tables S4.4 and S4.5 show similar patterns to the data in Table S4.3. These results showed that intermediate decision makers reported valued Benevolence and Universalism more, and Power less than selfish decision makers; and a lower valued Benevolence and Universalism less, and valued Power more than fairness decision makers. We didn't observe the difference in valuing Achievement.

These results suggest that people who endorse strong selfish or fair values tend to make selfish and fair decisions, while intermediate decisions were made by people who endorsed an intermediate level of selfish and fair values.

Table S4.4. Regression results examining z-scored valuing Benevolence and Universalism as a function of dummy-coded decision pairs

Outcome	*Benevolence*			*Universalism*		
Predictor	B(*β*)	SE	95% CI	B(*β*)	SE	95% CI
Other vs. Selfish	0.342 (0.153)**	0.125	0.096, 0.587	0.433 (0.2)***	0.12	0.198, 0.668
Other vs. Even-and-fair	-0.226 (-0.109)+	0.122	-0.466, 0.013	-0.11 (-0.054)	0.12	-0.345, 0.126
Other vs. Even-but-not-fair	-0.144 (-0.06)	0.155	-0.45, 0.162	-0.242 (-0.102)	0.152	-0.542, 0.057
Other vs. Not-even-but-fair	-0.085 (-0.042)	0.119	-0.32, 0.15	-0.034 (-0.017)	0.119	-0.269, 0.201

Note. + $p < .10$. ** $p < .010$. *** $p < .001$.

Table S4.5. Regression results examining z-scored valuing Achievement and Power as a function of dummy-coded decision pairs

Outcome	*Achievement*			*Power*		
Predictor	B(*β*)	SE	95% CI	B(*β*)	SE	95% CI
Other vs. Selfish	0.184 (0.086)	0.12	-0.053, 0.42	0.083 (0.041)	0.115	-0.143, 0.309
Other vs. Even-and-fair	0.043 (0.02)	0.127	-0.206, 0.293	0.367 (0.167)**	0.127	0.116, 0.617
Other vs. Even-but-not-fair	0.143 (0.057)	0.163	-0.178, 0.463	0.483 (0.188)**	0.163	0.161, 0.804
Other vs. Not-even-but-fair	0.193 (0.088)	0.129	-0.061, 0.448	0.496 (0.229)***	0.123	0.252, 0.739

Note. ** $p < .010$. *** $p < .001$.

Study 3

As well as measuring *general conflict*, which we reported in the main text, we also measured *motive conflict*: We used the definition by Evan and colleagues (2015), which assumes that participants feel most conflicted when different motives (e.g., the selfish and the fairness motives) are equally strong. We asked participants about their motives to pursue self-interest ("How much did you care about earning the highest payoff for you personally?"; $M = 3.31$, $SD = 1.45$) and fairness ("How much did you care about making a fair decision in the task?"; $M = 3.66$, $SD = 1.50$). These questions were scored from 1 = *not at all*, to 5 = *very much*. Then we calculated the absolute difference between the selfish and fair motives. The smaller the absolute difference is, the more conflict between the selfish and fair motive people feel, thus we used reverse-scoring to create our measure of *motive conflict*.

Results

We aimed to show that conflict was not the main driver of the response time differences among the four extreme decisions. To do so, we ran the same regression analysis on response time as in Study 3 but added general conflict and motive conflict as extra predictors. Even with these controls, our results strongly mirrored the findings in Studies 1-3. In particular, and as shown in Table S4.6, the selfish and even-and-fair decisions were the fastest, followed by not-even-but-fair decisions as the second fast group, and not-even-but-fair decisions as the slowest.

Table S4.6. Regression results examining log10-transformed response time as a function of dummy-coded decision pairs, general conflict and motive conflict

Predictor	*B(β)*	*SE*	*95% CI*
Even-and-fair (1) vs. Selfish (0)	0.149 (0.134)*	0.074	0.003, 0.295
General Conflict	0.034 (0.086)	0.027	-0.02, 0.088
Motive Conflict	0.009 (0.023)	0.028	-0.046, 0.064
Even-but-not-fair vs. Selfish	0.425 (0.297)***	0.104	0.219, 0.631
General Conflict	0.037 (0.083)	0.032	-0.026, 0.1
Motive Conflict	0.04 (0.095)	0.032	-0.023, 0.103
Not-even-but-fair vs. Selfish	0.724 (0.556)***	0.069	0.589, 0.86
General Conflict	0.051 (0.103)	0.027	-0.002, 0.105
Motive Conflict	0.025 (0.052)	0.027	-0.027, 0.078
Even-but-not-fair vs. Even-and-fair	0.344 (0.349)***	0.086	0.173, 0.514
General Conflict	0.008 (0.024)	0.03	-0.051, 0.067
Motive Conflict	-0.01 (-0.029)	0.03	-0.07, 0.05
Not-even-but-fair vs. Even-and-fair	0.577 (0.551)***	0.062	0.455, 0.7
General Conflict	0.033 (0.078)	0.026	-0.017, 0.084
Motive Conflict	-0.014 (-0.033)	0.025	-0.064, 0.036
Not-even-but-fair vs. Even-but-not-fair	0.283 (0.268)**	0.086	0.112, 0.453
General Conflict	0.045 (0.117)	0.031	-0.016, 0.106
Motive Conflict	0.025 (0.068)	0.03	-0.034, 0.084

Note. * p < .05. ** p < .010. *** p < .001.