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Inequity Aversion and Fairness in Development

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Abstract

Inequity Aversion and Fairness in Development
By Erin Robbins

Central to the issue of fairness is inequity aversion, a description of the malaise individuals experience when they have more (advantageous inequity) or less (disadvantageous inequity) than another. Aversion to inequity emerges between five to seven years, as evidenced by children's relatively egalitarian distribution of resources. However, contemporary accounts of inequity aversion tend to reduce inequity aversion to a general preference for fair outcomes, a tautological and intractable position.

From the perspective of development, it is unclear why such an inequity aversion unfolds, let alone manifests into the principled and ethical stance children adopt by five years of age. This dissertation addresses the circularity that has characterized many accounts of inequity aversion by proposing three proximate mechanisms (risk aversion, competition aversion, and loss aversion) that subtend the emergence of egalitarianism in three- to seven-year-old children.

Competition and risky gambles have the potential to create inequity if they result in a disparity of material wealth between individuals. In Study 1 children's propensity to eschew competition and minimize risk (both for themselves and a partner) predicted individual and developmental differences in egalitarian sharing.

Inequity aversion may also reflect a tension between the affective experiences associated with losing versus gaining resources. In Study 2, children estimated how much of a valuable resource they had won or lost. Although the objective magnitude of the losses and gains was equivalent, by seven years children displayed robust signs of loss aversion by *overestimating* personal losses and simultaneously *underestimating* personal gains, a trend that correlated with egalitarian sharing.

Finally, Study 3 examined how children rectify perceived inequity. By five years, but not prior, children selectively punish selfish sharing partners and compensate generous sharing partners, even when doing so comes at a personal cost.

In all, considerable asymmetries characterize inequity aversion: the relative influence of competition and risk, the subjective experience of losses and gains, and the relative importance placed on personal welfare versus that of a partner. It is arguably the resolution of these tensions that drives development, eventually forming the basis of the child's principled, ethical stance toward others that emerges by five years of age.

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For J.-P.

He knows what he did

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I did not write this in isolation. The inspiration, the articulation, the struggle for meaning.... these were all shared with other people.

This is for Rachel and Carrie, Douglas and Barbara, Libby and Sarah, whom I love.

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PART I:

THEORETICAL BACKGROUND

CHAPTER 1

1. What is inequity aversion? Introduction and General Overview

Fairness is a perennial concern. It is also fundamentally a developmental issue. The human social world is driven by exchanges and negotiation—of objects, of attention and inter-subjectivity, of abstract ideas. This world surrounds children from the outset. The notion of fairness, examined in the context of sharing games in the experiments described here, does not involve only persons and objects, but more broadly the relationships *between* persons and *with respect to* objects. These relationships always occur within a larger framework of institutions, collective rules, and norms that govern exchanges in general.

The question under investigation here is how children develop into moral agents, moving from the detection of sameness and inequity into a more prescriptive 'ethical stance' about how things *ought* to be shared. At what age do children not only recognize but also enforce these norms? To what extent do children perceive themselves as accountable to these same norms, and how do we make sense of the considerable individual differences that exist with regard to children's sharing? These are the questions that we propose to address in this thesis.

Central to this investigation is inequity aversion, a description of the malaise individuals experience when they have more (advantageous inequity) or less (disadvantageous inequity) than another. According to this description, fairness would be determined by one of two psychological propensities—either envy or compassion – that both cause an aversion to inequitable outcomes.

The work presented here addresses the emerging understanding of fairness in children between three to seven years of age. Two overarching intuitions guide this work. First, a sense of fairness entails more than either prosocial behavior (generosity, empathy, compassion, cooperation etc.), or an evolved instinct toward inequity aversion, both of which are at the center of current developmental and comparative (evolutionary) theories. Second, understanding inter-individual differences is a crucial source of information regarding the origins of fairness, particularly in regard to the variable ways children reason about and behave in relation to what they understand as being fair. These differences may reflect basic intra-psychic tensions. They may also reflect the impact of variable cultural or institutional contexts. In sum, these variations need to be considered if we want to capture the proximate mechanisms underlying inequity aversion, and in general the emergence of fair-mindedness in children.

This thesis is divided into two sections. Part I (Theory) describes the history of how fairness as a concept has been treated by psychologists in general, and developmental psychologists in particular. In doing so, it touches on classic philosophic debates about the nature of morality and the legacy of these debates in shaping current empirical studies and methodology, not only in psychology, but in the closely related disciplines of economics, anthropology, and evolutionary biology. In brief, although fairness has often been considered the purview of moral philosophy or social contract theories (e.g., Kant, Rousseau, Rawls), the naturalization of these ideas as a topic of scientific inquiry led to the adoption and reinforcement of inequity aversion as a phenomenon.

Inequity aversion posits that fairness is rooted in the tendency to value not only one's personal welfare, but also that of others, and in ways that can be modeled and empirically validated. As Fehr and Fischbacher (2005a) explain:

> "...inequity-averse persons want to achieve an equitable distribution of economic resources. This means that they are altruistic toward other persons—that is, they want to increase other persons' economic payoff if the other persons' economic payoffs are below an equitable benchmark. However, inequity-averse individuals also feel envy—that is, they want to decrease the other persons' payoffs when those payoffs exceed the equitable level" (excerpted from *Moral Sentiments and Material Interests,* p. 153).

Taking this as our starting point, we review accounts of inequity aversion, beginning with the origin of the concept before then explaining how it has been approached in recent years from the perspective of behavioral economists and psychologists. To ground our developmental account, we next review the cognitive capacities that facilitate such understanding in children. Finally, we review the literature on children's understanding of inequity as it has been studied in sharing games. As this review will demonstrate, many accounts of inequity aversion are circular. Given this, a number of questions remain regarding the origins, expression, and proximate mechanisms that subtend inequity aversion. These outstanding issues motivate Part II (Empirical Studies). Here we present the findings of three studies with three- to seven-year-olds growing up in middle-class urban and suburban environs in the United States. These studies examine not only the *perception* of inequity (Study 1) but also the ways in which children subjectively *experience* inequity (Study 2) and *rectify* inequity (Study 3). If we are to take inequity aversion as a precursor to fairness, then this more robust articulation of its developmental origins is crucial.

1.1 Fairness as a (moral) value: Historical context

1.1.1 *Fairness as justice, impartiality, and equity*

The 2012 Presidential debates in the United States were situated in a time of widespread economic uncertainty and dissatisfaction. Many of the narratives leading up to the election—promulgated by political action committees and by the candidates themselves in some instances—tacitly referred to the issue of fairness: Which citizens should shoulder the burden of taxation? Should companies with records of financial insolvency or impropriety be given federal bailouts? Should healthcare be federally funded and universal, and if so, who should decide what services are provided?

And yet, in the three Presidential debates leading up to the national election, the word "fairness" appeared only six times (once by Governor Romney and five times by President Obama), and all within the rhetoric of the second town-hall debate. Consider these representative statements[1]:

> **MR. ROMNEY:** We can compete with anyone in the world as long as the playing field is level. China's been cheating over the years, one, by holding down the value of their currency, number two, by stealing our intellectual property, our designs, our patents, our technology. There's even an Apple store in China that's a counterfeit Apple store selling counterfeit goods. They hack into our computers. We will have to have people play on a ***fair*** basis. That's number one.

> **PRESIDENT OBAMA:** I believe that the free enterprise system is the greatest engine of prosperity the world's ever known. I believe in self-reliance and individual initiative and risk-takers being rewarded. But I also believe that everybody should have a ***fair*** shot and everybody should do their ***fair*** share and everybody should play by the same rules, because that's how our economy is grown. That's how we built the world's

[1] (Transcripts from Federal News Service at http://blog.fednews.com/presidential-debate-2012), all emphasis mine.

greatest middle class.

These responses reflect a national concern for justice, equity, and impartiality before the law, but they also serve to illustrate the multiplicity of meanings evoked by the term "fairness." So construed, fairness is both a family of principles (Rawls, 1958) but also the process by which these principles are enacted and reinforced.

The etymology of "fair" stems from the archaic German *faeger,* meaning "beautiful" and which was almost exclusively used as the antithetical of "foul." Later definitions (c. 1175) equated fairness with freedom from moral stain or blemish, and around 1400 usage of the word extended this meaning to individuals relationships, with fairness describing "arguments...[and] methods free from bias, fraud, or injustice; equitable, legitimate, and hence of persons" (Oxford English Dictionray)[2]. How these various connotations came to have a common "commendatory core" (Cordero, 1988) is beyond the scope of this paper, though again it highlights the multiplicity of meaning regarding fairness as a reified object of contemplation, as descriptive of objects, and as descriptive of actions.

Inequity aversion, on the other hand, is a description about how and why individuals share. It is grounded in the assumption that fairness is tantamount to equity, and it has dominated contemporary accounts of resource negotiation and exchange. To understand why inequity aversion has become so central to psychological accounts of fairness, it is useful to first review the historical framework in which the idea was conceived.

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[2] "fairness, n." OED online. December 2012. Oxford University Press. 01 December 2012. <http://www.oed.com/view/Entry67729?redirectfrom=fairness>

1.1.2 *Social contract theory*

Aristotle inextricably links fairness to market exchanges. In *The Nicomachean Ethics* he advocates that justice depends on individuals receiving what they are due according to principles of proportional equity. Fairness is a form of reciprocity that can restore balance between even disparate parties, hence usage of the phrase "as builder to shoemaker" in describing fair and impartial exchanges (Meikle, 1991). Centuries later, Hume and Kant maintained that impartiality was the basis from which moral values (like fairness) could be assessed and justified as principles. Impartiality as the ideal "moral point of view" came to characterize social contract theories such as Rousseau's general will and Adam Smith's impartial spectator.

Rawl's theory of justice (1958) is the social contract theory most closely related to contemporary psychological accounts of fairness. Rawls equated fairness with justice, which itself is only possible when free and equal agents jointly agree upon and commit themselves to certain social principles including impartiality and equity. What distinguishes this perspective from its antecedents is that the source of moral authority is inherently social. Rather than derivative of principles of logic (Kant) or intuitive sentiments (Hume) that ground fairness in individual agents, for Rawls the action and reasoning of one person would never be enough to justify a system of morality. In his own words, Rawls maintained that "justice as fairness assigns a certain primacy to the social" (1999, p. 339) and that "the profoundly social nature of human relationships grounds justice and fairness in social cooperation and reciprocity" (1993, p. 259).

In these conceits it is possible to see the seeds of inter-subjectivity that form the backbone of the contemporary articulation of inequity aversion and which prioritize social comparison (concern for my well-being and that of others) in judgments of fairness. These propositions later became crucial to psychological accounts of moral development (see Piaget, 1965 and Kohlberg, 1984 for their constructivist accounts). However, at the time that Rawls conceived his theory of fairness as justice, moral values were not yet widely considered a legitimate topic for scientific inquiry. It would take the naturalization of such social contract theories for inequity aversion to become a question appropriate to empirical testing and validation.

1.2 Naturalization of the moral sense

1.2.1 *Darwin, Dawkins, and the Only Animal that Blushes*

In *The Descent of Man and Selection in Relation to Sex*, Darwin (1874) speculated that social instincts (of which morality is a specific subset of behaviors) originated from precursors common to other species and that were refined and expanded over the course of human evolution. These basic sentiments (self-interest and sympathy for others) acquired increasing sophistication as cognitive capacities for language developed, eventually endowing humans with conscience. According to Darwin:

> "after the power of language had been acquired, and the wishes of the community could be expressed, the common opinion how each member ought to act for the public good would naturally become in a paramount degree the guide to action [...] The social instinct, together with sympathy could be greatly strengthened by habit, and so consequentially would be obedience to the wishes and judgment of the community" (1874, p.96).

Not all evolutionary theorists agreed with Darwin's assumption that morality was closely tied to sympathy and concern for others, at least, not at the level of natural selection. Dawkins (1989) famous posited that natural selection necessarily favors "selfish genes" that increase individual fitness. (He is also famous for the assertion, "Let us try to teach generosity and altruism, because we are born selfish," 1989, p. 3.)

The debate surrounding the evolutionary origins of morality highlight the tension between ultimate and proximate causes of fairness. Gintis (2001) argues that selfish genes do not necessitate selfish behavior at the level of individual psychology. Rather, several different proximate mechanisms might produce moral beliefs and moral decisions independent of their ultimate evolutionary origins. As Crespi (2000) notes, dispositions that were initially genetically selfish in the environments in which they were originally selected may give rise to genetically unselfish (or indeed generous) behaviors in other contexts. At the level of ultimate causes, the challenge for evolutionary theorists is to identify the adaptive functions that moral sentiments evolved to serve. At the level of proximate causes, the challenge for evolutionary theory is rather to explain which mechanisms are activated over developmental time, and why (Gintis, 2007; Sober & Wilson, 1998). [3]

[3] Tinbergen (1986) also makes this point clear in his articulation of proximate and ultimate causes. At the level of the individual are psychological (proximate) mechanisms that trigger certain behaviors or cognitions. Upstream from those are the developmental processes that cause those proximal mechanisms to arise or unfold during an individual's lifetime (this is the ontogenetic question). Upstream from that are the evolutionary forces (e.g., reciprocity, mutualism) that are based on more ultimate causes that explain why these mechanisms exist rather than other possible psychologies that could have arisen (Tinbergen, ibid).

1.2.2 *Evolutionary Models: Varieties of Cooperative Behavior*

Trivers (1985) argues that moral sentiments like fairness evolved to provide the human species with a standard against which the behavior of self and others could be measured, with the specific purpose of safe-guarding against cheating in reciprocal exchanges. Such conflict resolution could be accomplished in a variety of ways through different cooperative mechanisms. Here we will briefly review two of the major theories regarding the evolution of morality.

Theories of direct (tit-for tat) and indirect (generalized) reciprocity maintain that fairness is the by-product of sequential exchanges in which individuals tend to treat partners as they themselves have been treated in past exchanges. Direct reciprocity entails reproducing in exaction the previous action of a partner. Indirect reciprocity assumes that acts carried out now will confer benefits at an undetermined point in the future. Trivers (1971) and Axelrod and Hamilton (1981) have argued that at the population level, such strategies lead to enough behavioral variability (selfishness, generosity, altruism) to protect against cheating and exploitation. If, for example, an agent learns that it is beneficial to "cooperate with a cooperator" (Skyrms, 2000), then the short-term costs of collaborating and helping can create long-term benefits. The flip side to this (what Jensen, 2010, describes as "the dark side to cooperation") is punishment. To protect the group, sanctions must be taken against selfish individuals. Thus, after iterative exchanges characterized by cooperation and punishment, it is possible to arrive at solutions that are equitable for involved parties.

Theories of mutualism (Sachs, et al., 2001; Baumard et al., 2012) focus on the relationship between partner control (tit-for-tat reciprocity) and partner choice. In the

theories described previously, social control is maintained through the threat of punishment alone. In mutualistic accounts, individuals may choose to avoid future interactions with uncooperative individuals and elect to interact with partners with more equitable reputations (partner choice). More recent articulations of this theory (Baumard et al., 2012) posit that through such partner choice, humans evolved a "moral sense" that emerged to guide the distribution of material resources. In this perspective, morality is an adaptation to an environment in which humans were in competition (to be chosen as cooperative partners), and in such an environment, the most optimal strategy is to treat others equitably, hence fairly.

Inequity aversion capitalizes on these two intuitions by positing that individuals are motivated by both the *intents* of their partners as well as the *consequences* of an action (e.g., the actual material payoff to involved parties). Thus, individuals will engage in reciprocal or mutualistic exchange only insofar as involved parties intend to act with fairness and impartiality that results in material equity. The implication of this position is that it is impossible to model fairness without consideration for both one's own welfare and that of one's partner.

1.3 Social preferences and inequity aversion

One consequence of the naturalization of moral sentiments was that socio-moral behavior became reducible to psychological hedonism. Neo-classical economic theories favored the Dawkins approach and posited *Homo economicus*—the individual as a self-interested, rational maximizer of economic gains who is unconcerned with social norms. According to Sober and Wilson (1998), such "what's in it for me" philosophy has been a pervasive influence on our understanding of fairness across several disciplines, one that

has marginalized the role generous and altruistic acts. (It should be noted, however, that not everyone followed this approach; see, for example Baumard et al., 2012 on mutualism and Preston & de Waal, 2002 for a comprehensive review on empathy.)

The conflation of ultimate and proximate selection mechanisms led to the assumption that individuals are psychological egoists exclusively concerned with their own welfare, driven to avoid pain and attain pleasure without much consideration for others. Over the past decade, however, a growing body of research has emerged to challenge the self-interested, *Homo economicus* position, suggesting that such an account may be too simplistic and that fairness may also be guided by our concern for the welfare of (and evaluation by) others. Individuals demonstrate *social preferences*—other-regarding tendencies that value what material payoffs another receives, both for their own sake but also in relation to one's own material wealth (Fehr& Fischbacher, 2005b).

As De Cremer and van Dijk (2003) observe, many decisions are embedded within a social context such that decision makers are often interdependent on one another. Through the use of experimental economic paradigms, Bolton (1997) has demonstrated that adults have strong intuitions about fairness, such that a 50/50 division of a given good is frequently cited as the most desirable and equitable, even in conditions where participants could conceivably take more without repercussion. Such "other-regarding" preferences may also be a strong motivating factor in cooperative exchanges by promoting trust through conflict resolution (Rusbult, 2003) and the maintenance and enhancement of a "fair" reputation (Declerck, Kiyonari, & Boone, 2009; Piazza & Bering, 2008; King-Casas, et al., 2005; Milinski, Semmann, & Krambeck, 2002). Taken

together, these findings suggest that social preferences are important components to bargaining and cooperation.

The inequity aversion hypothesis popularized by Fehr and Schmidt (1999) draws from a rich history of socio-economic theories questioning why individuals deviate from the neo-classical prediction of self-interested behavior (e.g., *Homo economicus*). Rabin (1993) addressed the issue by modeling the intentions of participants in a bargaining situation. Rabin argued that in general, people want to be kind to those who treat them fairly and punish those who are unkind and hurt them. Hypothetical judgments of fairness depend on observable actions and the intentions behind them: a behavior may be perceived as fair if the intent behind it is kind, or it may be perceived as unfair if the intention is hostile. In turn, the relative kindness or hostility of an intent is derived from the equitability of the payoffs between players (Rabin, 1993).

Other theorists have also posited that judgments of fairness depend on relative comparisons between the material gains of the individual and the individual's partner(s). Loewenstein, Thompson, and Bazerman (1989) asked participants to rank order different distributions of payoffs between the subject and a hypothetical partner. The authors then used these rankings to determine how relative payoffs enter into judgments about fairness. Participants exhibited a consistently strong aversion to disadvantageous inequity (i.e., personal gains were less that of a partner). At the same time, participants were also averse to advantageous inequity, (i.e., outcomes in which payoffs to the individual exceeded those to a partner), although this effect was not as pronounced. These findings point to the importance that social comparison and social preferences play in determining what acts are fair (Loewenstein, Thompson, & Bazerman, 1989).

Such findings are not unique to humans. Growing evidence suggests that equity norms are important for cleaner fish (Raihani & McAuliffe, 2012), canines (Horotitz, 2012; Range et al., 2009), and non-human primates. Capuchin monkeys and marmosets detect and react negatively to inequity (Burkart, Fehr, Efferson, & van Schaik, 2007; Lakshminarayananan & Santos, 2008). For example, capuchin monkeys reject a desired food reward if they have previously observed another monkey obtain a more desirable reward for the same amount of effort (Brosnan & de Waal, 2003), but they will also spontaneously share food provisions with con-specifics who have helped them obtain rewards. (See, however, Silk et al., 2005 as well as Jensen, Call, & Tomasello, 2007, for examples of anti-social reactions to inequity in chimpanzees.) The roots of inequity aversion extend deep into phylogeny and, as we shall demonstrate, ontogeny.

1.3.1 *Parameterizing inequity aversion*

Fehr and Schmidt (1999) do not discount that actions and intentions are closely aligned and attempt to capture the importance of social comparisons by modeling both advantageous and disadvantageous inequity. According to their definition, "inequity aversion means that people resist inequitable outcomes, i.e., they are willing to give up some material payoff to move in the direction of more equitable outcomes" (p. 819). In general, Fehr and Schmidt claim that individuals suffer more from inequity that is to their material disadvantage than inequity that is to their material advantage (although a certain percentage of the population will be purely self-interested and unconcerned with the material welfare of other individuals). In short, inequity aversion is defined by two parameters, one of which measures the envy associated with being "poorer" than another

individual (disadvantageous inequity), and the other of which captures the discomfort of being better off (compassion for others, or what they call advantageous inequity). Critics of inequity aversion have argued that such predispositions are less evidence of other-regarding preferences than evidence that individuals behave irrationally when they minimize their own gains. In rebuttal, Andreoni and Miller (2002) argue that kindness toward others is an example of bounded rationality; individuals may act generously toward others, but they do so in ways that are efficient and predictable. To cite one example derived from game theoretical approaches (including the ultimatum game), individuals are less generous when such generosity is simultaneously costly to the giver and minimally beneficial to the recipient (Andreoni & Miller, 2002). In other words, interactions between agents are characterized by a degree of strategy: individuals do not generally give just for the sake of giving.

1.3.2 *Experimental paradigms from behavioral economics*

The assumptions of inequity aversion position have been tested extensively using game theoretical paradigms in which participants bargain over how to best divide a shared good. Consider the ultimatum game, which is typically played between two players under conditions of anonymity. One player proposes a division of the resources, which may either be accepted or rejected by the second player (the responder). An acceptance leads to a payoff for both parties, but a rejection entails that neither party will receive anything. If the norm of self-regard prevails (Miller, 1999), then the rational proposer should offer as small a portion of the pie as possible, and the rational responder should accept any offer, no matter how small. However, the assumption of the self-regarding actor does not hold up to empirical scrutiny (Gintis et al., 2005a).

Contrary to neo-classical predictions, experimental evidence indicates that adults make offers that are very close to the equitable solution of a even split. Furthermore, adults reject offers that are perceived as too stingy, typically less than 20-30% of the shared good (Camerer, 2003; Murnighan & Saxon, 1998; Camerer & Thaler, 1995). This tendency is pervasive in Western settings, although cross-cultural evidence suggests that it might also depend on market inclusion and social context (Henrich, et al., 2006; Dwyer, 2000). The preference for "fair play" is also present in young children (Harbaugh, Krause, & Vesterlund, 2007; Harbaugh, Krause, & Liday, 2003), with some evidence suggesting that children may be even more generous than their adult counterparts (Murnighan & Saxon, 1998).

Perhaps the strongest evidence of inequity aversion to date has come from a recent study by Bartling, Fehr, Maréchal, and Schunk (2009). In a within-subjects design, participants were presented with a series of paired distributions. They were then instructed to pick one of the options, which would be distributed between themselves and an anonymous partner. One of the options (hereafter referred to as the egalitarian solution) was always an equitable distribution (10:10) of money. In the non-costly prosocial condition, the alternative distribution featured an advantageous inequity ($10 to the participant and $6 to the anonymous partner). It was hypothesized that if individuals are inequity adverse, they should select the 10:10 option, as it maintains equity but without incurring a cost to the participant. In the costly prosocial condition, enforcing equity came at a personal cost: the alternative distribution of 16:4 meant that choosing the egalitarian solution would result in a smaller payoff for the participant. In the envy condition, the alternative distribution favored the anonymous partner (10:18). Here,

participants could choose the 10:10 distribution and restore equity without cost to themselves. Finally, in the costly envy condition, enforcing the egalitarian solution came at a personal cost when compared to the alternative distribution of 11:19. Results revealed that the majority of participants (81%) chose the egalitarian solution in both the non-costly and costly prosocial games, indicating that individuals are adverse to advantageous inequity. Similarly, participants demonstrated evidence of an aversion to disadvantageous inequity by choosing the egalitarian solution 75% of the time in the envy and costly envy conditions. Sixty-four percent of participants were characterized as "strongly egalitarian" by opting for the equitable solution in all four conditions (Bartling, Fehr, Marechal, & Schunk, 2009).

1.3.3 *Renewed interest in ontogenetic accounts*

To summarize, a growing body of evidence substantiates the inequity aversion position, that self-regarding and other-regarding preferences are both influential in determining whether a behavioral act is fair. At the same time, little is known about inequity aversion in ontogeny. When and why children might start to express a preference for egalitarian outcomes is a question that can be addressed empirically. As an additional benefit, the developmental approach can illuminate what proximate mechanisms might underlie the emergence and expression of inequity aversion in human ontogeny, the main goal of this dissertation.

2. Developmental bases of the concept of fairness

2.1 A brief comment on terminology and theoretical perspective

The purpose of this dissertation is to address the origins of inequity aversion in development, particularly with regard to recent findings documenting the emergence of fair, egalitarian sharing between three and eight years of age (Rochat, et al., 2009; Fehr, Bernhard, & Rockenbach, 2008). In reviewing the developmental literature on sharing behavior it is helpful to clarify the terminology that is typically used to describe economic exchanges in children.

The study of inequity aversion spans multiple disciplines, ranging from economics to psychology and evolutionary biology. Consequently, there is a wide (and sometimes redundant) vocabulary for describing behavioral phenomena. For example, "self-interested," "self-regarding," "self-maximizing," and "selfishness" are all frequently used to describe acts in which an individual favors his or her own personal gain over that of others. Although there are some subtle distinctions between these terms (particularly between "self-interest" and "self-regard;" see Gintis et al., 2005), for the purposes of this paper they will be used interchangeably. At the opposite end of the spectrum, acts that favor another individual can be described as "generous" and "other-regarding." Neither term should be confused with altruism, which is an act that benefits a recipient but at personal cost to the giver.

The terminology describing economic games is equally diverse. Here, "payoff" is used synonymously with the material gains or rewards that participants receive at the conclusion of a given interaction. When describing the outcome of a game, the term "egalitarian" is used to denote distributions that are strictly equal, e.g., those that conform

to the expected norm of equity as described by Bolton (1997), a 50/50 division of the shared good.

2.1.1 *The difference between conventionality, prosociality, and morality*

With the exception of distributive justice games (discussed in the next section) that assess children's understanding of equity, developmental accounts of fairness have typically focused on either the emergence of prosocial behavior (e.g., voluntary acts intended to help or benefit an individual or group; Eisenberg & Mussen, 1989), or moral reasoning (e.g., determinations about how individuals ought to resolve a conflict or abide by conflicting norms (Kolhberg, 1984; Piaget, 1965). These two terms have been conflated, with many studies treating "prosocial" and "moral" as interchangable. We adopt the position that these are distinct levels of description that entail very different psychological senses of how to respond to social dilemmas. Morality in this sense entails a transcendence of convention, and unlike prosocial acts, moral acts and judgments would therefore be generalizable independent of authority (Turiel, 1983).

Inequity aversion and fairness have been similarly conflated. A minimal or lean interpretation of inequity aversion suggests that children (and adults) dislike perceptual asymmetry; they may prefer equitable outcomes because they provide a 1:1 correspondence between recipients and resources. This account does not require an understanding or appreciation of a partner's beliefs or desires. A richer reading of the phenomenon suggests that inequity aversion stems from one's desire to create an equivalency of values or welfare across involved parties. As we shall see, the data on inequity aversion in development supports both interpretations. What it does not support

is the interpretation that aversion to inequity is necessarily moral. Thus, in discussions about inequity aversion, fairness typically maps onto the concept of equity rather than morality proper.

It should also be noted that pro-sociality and morality are distinct from mere conventionality, or a sensitivity to the way things are usually done. Behavior can be both prosocial and conventional, but conventions in and of themselves are not concerned with helping or harm. Similarly, morality typically implies some level of imperative, a sensitivity to how things *ought* to be done rather than how they are *usually* done.

2.1.2 *Conceptualizing inequity aversion as a developmental phenomenon*

The basic tenant of inequity aversion is that individuals may be motivated by both self-interested *and* other-regarding preferences. According to Fehr and Schmidt (1999), inequity aversion is characterized by two parameters: Envy, or the distaste for disadvantageous outcomes (e.g., having less than one's partner), and compassion, or the distaste for advantageous outcomes (e.g., having more than one's partner). These two features may help to explain the *what* of inequity aversion, but not the *why*. At the level of individual psychology, the question of why children come to avoid inequity (Study 1), how they subjectively experience inequity (Study 2) and how they rectify inequity (Study 3) remains wide open.

However, before addressing these outstanding issues, it is useful to review the developmental evidence regarding the socio-cognitive capacities that would support inequity aversion and that we conjecture are necessary pre-requisites. This would include children's general understanding of numeracy and proportionality (what constitutes the

what) of sharing; their understanding of self and other (including theory of mind and social evaluation, what constitutes the *who* of sharing); and their reasoning about ownership, possession, and exchange relationships (what constitutes the *how* of sharing). It should be noted that while these capacities are arguably the most relevant to the current investigation, numerous others (e.g., language, memory, executive function, etc.) are also critical to social comparison by identifying which outcomes are equitable and which are not, and holding this information in mind during decision-making.

2.2 The *what* of sharing: Cognitive precursors in development

2.2.1 *Children's understanding of quantity*

Inequity aversion presumes that there are quantifiable *things* that can be distributed. One cognitive prerequisite to this understanding is a sense of numerosity. Numerical sense emerges early in development, progressively becoming more operational and explicit with age (Xu, Spelke, & Goddard, 2005). A "core number sense" (Dehaene, 1997) precedes infants' representations of abstract numbers, which begins to emerge around five months when infants understand basic arithmetic operations (e.g., small set subtraction and addition; Wynn, 1992). At six months infants discriminate between large sets of different magnitudes (Xu & Spelke, 2000), and by nine months they demonstrate the capacity for tracking cardinal values (Wood & Spelke, 2005). Recent evidence also demonstrates that infants track relative numerosity and quantities across modalities (Lourenco & Longo, 2010), a likely precursor to later, more explicit understanding of proportional equity (e.g., mapping of quantity in one domain to determine what is equitable in another; see below) that manifests as early as three years.

These early capacities expand, becoming more systematic and explicit over the course of early childhood as children gain mastery over non-symbolic arithmetic and abstract number concepts. By six years children demonstrate an explicit understanding of transformations like splitting in halves or doubling in quantity (Barth, Baron, Spelke, & Carey, 2009), computations that are commonly involved in sharing studies..

2.2.2 *Children's understanding of quality*

To understand the "what" of children's sharing, it is useful to address children's understanding of *quality* as well as quantity. What are the dimensions that children value?

Four to-five-year-old children attach value to perceptual features of objects, such as size, color, and attractiveness (Fox & Kehnet-Ward, 1990). These perceptual features can be graded, so that the *quality* of them becomes the next relevant dimension by which children value objects. Given the choice between stickers, for example, children will pick those that are the *biggest* or the *most* colorful, and not necessarily those that are the most numerous (see Rochat et al., 2009 for several manipulations of this kind in a sharing game).

The value of an object may also be derivative of the relative effort it takes to produce it. This valuation may be grounded in how children understand ownership: As early as three years children recognize that creative labor implies ownership over objects (Kanngiesser et al., 2010). But production need not imply creation; valuation also stems from the *attainment* of objects. Three-to-five year old report liking better objects that

they already own (versus identical objects that they do not own; Lusas et al., 2008) in what are signs of an early *endowment effect*.

Between five and seven years, abstract properties feature into children's consideration of value. These are often pragmatic affordances of an object (e.g., it is easy to use or play with; it is durable or strong), but associative affordances take on importance as well. At this age children value objects that create a shared sense of group (e.g., we are friends because we both have the same shirt; see Faigenbaum, 2005, for a comprehensive discourse analysis on the topic).

The variety of objects and their relative qualities presents an evaluative challenge to the developing child. The same problem is true of evaluating people: Some individuals have more, need more, or have done more. For exchange to occur, objects and individuals must be equated at some level. This is often achieved by sharing proportionally, as described next.

2.2.3 *Children's understanding of proportionality*

Especially relevant to discussions about inequity aversion, the concept of "half" seems to subtend children's first understanding of proportion. By six children are capable of making proportional judgments with both discrete and non-discrete quantities (Spinillo & Blake, 1999), and by seven years children grasp the inverse relation between the number of parts into which a quantity is divided and the size of those parts (Sophian, Garyantes, and Chuan, 1997). Such competencies may be evident in even younger children (three- to four-years) if they are presented as analogies between conceptual

referents (e.g., a half pizza came from a whole pizza, therefore a half bar of chocolate must come from a whole bar of chocolate (Singer-Freeman & Goswami, 2001).

The relationship between proportionality and equity works in the reverse: it may be an early sense of sharing that supports later proportional reasoning. Squire & Bryant (2002) suggest that schemas about portions and sharing support mathematic concepts. Division is a difficult mathematic concept for five- to nine-year-old children, despite the fact that at this age readily and spontaneously participate in acts of portioning (e.g., sharing). Children at this age also experience difficulty discriminating between divisors and quotients. However, re-framing division problems in terms of sharing makes such discriminations easier. For example, children understand the concept of a quotient more easily if dividends (e.g., a part of the whole, like an apple slice) are grouped by the divisor (e.g., the thing being split, like an apple).

Finally, determinations of equity and fairness often involve more than determinations of absolute quantity. Sharing can be *relative* or proportional, involving what one has *in comparison* to another. Adam's (1963) theory of equity, for example, maintains that egalitarian preferences depend on proportional reasoning. Individuals compare and weigh the relative wealth, contributions, or attributes of players (which need not necessarily be material) to determine what payoffs each player should receive. Whether young children are capable of this level of transitivity and proportional reasoning has been contested in developmental literature. Studying 5-14 year olds, Piaget (1970) argued that the ability to transform values in one domain (e.g., speed) to another (e.g., distance) did not emerge until around twelve years. Accordingly, children would be unable to make conversions between a player's initial wealth, need, or effort and their

deserved payoff, praise, or rebuke. Others have argued that young children fail tests of proportional reasoning less because any such conversions that must be done across domains, but rather because they overextend numerical equivalency concepts (Boyer, Levine, & Huttenlocher, 2008; Jeong, Levine, & Huttenlocher, 2007). They find that children more accurately reason about such transformations if quantities are continuous rather than discrete (a point that we will return to in Study 2).

However, in the social domain, it seems as though proportional reasoning emerges earlier. Children associate value with the act of portioning things, and they factor proportional resource distribution into their social evaluation of sharing partners. By five years children judge as being "nicer" partners who give proportionally more than those who give proportionally less, above and beyond the absolute number of goods given (e.g., 3 out of 4 coins versus 6 out of 12 coins; McCrink & Bloom, 2009). In some instances, even three-year-olds may prioritize proportional information over absolute quantity if they are removed as recipients of sharing (Ng, Heyman, & Barner, 2011). By seven years children proportionally distribute resources on the basis of relative need or merit, giving more to partners who demonstrate greater need or who have invested greater effort (Hull & Reuter, 1977; Lerner, 1974; Sigelman & Waitzman, 1991).

2.2.4 *Children can compute expected values and risk*

A certain amount of uncertainty and risk are inherent to exchange relationships. In the ultimatum game, for example, there is never a guarantee of an equitable solution between parties; the only certainty in the game is that a rejection by one player will result in the forfeiture of material gains for both. In iterative exchange games, participants can

weigh what they know of a partner's behavior against the probability that they will continue to act in this way. Formal assessment of risk and probability are important to many domains of economic reasoning. Lotteries are institutionalized risk sharing in the sense that everyone contributes toward a pot, but not everyone will benefit from the ultimate endowment. And of course the very nature of indirect reciprocity—the notion that if I help you, someone else will likely help me at some undetermined time in the future (Nowak & Sigmund, 2005)—is a gamble in the most abstract sense.

In judgments about risk adults take into consideration not only probabilistic information, but also the size of the reward, what is called expected value. In addition to understanding proportionality, it seems that the ability to compute expected values and engage in probabilistic reasoning is not beyond the capacities of young children three- to five-years of age (Schlotmann & Tring, 2005). Children demonstrate understanding of concrete and tangible payoffs, but they are also skilled at computing and considering *potential* outcomes. As early as four years children make multiplicative judgments that weigh the probability of an outcome against its value (e.g, expected value) and demonstrate the capacity to consider the probability of two competing outcomes at once (Anderson, 1980; Schlottmann, 2000, 2001; Schlottmann & Anderson, 1994). This multiplicative inference allows individuals to equate different gambles to decide which will be the most advantageous. Even when expected values are comparable, adults tend to be risk-averse and prefer smaller "sure bets" to those that, while more lucrative, carry more risk. Between three and five years children engage in more risky economic decisions (e.g., are more inclined to gamble than opt for a smaller sure bet), but by six years are adult-like in their relative aversion to risky outcomes, though this depends on

context. Five to eleven year old children are more risk-taking than their parents when gambles are framed as wins, but not when they are framed as losses (Levin et al., 2003; Levin et al., 2007).

At the level of proximate mechanisms, relative risk aversion may be relevant to children's sharing behavior. Gambling can create inequity between parties; it is therefore possible that children who are egalitarian in their sharing would seek to minimize not only actual material inequity, but also *potential* material inequity caused by risky decision making.

The issue of uncertainty begs the question of who should shoulder the burden of risk in an exchange. It is useful to consider the extent to which children tie their fate to that of partner. For example, in a gambling task in which we both have something to gain (and lose), should our level of risk be equivalent? If not, what determines who gets the riskier deal? This potential equivalence between self and other will be addressed in the next section which examines the relationship between self-concept, theory of mind, and social evaluation.

2.3 The *who* of sharing: Development of perspective taking, social evaluation, and moral emotions

2.3.1 *Social perspective taking and moral reasoning*

With regard to equity, Enright et al. (1984) argue that children's judgments of fairness follow a stage-like sequence. Egoistic concerns (e.g., "I want the reward the most") and arbitrary attributions (e.g., height, age) characterize the earliest stages, whereas later stages are marked by increasing impartiality and appeals to standards ("She

deserves more because she worked more") as well as greater consideration for what others think they deserve. Proportional reasoning becomes an objective tool that older children (seven- to eight-years-old) may use to determine who deserves what, whereas younger children (five- to six-years-old) may rely rules such as "half is equal and fair" when distributing goods (Singh, Chong, Leow, & Tan, 1996; Hook & Cook, 1979). Still younger children (three- to four-year-olds) may simply self-maximize payoffs without regard to any fairness rules or "do-as-you-would-be-done" perspective.

Hoffman (2000) has described this phenomenon as social perspective taking, an act that involves both an awareness of what another is feeling as well as the imaginative act of placing oneself in that person's place. Social perspective also entails understanding the condition of reversibility, i.e., the sentiment that a behavior must be acceptable to both the instigator as well as the target of a given act (Gibbs, 2003). Children's ability to reason about reversibility is initially poor but begins to improve around five years of age (Piaget, 1965), approximately the same time that false belief and other important indicators of social cognition also begin to flourish (Wellman & Liu, 2004).

Sally and Hill (2006) have argued that this kind of social perspective taking and theory of mind accounts for fair-minded acts in ultimatum game play. Researchers sampled six- to ten-year olds and asked children to complete a series of tasks including the ultimatum and dictator game, as well as a classic false belief task. For normally developing children, results were consistent with adult findings: children made egalitarian offers to their partners and rejected stingy offers in the ultimatum game and were relatively altruistic to their partners in the dictator game (in which there is no possible retaliation). Furthermore, these children passed the false belief task, indicating

an ability to reason successfully about other's mental states. However, a sample of children with autism spectrum disorder (ASD) who participated in the same tasks yielded markedly different results. ASD children appeared to base their distributions on one of two rules: either divide the reward exactly in half, or keep everything. There was no variation in offers outside these two strategies. Additionally, when they were recipients who could decide to accept or reject their partner's offer in the ultimatum game, ASD children were not discriminating. They commonly accepted offers that were stingy (i.e., less than 20% of the payoff), whereas typically developing children and adults would reject such an outcome. Finally, these results were significantly correlated with ASD children's failing performances on the false belief task. The authors concluded that the inability to mentalize on the part of ASD children resulted in their less than strategic behavior and seeming insensitivity to fairness in the bargaining games (Sally & Hill, 2006). These findings point to the importance of perspective-taking in the development of inequity aversion.

However, in typically developing populations, performance on the false belief task does not predict egalitarian sharing per se (Rochat et al., 2009). Rather, false belief understanding is correlated with *strategic* sharing. Robbins and Rochat (in prep) presented three year olds with a collection of six coins, four of which were plain and two of which were brightly colored. In a sharing task children were asked to split these coins between themselves and the experimenter. Three-year-olds who passed the false belief task shared the coins strategically, sharing equitably with regard to *quantity* (e.g., giving each player three coins) but not *quality* (e.g, keeping the two special and one plain but giving the experimenter only plain coins).

The absence of any correlation between egalitarian sharing and theory of mind in these studies suggests several possibilities. First, when younger children are equitable, it may be less about considering the needs of oneself relative to a partner and may instead reflect a preference for perceptual symmetry. Second, although by age five the majority of children share equitably, a sizable number do not. These children are well beyond the age at which most Western children pass the false belief task, and therefore their selfish tendencies are likely not attributable in full to a diminished capacity for perspective-taking. An alternative explanation would suggest that fairness may not be linked to theory of mind per se, but rather to the child's experience with possession, ownership, and endowment.

2.3.2 *Social Evaluation and Reputation*

Social evaluation begins early in development. Infants and children demonstrate signs of parochialism and in-group bias by preferring to interact with members of their own group. For example, ten-month-old infants prefer to engage with objects that have been modeled by or associated with a speaker of their native language (Kinzler et al., 2012). Preference for these in-group members translated to preferential distribution of resources. At 2.5 years children will share toys with a speaker of their native language over a non-native speaker (Kinzler et al., ibid). In third-party sharing, three-year-olds asked to "assist" a doll in distributing resources will give more to partners descried as kin or friends, but not as strangers (Olson & Spelke, 2008). Furthermore, in first party-sharing, three- to seven-year-olds all demonstrate signs of parochialism, sharing more

equitably with anonymous partners described as classmates versus children from a different class (Fehr et al., 2008).

Children are also sensitive to how others elect to distribute resources or act prosocially. Three-month-old infants who view a vignette in which an agent is helped or hindered in the attainment of a goal (e.g., climbing a hill) react more 'negatively' (e.g., look longer) to the antisocial hinderer (Hamlin et al., 2010). Between six- to twelve-months infants shift focus and become more inclined toward the prosocial helper (as indexed in reaching tasks; Hamlin, Wynn, & Bloom, 2008). Infants also evaluate how adults interact with third parties. At nineteen months they look longer when adults split resources inequitably between identical animate puppets, and by 21 months they anticipate that collaborators on a task should be equally rewarded by an experimenter (Sloane et al., 2012). This same negative appraisal of antisocial or unfair others is also evident during the preschool years. Three-year-olds show non-verbal signs of discomfort (e.g., negative affect, averted gaze) when sharing outcomes are inequitable, and by five years children selectively share with partners who have previously shown them generosity (Robbins & Rochat, 2011; but see also Baumard et al., 2010 and Kenward & Dahl, 2011 for examples of this in third party sharing).

Social evaluation of others is ubiquitous: the question is the extent to which children also understand that *they* may be socially evaluated. An emerging understanding of reputation is the process by which children come to know that they are *also* the product of social evaluation.

Concern for social evaluation has long been considered an important factor in models of prosociality and cooperation. Great apes, for example, demonstrate preference

for con-specifics who have demonstrated competency on a collaborative task (Melis, Hare, & Tomasello, 2006) as well as human experimenters who have been generous versus selfish in previous interactions (Subiaul et al., 2008; Russel, Call, & Duncan, 2008), and there is evidence that such a "reputation effect" is present for canines (Kundey et al., 2011) and certain species of fish (Bshary & Grutter, 2006). As Axelrod (1984) notes, a reputation helps define the "shadow of the future" by projecting information about prior behavioral consistency and expected future outcomes, including adherence to socially desirable norms for cooperation and reciprocity. The etymology of word points to this fact: "reputation" stems from the Latin *reputare*, meaning to reflect upon, reconsider, or recalculate.

Many developmental studies of reputation have focused on peer perceptions of behavior traits including friendliness and popularity (Hill & Pillow, 2006; Gifford-Smith & Brownell, 2003; but see also Zeller et al., 2003 for a review). Children as young as three evaluate others' actions both in relation to normative appeals (e.g., for fairness; Dunn, 2006; Ingram & Bering, 2010) and descriptive rules (e.g., discriminating between doing something "naughty" versus doing something "different;" see Cosmides, 1989; Harris & Nuñez, 1996; Rakoczy et al., 2008). Young children also demonstrate an awareness of being evaluated by others. Around 21 months, the same age that they begin to manifest explicit understanding of ownership and reciprocal exchange (Rochat 2011), children increasingly call attention to their achievements during free play situations (Stipek et al., 1992). By three years children show both explicit and implicit signs of discomfort with inequity perpetrated by others (LoBue et al., 2009) and by five years children demonstrate a disinclination to perpetrate inequity themselves (Fehr et al., 2008).

In terms of self-presentation and evaluation, three- to seven-year-olds tell white lies in contexts that encourage politeness (such as neglecting to inform an adult experimenter that she has a mark on her face; Talwar & Lee, 2007) and have been shown to spontaneously inhibit negative affective displays in the presence of an experimenter who has established an expectation for positive affective reactions (Cole, 1986). When evaluating identical actions four to nine year olds tend to judge their own behavior more favorably compared to that of a sibling (Ross et al., 2004) and show evidence of the "subtle eyes" effect demonstrated in adults by sharing more altruistically in the presence of a mirror (Ross, Anderson, & Campbell, 2011).

Recent work (Robbins & Rochat, in prep; Shaw et al., 2012) demonstrates that concern for reputation is explicitly linked to children's egalitarian sharing. Between five to seven years children distribute resources more equitably if the outcome of their distribution is public. In contrast, if the outcome of a sharing decision is private and unobservable to sharing partners, children at this age are more self-maximizing in their distribution of resources. (Note, however, that a sizeable proportion of five-year-olds and seven-year-olds do not show this effect and are egalitarian regardless of context; see Robbins and Rochat, in prep).

2.3.3 *Moral Emotions in Development*

The moral emotions of guilt, shame, and empathy are often referred to as the "self-conscious emotions" because they entail an individual's evaluation and appraisal of the self in reference to others (Eisenberg, 2000). Guilt and shame, for example, may be elicited in response to unacceptable impulses and may therefore evoke feelings of

responsibility in response to the perceived violation of a moral norm that is presumably shared with others (Ferguson & Stegge, 1998).

Of the so-called moral emotions, empathy has received the most attention (for a comprehensive review of its proximate and ultimate causes, see Preston & de Waal, 2002). As defined by Eisenberg (2000), empathy is an affective response driven by the comprehension of another's emotional state. So construed, empathy is associated with pro-social acts such as helping behavior (particularly oriented toward distressed peers; Eisenberg, 2003; Holmgren, Eisenberg, & Fabes, 1998; Eisenberg & Mussen, 1989), as well as to human and animal models of altruism (Warneken & Tomasello, 2006; Preston & de Waal, 2002).

In ontogeny, empathic responding is one of the first of the social competencies to develop after joint-attention and social-referencing. These "competencies" enable the infant to engage in triadic exchange of attention and subjective states with others, a precursor to developing phenomena like false belief understanding that emerges during the preschool years. Zahn-Waxler and Radke-Yarrow (1982) as well as others (Ungerer, 1990; Sagi & Hoffman, 1976) document that whereas infants respond to the pain of others with personal distress, by the second year of life, this reaction has become one of true empathic concern: by 14 months personal distress is not required to motivate pro-social behaviors such as comforting (Eisenberg & Fabes, 1998) or assisting an adult in the attainment a goal, such as opening a cabinet, even when this assistance is not rewarded (Warneken & Tomasello, 2009).

In later childhood (around three- to four-years) this tendency toward helping is tied to both the child's understanding of conventionality as well as their burgeoning

theory of mind and ability to engage in perspective taking (Gopnik & Wellman, 1992; Wellman, Cross, & Watson, 2003). By 34 months children not only discriminate between conventional and moral transgressions (Smetana & Braeges, 1990) but are more likely to report feelings of guilt and remorse following their own moral transgressions (Stipek et al., 1990; Zahn-Waxler & Robinson, 1995). Children who frequently report experiencing these moral emotions are also more likely to accept responsibility and focus on reparation following a transgression event (Kochanska et al., 1994), suggesting that at some level they see themselves as accountable. Later in childhood and with regard to fairness, in *hypothetical* judgments about how a good should be distributed, children frequently provide rationales indicative of empathic concern, such as wanting to make a friend happy (Singh, et al., 1996; Enright, et al., 1984; Damon, 1975).

In short, the "who" of sharing depends on several factorrs. Social perspective taking and theory of mind provide three- to seven-year-old children a window into the needs and desires of their sharing partners. Children evaluate their sharing partners, and by five years are sensitive to the fact that they themselves are also evaluated. These evaluations carry affective overtones, the so-called moral emotions, that may be elicited in response to perceived inequity or transgressions.

2.4 The *how* of sharing: Co-developing experiences with exclusivity and possession

As the child's ability to combine multiple perspectives strengthens, value judgments and appeals to norms (e.g., to share equitably) begin to characterize how children determine the appropriateness of social interactions. Children learn through

early experiences with personal agency and perspective-taking that they can influence the outcome of their interactions with others (Goubet, Rochat, Marie-LeBlond, & Poss, 2005). By the second year of life, this sense of personal agency becomes apparent in the child's understanding of possession and ownership. Faigenbaum (2005) notes that as children abandon purely instrumental understanding of objects, negotiation (particularly reciprocal exchange) features prominently in defining and re-defining the value of a good or an act. In the next subsections we briefly address how this understanding unfolds in early development. Although a rich literature describes concepts of possession and ownership in infancy, here we address the developmental changes that occur during the preschool years when inequity aversion first begins to manifest.

2.4.1 *Origins of self-concept and possession in infancy*

The sense of agency and ownership that emerge early in development are important constituents of what it means to have self-concept, and by extension, what it means to share. From two months infants explore the sense of self as agentive through contingency (e.g., perceptual effects of the infant's own embodied actions; see Rochat, 2011) and later through interaction with (and control over) objects. Two-month-olds explore the causal links between their actions and objects in the environment by modulating their sucking behavior on a pacifier that creates pitch variation in response to pressure variation (Rochat & Striano, 2009) or modifying kicking behavior when it is contingent with the movement of a mobile (Rovee-Collier, 1987).

Infants engage in triadic interactions between agents and objects at nine months. The pointing and grabbing behavior of infants at this age ("proto-imperatives") may be

first signs of possession and control over the physical environment, but also the social environment, when it captures a care-givers's attention (Rochat, 2011). The back and forth exchange of eye contact and attention between infants and their caregivers may constitute a "symbolic reciprocity" (Bruner, 1983) that becomes more explicit over development. At this age infants also develop a sense of exclusivity in regards to persons (e.g., a mother's attention) but also in relation to objects (e.g., familiar objects of attachment or transitional objects, see Winnicott, 1982). Finally, between 12-24 months infants begin to participate in peer exchanges such as greeting friends or offering toys (Faigenbaum, 2005). These exchanges are often accompanied by holophrastic expressions like "mine!" that denote possession (Rochat, 2011).

2.4.2 *Children's understanding of ownership and exclusivity*

In any exchange of resources, children must (at least implicit) identify *who has what.* Whereas ownership is an intangible, invisible, and abstract property of objects, possession (insofar as it involves physical contact) is visible to others. Early conflicts over resources (two- to three-years) are therefore conflicts of possession ("who has it?") rather than ownership ("whose is it?"). Prior to three years children demonstrate a "first possessor bias" by which the first person who owns (or controls) the object retains ownership over it (Friedman & Neary, 2008; Friedman & Neary, 2009. In principle, early conflicts about possession are conventional in nature—disputes about how toys are typically used to perform an activity (Dunn, 1988; Faigenbaum, 2005).

Sharing entails a both an understanding of ownership and transference of that ownership. Transfer of objects does not imply transfer of ownership. In a sharing game,

for example, many individuals may possess a toy, but this temporary state of having does not mean the possessor owns the toy. Three-year-olds protest partners who do not return objects to their original owner (Hook, 1993) or who claim their own control over an object (Rossano et al., 2011). As a consequence, rules of transfer become important to children starting around age four, when children protest the illigetimate acquisition of an object (e.g., theft) or wrongful use of them (e.g., breaking a toy; Weisberg & Leslie, 2009; Vaish et al., 2010; Vaish et al., 2009). By five years this conventional understanding takes on normative overtones. Five-year-olds will appeal to rights that owners have over their objects (Kim & Kalish, 2009) and will describe transgressions of transference rules as "unfair." By seven years, children engage in restitution following an transfer transgression by either punishing or compensating the wronged party (Hook, 1993).

In brief, the developmental story regarding ownership is one in which children move from concrete and inflexible notions of possession that have their roots deep in infancy to a more abstracted understanding of ownership that is reciprocal and in some cases contractual in nature.

3. Synthesis: How do children share?

3.1 An overview of the literature on inequity aversion in development

To date, only two studies (Moore, 2009; Fehr et al., 2008) have explicitly investigated inequity aversion. Although both studies (described in detail below) demonstrate that inequity aversion is present in young children, they differ with regard to the age that this phenomenon first emerges. Fehr et al. (2008) find that inequity aversion

is expressed in children no sooner than eight-years of age; using a slightly modified paradigm, Moore (2009) finds that children as young as 4.5-years-old prefer egalitarian outcomes. In addition to these two reports, several studies of children's sharing behaviors have indirectly or implicitly assessed inequity aversion and have uncovered strikingly similar developmental patterns. In what follows we present a review of the literature regarding the sharing and distributive acts of children between three and eight years and relate these findings to Fehr and Schmidt's (1999) conceptualization of inequity aversion.

The aim of this review is two-fold. First, it addresses the issue of selfishness: when do children first show signs of modulating their behavior to be fair and equitable? As a related line of inquiry, when do children show signs of discomfort with selfish acts perpetrated by others? Second, it addresses the issue egalitarian preferences by examining children's reactions to both advantageous and disadvantageous inequity (e.g., the malaise of having more and having less).

3.2 Methodological considerations

Many developmental studies touch upon egalitarian (equitable) preferences, even if they do not examine inequity aversion directly. These studies fall into one of two general categories. Investigations of *strategic sharing games* most closely resemble the behavioral economic and game theoretical paradigms used in the adult literature in that they ask children to bargain over the allocation of a shared good. *Distributive justice games* broadly construed include any sharing task in which children are simply prompted to split resources between either themselves and a partner, or between third parties.

A few manipulations are common within this later genre of sharing games. Studies that probe proportional equity ask children respond to a pre-existing inequity forced upon them by the experimental situation. Here, children distribute resources after learning that one player has contributed proportionally more effort to a joint task, or is in relatively greater need of the shared resource. In what we dub spontaneous sharing games children are provided no explicit instructions about how to divide resources, nor are they provided with details or traits about their sharing partners.

Across each of these various paradigms, the issue at stake is whether with age children are more or less inclined to distribute resources equitably. Furthermore, when children show signs of egalitarianism, can it be determined from the features of the experimental situation whether this behavior is driven by a distaste for disadvantageous inequity (envy), advantageous inequity (compassion), or both?

The selection of studies reviewed here is constrained by further methodological considerations. First, to enable comparisons and generalizations to the populations sampled in this dissertation, we review only those studies sampling children between three- to eight-years of age. This age range that encompasses many developmental milestones—most notably the emergence of false belief understanding (Wellman & Liu, 2004; Gopnick & Graf, 1988) and the sense of ownership and possession (Faigenbaum, 2005)—that have been linked to an understanding of fairness in the prosocial and moral development literatures (Gibbs, 2003; Holmgren, Eisenberg, & Fabes, 1998; Enright, et al., 1984). Second, because the focus of this review is on children's behavior, the works cited here all represent studies in which children are active participants in a distributive

decision[4]. This is not limited to studies in which the child is a recipient of the shared good; by including studies featuring the child as a non-recipient distributing a good between third parties, we are able to tease apart the role that self-interest and immediate personal gratification might play in children's inequity aversion. The important point to reiterate here is that these studies examine actual distributive behavior, not hypothetical judgments about fairness (Enright, Franklin, & Manheim, 1980; Damon, 1975).

3.3 A review of strategic sharing games

Strategic sharing refers to studies in which children are placed in a bargaining-like scenario and asked to distribute resources accordingly. The paradigmatic example is the standard ultimatum game in which one player proposes a means of dividing resources to a second player who may either accept or reject the offer (in which case neither party receives anything). We also include in this category studies that involve forced choice tasks (e.g., Bartling et al., 2009) that require children to decide between an egalitarian outcome and sets of alternative distributions. Forced choice tasks are bargaining-like in that the participant explicitly considers the payoffs available to herself and to her partner; it is strategic in that children chose between a limited number of outcomes (other tasks, such as distributive justice games, are much more open-ended and do not explicitly provide the child with alternatives). Because this experimental forced choice paradigm is the most direct test of inequity aversion to date, we will start our review of strategic sharing here before returning to the ultimatum and dictator games. It is important to note

[4] This in contrast to the classical work of Piaget (1965) and Kohlberg (1984) that depended primarily on verbal interviews to assess children's reasoning about hypothetical moral dilemmas, including those about fairness and justice.

that, as with adults, these kinds of tasks are usually one-shot interactions carried out under conditions of anonymity (on the part of the players; for safety and ethical concerns, the experimenter is usually cognizant of the child's role in the game). Even in situations where the child shares with a familiar in-group member (e.g., Moore, 2009; Fehr et al., 2008), the partner is never physically present. Instead, drawings or photographs are used as reminders of the familiar other.

3.3.1 *Forced Choice Tasks*

In a recent and widely reported study conducted by Fehr and collaborators (2008), children participated in a forced choice task modified from the methodology detailed in the Bartling et al. (2009). In this study, three- to eight-year-olds chose between small collections of candies, one of which was always egalitarian (1:1 distribution). In the prosocial solution (1:0), a participant can deliver a payoff to both players without any personal sacrifice by opting for the egalitarian option, although the alternative distribution would result in an advantageous inequity favoring the child. In the envy condition (1:2 distribution), it is again possible to deliver egalitarian payoffs to both players, although in this case, the alternative solution results in a material disadvantage for the child because her partner receives more. The sharing condition (2:0 distribution) is considered the strongest test of inequity aversion, as the egalitarian choice to deliver candy to both players comes a personal cost because the alternative would give the child double the rewards.

In another departure from the Bartling et al. (2009) study, children in the Ferh et al. (2008) study did not interact with an anonymous partner. Instead, children made

choices for themselves and a series of protagonists (represented by pictures of a classmate or peer in another class). Eight-year-olds demonstrated inequity aversion by avoiding inequitable distributions and choosing the egalitarian solution in most conditions, even when the inequity was advantageous and in their favor. This trend was not observed amongst three-year-olds, who tended to act selfishly across all conditions by choosing the distribution that would benefit them the most (Fehr et al., 2008). The authors found that across all age groups, decisions were mediated by parochialism, such that the egalitarian choice was more common when interacting with familiar others.

Moore (2009) replicated this study with four- to six-year-olds, with a few notable changes. First, rather than sharing with generic in-group members represented by a photograph (as in the Fehr et al. study), children in Moore's study were asked to envision a specific friend with whom they had interacted in the past. This modification was included to make the manipulation of social proximity more salient. Second, Moore added a delayed gratification manipulation. The egalitarian (1:1) solution offered immediate rewards to the child and her partner, but for the prosocial and sharing choices, the rewards (1:1 and 2:1, respectively) were not distributed until after a brief delay. The impact of this delayed reward was that four-year-old children were more equitable, able to distance themselves from the immediacy of a larger absolute payoff in favor of picking the egalitarian outcome. Consistent with Fehr et al., Moore found an interaction between choice type and degree of social closeness: egalitarian sharing was more common with friends, even when this choice came at a personal cost.

Forced choice paradigms reveal both a heterogeneity of preferences as well as effects of social proximity. In addition to egalitarian tendencies, a sizeable percentage of

children are characterized by varying degrees of generosity or selfishness. This heterogeneity is not determined by entirely by parochialism—a certain proportion of children are egalitarian, generous, or selfish regardless of the identity of their sharing partner—suggesting that other factors may be at play and thus motivating the studies of this thesis.

3.3.2 *Ultimatum Games*

Generally speaking, there are little to no developmental trends with regard to ultimatum games, in which children across all age groups (four- to seven-years) tested offer partners at least a portion of the potential payoff. Consistent with adult studies and across developmental time, offers made to partners approximate a 50/50 division of the resources, and rejection is common when offers fall below 20% of the good. This is true independent of reward type including stickers (Benneson et al., 2007; Lucas et al., 2008 Sally & Hill, 2006), candy (Murnighan & Saxon, 1998), or tokens (Harbaugh & Krausse, 2000; Harbaugh et al., 2007).

With regard to inequity aversion, some evidence suggests that when children deviate from the 50/50 split they do so in ways that are generous, giving more to their partner and creating disadvantageous inequity for themselves. Evidence of such "hyperfair" offers stems from younger cohorts (four- to six-year-olds; Benenson et al., 2007). As a result, there is some debate as to whether generosity in this context constitutes a prioritizing of another's welfare versus an inability to reason strategically about the game because these "hyperfair" children were also more likely to accept small offers from their partners when their role in the game was reversed.

At the same time, children's sharing in ultimatum games seems insensitive to contextual factors, at least in one-shot interactions. Partnering children with stingy or generous confederates, for example, does not influence participants to become more strategic about their offers (Lucas et al., 2008). However, in iterative games when they are allowed to observe all possible interactions between all participants playing the ultimatum game, five- to seven-year-old children demonstrate clear signs of reinforcement learning by becoming more strategic in their offers to their partners (Harbaugh, et al., 2007). In relation to inequity aversion, this finding suggests that other-regarding behavior might be a learned response that depends on repeated interactions. In other words, of the two parameters guiding inequity aversion, by default the stronger may be self-regard, with other-regard becoming more predominant only after repeated exchanges with a partner makes more evident their intentions, needs, or desires.

3.3.3 *Dictator games*

Dictator games are conceptually related to ultimatum games, with one caveat: the offer made by the proposer in the game cannot be rejected and partners are passive recipients of the proposed distribution. Rather than testing children's inequity aversion proper, the dictator game is more a measurement of altruism, since without any fear of rejection, anything that the child offers to her partner comes at the cost of personal gain. It is often paired with the ultimatum game as an assessment how generous individuals are in the absence of any strategic considerations.

As with adults (Koch & Normann, 2008; Camerer & Thaler, 1995), five- to seven-year-old children seldom give nothing to their partners, behavior that is often

interpreted as a sign of other-regarding behavior. Furthermore, within-subjects designs in which children play both dictator and ultimatum games speak to the issue of intent. As proposers, when children make *smaller* offers in the dictator than in the ultimatum game, they are said to be other-regarding because this generosity confers no strategic advantage (e.g., they offer less than 50% but still offer something when there is no pressure to do so). In other words, children share in the dictator game because they intend to be kind or generous, but they share in the ultimatum game to avoid rejection without any overt intention toward their partner.

In the studies reviewed here, the average offer of approximately 40% of the payoff in the dictator game is smaller than the offers made in ultimatum bargaining, but still larger than a zero offer (total monopolization; Lucas, et al., 2008; Harbaugh, et al., 2003). A rich interpretation of these findings suggests that children are motivated by concern for the satisfaction of their partners, or that they want to be perceived as generous. At the very least, in a lean interpretation, these findings indicate that children understand the difference between the two games and attempt to avoid rejection when it is a possiblity. With regard to development, no clear age effects are evident, although Benenson et al. (2007) suggests that older children (eight- to nine-years-old) are more generous than younger children (four- to five-years-old, with the exception of the small minority of "hyperfair" children in this younger age cohort).

Collectively, the strategic sharing games reviewed here (forced choice, ultimatum, and dictator) suggest that egalitarian sharing emerges between five to seven years. Prior to this age younger children may make fair offers, but this is usually an artifact of the experimental situation: fair offers are only made when there is the potential for rejection

(as in the ultimatum game) but not when partners are passive recipients (as in the forced choice and dictator games).

3.4 A review of distributive justice games

In distributive justice games children decide how to distribute resources between parties. Some of these games are modified dictator games—children split resources with a partner, or they decide how to split resources between third parties when they are not themselves recipients.[5] In another kind of distributive justice game children are presented with a pre-existing inequity that they may choose to rectify or not by allocating resources selectively. In all cases, whether children distribute between themselves and a partner or between third parties, there is no chance of retaliation from other players.

In a typical study, participants are assigned an anonymous partner about whom no specific details are provided. In one of the first developmental distributive justice studies, Uğurel-Semin (1959) presented children (4- to 16-years-old) with odd numbers of nuts (either 5 or 15) before instructing them to share them with an unfamiliar partner who was present in the room during the distribution. The egalitarian solution (i.e., the one that was the most relatively fair, either a 2:3 or 5:7 split) was rare amongst all age groups, though perhaps this was an artifact of how "equity" had to be operationalized with an odd number set. Instead, young children (four to six years) were characterized by selfishness (tending to monopolize the nuts), and older children (seven to eight years) were characterized as generous (giving more than "half" or the lion's share to the partner).

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[5] Dictator games paired with ultimatum games are always played between the child and a partner. In no studies that we reviewed were ultimatum games partnered with dictator game in which children distribute resources between third parties, hence our labeling of the games as "modified."

Though the use of even number sets in forced choice (Fehr et al., 2008; Moore, 2009) tasks has made it possible to better operationalize and measure egalitarianism, this basic trend toward increased generosity with age has remained a persistent and highly replicated finding.

In addition to manipulating the number set of shared items, manipulation of the child's sharing partners is a common strategy for probing social preferences. Two of the most salient features that children may use to evaluate their partners are relative effort (e.g., Hook, 1978; Leventhal & Anderson, 1970) and relative need (McGillicuddy-De Lisi et al., 1994; Hull & Reuter, 1977). In other words, these studies present children with a pre-existing inequity before giving them the chance to distribute goods. Hence, children are essentially making two related fairness judgments: Is the condition surrounding the sharing task fair (e.g. procedural justice and the issue of impartiality), and should proportionality be taken into account when distributing the good. Following, children are asked to distribute a reward between themselves and their partner. There are three possible outcomes to such a scenario. First, children can decide to split the good equally and without regard to the relative need or deservingness of the players (this is egalitarianism in its strictest and most literal sense). Second, children can adjust their distributions by giving a proportionally greater share to the more deserving protagonist. This solution is called "proportional equity" because it levels out the relative contributions of players in the game by giving one individual proportionally more (e.g., the player who is perceived as more deserving or meritorious receives a proportionally greater payoff). It should be noted that in situations where the child is a recipient of the distribution, such a division could theoretically result in disadvantageous inequity (if

one's partner is perceived as more deserving) or advantageous inequity (if the child perceives herself as more deserving). Third, children can choose to favor themselves regardless of the deservingness of their partner; this is the self-interested solution, and it creates an advantageous inequity that favors the child.

In what follows we summarize the major findings from these various permutations of the distributive justice game.

3.4.1 *Universal trends toward egalitarianism*

Rochat et al. (2009) argue that the transition from relatively selfish to relatively egalitarian sharing emerges around five years and is universal. In their cross-cultural study of seven highly contrasted cultural contexts, Rochat and colleagues manipulated the number of candies to be distributed (even or odd sets) as well as the child's status in the game—children split candy as both recipients and non-recipients. Generally speaking, three-year-olds across all cultures were not inequity averse as recipients, allotting to themselves on average around 65% of the candy. However, when they were non-recipients, three-year-olds were significantly more inclined to split equitably. Five-year-olds in all cultures were comparatively equitable, though the *magnitude* of this developmental trend was culturally-specific. Already by three years of age heightened egalitarianism and generosity were more common in cultures characterized by collectivism and small-scale subsistence living (e.g., Samoa) relative to individualistic and industrialized cultures (e.g., United States) that show a steeper developmental trend between three and five years.

This general developmental trajectory has been observed in other cross-cultural samples (e.g., Columbian preschools; Pilgrim & Rueda-Riedle; 2002) as well as among Indian and Chinese preschoolers (Rao and Steward, 1999). What seems to vary across cultures is less egalitarianism proper, and more the means by which such equitable outcomes are solicited and negotiated between children (e.g., the frequency with which children request versus spontaneously share resources equitably, the frequency with which children protest inequitable outcomes, etc.).

3.4.2 *Factoring social proximity, parochialism, and in-group bias*

Just as in forced choice tasks (Fehr et al., 2008; Moore, 2009), distributive justice games routinely find effects of social proximity and parochialism, such that children are more equitable with kin and familiar others than strangers. Olson and Spelke (2008) asked 3.5-year-olds to split small sets of blocks (no more than four) between a series of protagonists; children were non-recipients of the distribution. Children acted as a "consultant" to a doll who had to make sharing decisions regarding other dolls. Children helped divide resources more equitably with dolls who were described as relatives, familiar others, or previous sharing partners compared to dolls who were described as non-kin, strangers, or indirect sharing partners. This suggests that even very young children may exhibit egalitarian preferences, and that these preferences may depend on the attributes of the sharing partners. Children were more likely to avoid inequitable outcomes when the degree of social closeness between the dolls was higher. Such parochialism mediates even sharing of highly desirable resources (like cookies) split between a child and her partner. Three- to five-year-olds distribute more of their favorite

snack to friends than acquaintances, and are more receptive to solicitations and prompts to share when they are made by partners to whom they feel greater affinity (Birch & Billman, 1986).

3.4.3 *Proportional equity: Relative merit and effort*

The paradigmatic manipulation of perceived effort in a distributive justice game comes from Leventhal and Anderson's (1970) examination of children's sharing behavior. In this study, five year olds were asked to complete a trivial task (e.g., sorting letters, putting stickers on boards). Upon completion, participants learned that an anonymous partner had also completed this same trivial task. Children then compared the results of their own labor against the results of their unseen partner. In some cases, the partner was described as having completed significantly less work (implying a lesser degree of effort); in other cases, the work done by the partner equaled or exceeded that of the child (implying equivalent or greater effort). Importantly, the amount of work done by the participant was not manipulated. The dependent measure of interest was the number of stickers children distributed to themselves and to their partner. Replications of this basic design have been done with four- to eight-year-olds (Anderson & Butzin, 1978; Hull & Reuter, 1977; Lerner, 1974; McGillicudy-de Lisi et al., 1991; Nisan, 1984; Sigelman & Waitzman, 1991; Streater & Chertkoff, 1976; and Zinser et al., 1991). The most common finding that emerges from this developmental investigation is that children younger than nine tend to be insensitive to manipulations of effort. They do not engage in proportional equity, preferring instead to split resources in a strict egalitarian fashion. This developmental trend remains even after other factors are manipulated, including the

nature of the shared resource, the standards for determining relative effort, and the child's status in the game (e.g., worker and potential recipient versus observer deciding how to split goods between laboring third parties; see Thompson & Jones, 2005; Sigelman & Waitzman, 1991; Olejnik, 1976).

To reiterate, a consistent developmental finding across these manipulations is that prior to nine years children tend to be strictly egalitarian, dividing the rewards equally and seemingly without much regard for the relative effort of their partner. This is true in both conditions where the child is a recipient (e.g., Libby & Carrett, 1974; Lane & Coon, 1972; Masters, 1971) and a non-recipient (e.g., Sin & Singh, 2005; Singh et al., 2002; Tolan & Krantz, 1981). This trend spans a wide range of ages, from four-year-olds (Nelson & Dweck, 1977) to almost eight-year-olds (Tompkins & Olejnik, 1978). Furthermore, the preference for egalitarian outcomes is common across reward types, including candy (Peterson et al., 1975), toys and stickers (Larsen & Kellogg, 1974), and monetary compensation like tokens or pennies (Thompson & Jones, 2005).

With regard to non-egalitarian outcomes, two patterns emerge. First, selfish sharing that ignores or minimizes a partner's effort is more common in younger children, typically less than five-years (Larsen & Kellogg, 1974; Lane & Coon, 1972; Leventhal & Anderson, 1970). Second, proportional equity (i.e., outcomes where reward is proportional to the effort of the players) is rare and specific to older children (typically around nine years of age; Sigelman & Waitzman, 1991; Lerner, 1974), though more recent findings have challenged this developmental trend (Warneken et al., 2012). Older children engage in proportional equity both when they have been shortchanged (working harder but earning less) but also to a lesser degree when a partner has been similarly

disadvantaged, pointing to the joint influence of self- and other-regarding influences in inequity aversion. In cases where children acted as recipients and non-recipients (e.g., Streater & Chertkoff, 1976), proportional equity was only observed in non-recipient, third party contexts. This last point implies that children, particularly younger children, may be initially egoistic in their behaviors, only able to act equitably by suppressing this impulse or by removing themselves as potential beneficiaries (as in non-recipient sharing). Such findings converge with what has been observed regarding children's slow emerging generosity toward partners in ultimatum and forced choice sharing games discussed previously.

3.4.4 *Proportional equity: Manipulations Involving Relative Need*

A second (though less common) manipulation in distributive justice games is to vary a protagonist's need for material wealth. Experimenters might describe a sharing partner as "poor" or appeal to the child's emotion (e.g., "this little girl is sad because she doesn't have a lot of candy"). Unlike manipulations of effort, this manipulation produces consistent preferences for proportional equity, even in younger children. In first party sharing games, four- to eight-year-olds reliably distribute proportionally more resources to partners who are described as needy than to themselves (Streater & Chertkoff, 1976). The same is true in third party sharing games when who children are faced with two protagonists distribute more to the more needy party (McGillicuddy-de Lisi et al., 1991; Zinser et al., 1991).

At one level, the fact that children opt toward egalitarian solutions (except where need is involved) would seem to be a *disconfirmation* that children are inequity averse.

In general, children do not take advantage of the ability to rectify a pre-existing inequity in one domain (i.e., inputs such as effort) by proportionally allocating goods in another (i.e., the output domain, material reward). Beyond speculation that children at this age are simply too young to fully comprehend such transformations (see Boyer, Levine, & Huttenlocher, 2008; Jeong, Levine, & Huttenlocher, 2007), that children in effort manipulations do not tailor outputs to inputs, either as recipients or non-recipients, would seem to be a disconfirmation that children equate fairness with proportional equity. This in turn might imply that inequity aversion is at a different (perhaps more simplistic) level of fairness reasoning. The exception to this trend is relative need; here, it is not uncommon for children to proportionally favor a materially disadvantaged partner. Thus, we could conclude that children do not demonstrate signs of proportionally-based inequity aversion unless need is a factor in the decision.

On the other hand, children appear to be inequity averse in its most strict and literal sense if we consider only the tangible, concrete consquences (e.g., the material distributions themselves) and not the context in which they were decided. Here, it could be said that children are inequity averse because they typically opt for the egalitarian solution in which payoffs are divided equally between players, resulting in no absolute material disadvantages or advantages. Interpreting the data in this more literal manner reveals a developmental trend (more egalitarianism with age) that is consistent with the inequity aversion findings reported in Fehr et al. (2008).

A few methodological details must be addressed. An appropriate control for neediness manipulations is difficult to find, as any situation in which the child (rather than her partner) is impoverished would be conflated with any general tendency to self-

maximize resources. Neediness manipulations therefore inadvertently "stack the deck" toward other-oriented outcomes. Other considerations: the number of items comprising the resource set. In most distributive justice games children split anywhere between 10-20 items; these larger quantities may be beyond the register of participants (especially younger children), making proportionality decisions difficult. In such cases, the children may resort to the egalitarian solution simply because halving the reward is easier than computing other proportions that perhaps would be more obvious with smaller number sets.

Generally speaking, manipulations of effort and need suggest that sharing in young children is characterized by strict egalitarianism and inequity aversion in its most simplistic form. If children conceptualize fairness in terms of proportional equity, this tendency does not emerge until the end of the preschool years, if not later. This finding arguably reflects the conflict children may have between *recognizing* and *rectifying* inequity, the later of which may be more in the domain of moral reasoning about fairness than inequity aversion proper. This is a theme that will be revisited in Study 3.

3.5 Unresolved issues surrounding inequity aversion

Across experimental paradigms, there is remarkable cohesion regarding inequity aversion in children. First, there is significant heterogeneity with regard to social preferences. Although selfishness tends to characterize sharing in younger children (around three years) and egalitarianism and generosity tend to characterize older children (between five to eight years), these tendencies are not necessarily consistent within individuals at any age cohort. Individual differences are non-trivial, and, we would

argue, informative of the proximate mechanisms that subtend inequity aversion in the first place. A further investigation of these individual differences in relation to proximate mechanisms is required and forms the basis of Study 1.

Second, as a description of behavior, inequity aversion is agnostic with regard to whether social comparisons are construed in terms of negative or positive outcomes, and whether this construal is identical for self and other. For example, in considering disadvantageous inequity, do children appraise the situation in terms of personally having *less*, or someone else having *more*? It is an open question whether the experience of material loss and material gains or the potential for losses and gains) are of equivalent importance in deciding how resources should be distributed. This tension is explored further in Study 2.

Third, we question how children move beyond the recognition and avoidance of inequity to restorative justice that rectifies unfair outcomes. Building on the theme of asymmetry between negative and positive outcomes, we further question the nature of such so-called restorative justice, whether it stems from a desire to compensate victims or punish perpetrators. Finally we ask how strong these tendencies might be, whether children will act in a principled manner even at a personal cost and when doing so could not be construed as an act of personal retribution (Study 3).

4. Motivation for current investigation

4.1 Aim of the dissertation

Although inequity aversion is well-documented in adults (Bolton & Ockenfels, 2000; Falk & Fischbacher, 2005; Fehr, Bernhard, & Rockenback, 2008; Loewenstein,

Thompson, & Bazerman, 1989; Rabin 1993) and to a lesser extent in developmental literature (Fehr et al., 2008; Moore, 2009), the mechanisms underpinning the phenomenon remain underspecified. The studies presented here address three tenants of inequity aversion (and fairness reasoning) that have to date remained relatively unexamined.

4.2 Theoretical issues addressed

Proponents of inequity aversion posit that discomfort with unfair outcomes is driven by both self-interest and other-regard, but it is unclear what mediates the relationship or relative influence of these two parameters. At the level of individual psychology, it is an open question why one parameter would be more motivating. The experiments presented in Study 1 propose two proximate mechanisms—risk and competition aversion—that might account for the relationship between advantageous and disadvantageous inequity. In doing so, Study 1 addresses a potential source for the substantial developmental *and* inter-individual differences noted in the expression of inequity aversion (Fehr et al., 2008) and in acts of distributive justice more generally (Fraser et al., 2007; Hook & Cook, 1979).

The remaining two studies explore in parallel the potential asymmetry between self-regard and other-regard. Fehr and Schmidt (1999) speculate that individuals suffer more from disadvantageous inequity (i.e., being at a material disadvantage relative to one's partner) than they do from advantageous inequity (i.e., having more material wealth than one's partner). Such a 'losses loom larger than gains' mentality has been investigated in other areas of economic reasoning, particularly in relation to loss aversion,

or the notion that losses are more painful than gains are pleasurable. The purpose of Study 2 is to determine whether, as a function of age, children are prone to over/under-inflate estimates of their own material wealth (and that of a partner), and whether the magnitude of any errors in such estimations predict inequity aversion in children's sharing.

Finally, returning to the overarching issue of moral reasoning, it is unlikely that inequity aversion alone can account for the richness and diversity of fair-minded acts and moral judgment. For instance, in situations in which individuals are presented with a pre-existing inequity and given the opportunity to rectify it, do they do so to satisfy what is perceived as an imbalance or not-sameness (a very lean interpretation), or is a deeper meaning of fairness evoked? Strong reciprocity is defined as the tendency to punish those who have acted unkindly or to reward those who have acted with kindness (Gintis et al., 2005n). Study 3 examines the relationship between inequity aversion and strong reciprocity as they relate to the child's emerging sense of fairness. A secondary goal of study is to determine whether asymmetries exist with regard to *how* children opt to rectify inequity, either by compensating victims or punishing the trangressors of a moral norm like fairness. Collectively, the suite of experiments in Study 3 demonstrate how children move from mere inequity aversion to the adoption of an 'ethical stance' by refusing to accept unjust outcomes.

4.3 Prelude to general methodology

Although the experiments presented in the three studies of this thesis utilize different methodologies, they share the following features. First, in order to capture the

developmental trajectories of children's economic and moral reasoning, for all studies we sample three- to seven-year-old children from the same middle-class background living in metro-Atlanta, Georgia. This age range spans the emergence of several developmental milestones (e.g., false belief understanding, ability to compute expected value; see earlier discussion) presumably relevant to sharing behavior.

Second, to increase the comparability and generalizability of our data with the larger developmental literature on sharing, we have chosen as our dependent measure children's distributive decisions in two kinds of games: the forced choice task described in Fehr et al. (2008), which forms the backbone of Study 1, and modified dictator games (Study 2 and Study 3).

Finally, to parse apart the relative influence of self-regard from other-regard in children's sharing, all of the studies detailed here present children with the opportunity to make sharing decisions in both first-person and third-person contexts. This design allows us to examine differences in children's sharing when they are potential recipients of the distribution, compared to when they act as impartial non-recipients making distributive decisions for third parties.

It should be noted that although the data reported here are drawn from one culture, the majority of the work presented in this thesis has been replicated with children growing up in highly contrasted collectivistic cultures in Melanesia (Vanuatu) and Polynesia (Samoa). Although this thesis was not conceived to test hypotheses about the relative universality of inequity aversion, it fits into a larger program of research examining cross-cultural differences in the emergence and expression of fairness reasoning, an issue that is surely deserving of further empirical consideration.

PART II:

EMPIRICAL STUDIES

CHAPTER 2

5. Risk and competition aversion as two potential mechanisms of inequity aversion (Study 1)

As detailed in Part I (Theoretical Background), a wide body of literature confirms that children become more egalitarian with age. Whereas three-year-olds tend to share selfishly, by five years children manifest signs of inequity aversion, tending to split resources more equitably (Rochat et al., 2009; Robbins and Rochat, 2011). This trend is heightened amongst seven- to eight-year-olds who not only reject inequity but even opt to share generously and give the lion's share of their resources to a partner (Blake & McAulffie, 2011; Kogut, 2012).

In one of the most direct tests of inequity aversion to date (the Social Preferences Game), Fehr and colleagues (2008) presented three- to four-, five- to six-, and seven- to-eight-year olds with a forced choice task in which they decided how to split candies with an anonymous partner. A series of pre-determined distributions pitted an egalitarian (1:1) distribution against an alternative that was inequitable. In some cases the alternative created a material advantage for the child (advantageous inequity; partner receives less), and in other cases the alternative created a material disadvantage for the child (disadvantageous inequity; partner receives more).

Fehr et al. (2008) found that by seven years of age, children prefer egalitarian outcomes, whereas younger children (three- to-four years[6]) tend to opt more toward

[6] Note that in replications, egalitarian sharing is observed in children as young as four years if a delayed gratification design is used. Egalitarian choices increase if they are pitted against inequitable alternatives that immediately benefit only one party (Moore, 2009).

personal gain. These results beg the question of what drives the development of inequity aversion.

Parochialism and general in-group bias have received much attention in the literature, but, we argue, are less likely candidates to explain developmental differences with regard to inequity aversion. One reason for this may be that signs of parochialism are found much earlier in development (e.g., in prelinguistic infants; see Mahajan & Wynn, 2012) without seeming to change substantially over the preschool years, at least with regard to kin and close friendships. For example, Olson & Spelke (2008) asked three-year-olds to help a doll share resources between two other dolls described as strangers, friends, or kin and found that equitable sharing was most common in the friend and kin conditions. In the Fehr et al. study the child's anonymous partner was described as either a child from the same school (in-group) or from a different school (out-group). At all ages children demonstrated an effect of parochialism, such that they shared more equitably with in-group rather than out-group peers. (Moore, 2009, also replicates this affect with his younger cohort of four- to six-year-olds.)

Reasons for what would amount to marked developmental differences regarding egalitarian propensities remain unknown. We conjecture two possible reasons: one is that egalitarian behavior may depend on children's relative *risk aversion*. In particular, egalitarian children may opt to share only when they know the probability of gaining something is equivalent for themselves and their partner, risky choices leaving open the possibility of advantageous and disadvantageous inequity. The other possible reason is that egalitarianism may depend on whether children construe a sharing game as competitive. Egalitarian children may manifest *competition aversion*, competition

necessarily implying inequality as one person's gain is another's loss. These hypotheses are based on evidence of risk and competition aversion in development that we review next. The goal of this review is to document developmental changes that could ultimately explain and predict the differences noted in children's sharing behavior on the Social Preferences Game.

5.1 Potential Proximate Mechanisms: Risk and Competition Aversion

5.1.1 *Risk as a proximate mechanism*

Krawczyk and Lee (2010) argue that any volitional exchange of resources that can increase the probability of obtaining a reward makes *risk* relevant to both self-regarding and other-regarding acts (this would be true of sharing games and acts of reciprocity more broadly).

There are two levels at which risk may be relevant to distributive decisions. *Social risk* refers to the ambiguity that can characterize exchange and negotiation. In the absence of any exogenous pressures or reinforcement, there is no guarantee that a partner will share resources. In this sense, risk adverse individuals would share equitably to increase the probability of reciprocity (either directly from one's partner, or indirectly in the future). *Economic risk* relates to the probability that an investment (e.g., of resources, of time, of shared probable losses and gains) will be returned. From this perspective, risk adverse individuals share equitably because it increases the probability that both parties will walk away with something, no matter how minimal (Fehr & Fischbacher, 2005). In short, both social risk and economic risk can lead to material inequity, though the later is

more relevant to sharing contexts in which children unilaterally distribute resources (as in the Social Preferences Game, discussed above).

Decision-making tasks in adults tend to focus on the element of economic risk. For example, in a three-way dictator game, Karni et al. (2008) found that risk-averse participants sacrificed a portion of their expected payoffs to achieve greater procedural fairness (e.g., more equivalent risk) between other players. Economic assessments of risk take into consideration not only the probability of a reward but also the value of that reward, what is known as expected value. Even when expected values between choices are equivalent, adults tend to be risk-averse and conservative, preferring smaller "sure bets" to those, while yielding potentially larger payoffs, come at a higher risk of loss (Mahoney et al., 2011; Tversky & Kanheman, 1991; Weller, Levin, & Denburg, 2011).

Relative risk aversion also depends on whether the burden of a risky decision is shouldered by oneself or one's partner. Adults pay to reduce the risk associated with their own gambles (increasing their odds of a win) but not those of a partner (Brennan et al., 2008). Bartling et al. (2009) explicitly linked the risk and competitive tendencies of Swiss women with their proclivities toward egalitarianism. Participants played a modified version of the Social Preference Game (Fehr et al., 2008) that utilized cash incentives. Following the game, women could self-select into a lottery that might increase their payoffs, but at a high risk. Women characterized as egalitarian (based on their choices in the Social Preferences Game) tended to be risk averse, opting not to enter the lottery. In contrast a significant majority (72%) of non-egalitarian women self-selected into the lottery in what would amount to signs of risk-tolerance.

Assessments of risk presume at least a tacit consideration of probability—either in comparing the probability of two competing outcomes, or in comparing a single outcome to chance. Early studies suggested that both forms of reasoning were beyond the capacity of young children. Using a game in which children were asked to guess the source of a token drawn from two differing distributions, Inhelder & Piaget (1964) argued that prior to eight years, children have an almost binary understanding of probability (events either happen or not). However, if the question is reframed (e.g., from "which distribution is this token from" to "which outcome is more likely given these distributions"), five year olds are sensitive to probabilistic information. Brainerd (1981) showed three- to five-year old children differing ratios of animal stickers (e.g., 3 birds and 7 monkeys) and asked children to guess what would be drawn from a bag. Using this information, five-year-olds correctly predicted the outcome (e.g., a monkey sticker). Similar methodologies confirm that this ability likely emerges by five, but not before (Goldberg, 1966; Kuzmak & Gelman, 1986; Perner, 1979; Van Leijenhorst, Westenberg & Crone, 2008).

With regard to exclusive judgments of risk (e.g., those in which individuals compare a given outcome to chance rather than to the probability of a competing distribution), preschoolers and primary-school-aged children are able to identify optimal outcomes (i.e., those that confer the greatest payoff with the lowest possible level of risk), but do not act in accordance with this information. Four and five year olds are risk-tolerant, opting for gambles that are riskier than the optimal outcome, whereas seven-year-olds are risk-averse and choose gambles that are sub-optimal (van Leijenhorst et al., 2008).

Children also use multiplicative rules to integrate the probability of an outcome with the value of that outcome, computing expected values in ways that are similar to adult computations of risk (Schlottman, 2001). In a visual gambling task, four- to six-year-olds chose between a certain outcome (150mL of desirable juice that appeared on the left side of a table) versus uncertain receipt of either 300mL of the same juice or no juice, the results of which appeared randomly on the right side of the table. At this age, children tended to be risk-tolerant (opting for the gamble), although they demonstrated reinforcement learning and became more risk-averse over the course of multiple trials (Moreira, Matsushita, & Da Silva, 2010). Three- to five-year-olds are also sensitive to the context surrounding a gamble: at this age children are *risk tolerant,* preferring gambles to sure bets, but only when the outcome is framed as a win. If gambles and sure bets are framed as losses, three- to five-year-olds choose at chance levels (Schlotmann & Tring, 2005). In contrast, relative *risk aversion* (e.g, preference for sure bets delivered at a lower payoff) stabilizes between six- to nine-years and seems to be less context dependent. In other words, prior to six years the risk associated with a gamble has no predictive power over choice.

Judgments of risk may also depend on *who* is affected by the gamble, though the literature is not clear regarding the direction of this effect. Just as children may discriminate between the material rewards for self and other in sharing games, so too may they discriminate between the risk that assumed for self and other in gambling tasks. This may explain why a considerable number of children, even at seven years, are not egalitarian when sharing with others, particularly in the context of sharing resources with out-group member or unfamiliar others (Fehr et al., 2008; Moore, 2009; Zinser et al.,

1991). Crone et al. (2008) asked a sample of primary school children to make risk judgments (sure bet versus gamble) for themselves and an anonymous partner. Eight-year-olds (but not younger children) were risk-averse when making decisions for themselves and more risk-seeking when making decisions for a partner. However, other studies (Schlotmann & Tring, 2005) suggest that six to nine-year-old children are risk-averse for themselves, but also for third parties (e.g., dolls for whom they must make decisions). Recent findings in the adult literature (Poleman, 2012) substantiate this later position: undergraduates choosing between sure bets and risky gambles tend to be equally risk-averse when making decisions for themselves and a partner.

Taken together, these studies suggest that over the course of development children become more risk averse. This development seems to be independent of whether the source of the risk stems from the comparison of competing probabilities or the comparison of an outcome to chance. Furthermore, by seven years children may hold others in mind when making decisions under conditions of risk, though the direction of this effect (opting for equivalent or discrepant risk between parties) remains unclear.

The developmental rational for considering risk as a proximate mechanism of inequity aversion is as follows: Relative risk aversion (e.g., opting for sure bets over gains) minimizes the potential for loss (disadvantageous inequity), but in the context of social exchange, it also curtails the possibility of gaining more than someone else (advantageous inequity), even under conditions of uncertainty. Individuals can also maintain equity if they create an *equivalency* of risk between self and other (e.g., by making identical sure or risky choices for themselves and a partner). From this

perspective, egalitarianism would be the expression of an aversion to risk that becomes more marked between three- to seven-years.

5.1.2 *Competition as a proximate mechanism*

Sharing often occurs in the context of limited, finite resources. Arguments about possession pertain to who *owns* the object, but as relevant are conflicts about *access* to objects and how objects are acquired in the first place. The extent to which individuals are willing to vie over resources, what we call competition, may therefore aid in explaining developmental differences in egalitarian sharing.

A number adult studies use competitive preferences to study differences across institutions or cultures. A representative study by Gneezy et al. (2009) assessed the relative propensities of Maasi and Khasi individuals to self-select into a competitive tournament. In Maasi society (which is patrilineal), males were twice as likely to opt into competition than women. However, in Khasi society (which is matrilineal), women were more likely to compete than men. Such studies point to the importance of institutions in framing exchange relationships, but do not directly comment on how the experience of competition, at the level of individual psychology, translates to more or less equitable behaviour.

Other approaches offer more insight into the relationship between competition and inequity aversion. Relative tolerance for or aversion to competition can be measured by participants' willingness to self-select into competitive lotteries or tournaments. We highlight two such studies here. In the Bartling et al. (2009) experiment reviewed previously, women participated in a forced choice sharing task (the Social Preferences

Game) and were then offered the opportunity to enter into a competitive tournament against other players to earn more money. Egalitarian individuals were significantly less likely to opt into competitive games than were non-egalitarian women. In a modified ultimatum game (first reported in Fischbacher, Fong, & Fehr, 2003) multiple players competed to accept the offer of a single proposer. In this context, proposers made significantly smaller offers (e.g., were less equitable) than in traditional ultimatum games. Proposers in this modified ultimatum were able to get away with less generous offers because the probability of rejection decreased. Because many individuals were vying for the same offer, participants were willing to accept less generous offers if it meant "beating out" the other players.

What are the roots of such competitive tendencies in development? Starting around 2.5 years, children demonstrate a first possessor bias by attributing ownership of an object to the first person who possessed it (Blake & Harris, 2009). This property of ownership is associated with the first possessor no matter how the object is later exchanged, as evidenced by the fact that children at this age consider a birthday present given to a friend as still belonging to the giver defensive and proprietary about an object if told it belongs to them (Eisenberg-Berg, 1979). Three- to four-year-olds protest sharing outcomes that result from an exchange transgression (e.g., theft; Rosanno et al., 2011), though this is driven primarily by concern for rule abidance rather than by the concrete consequences for material wealth (Harris et al., 2001). Thus, prior to five years competition may not explicitly factor into children's sharing; the acquisition of resources may be less important than whether players in a game honour the proper rules governing that acquisition.

After age six, however, rivalry starts to influence children's sharing. Competitive contexts (e.g., those in which sharing is framed in terms of having winners and losers) lead to less generosity in sharing tasks (Barnett et al., 1979). Kagan and Madsen (1972) measured the relative competitive tendencies of five- to six- and seven- to eight-year-old Anglo-American and Mexican-American children in a forced choice sharing task that was similar to the Social Preferences Game (Fehr et al., 2008). Children could be collaborative (choosing options that gave the most resources to both themselves *and* a partner) or "rivalrous" (opting for outcome that favored only one player). Seven-year-olds were more collaborative than five-year-olds, though this effect was mediated by culture: Mexican-American children were significantly less competitive at both ages. That older children were more cooperative and hence more competition averse suggests that they were opposed to outcomes that did not also benefit their partner, or that created disharmony between players.

Replications of this basic effect are also noted in dictator games. Houser & Shunk (2009) asked five-to-eight year olds to split a collection of candies between themselves and an anonymous partner from their class. An additional directive specified that the child with the most candy after the offer (hence the child who offered the *least* candy to their partner) would receive a reward. The resulting competitive environment decreased egalitarian and generous sharing. Seven- to eight-year-olds were less inclined to compete than five- to six-year-old children, but when they did the magnitude of their self-maximizing tendencies (as indexed by their small offers in the dictator game) mirrored those of five-year-olds who tended on the whole to be more selfish. This would suggest that older children who are competition-averse are also inequity averse; they

eschew situations in which the material gains for one individual come at the expense of another. Collectively, these findings suggest that the sense of competition decreases between three to seven years.

The developmental rational for competition as a proximate mechanism of inequity aversion is as follows: Competition entails that a gain for one is a loss for another—it necessarily creates material disparity. Competition creates both advantageous inequity (for the person who wins) and disadvantageous inequity (for the person who looses). From this perspective, egalitarianism would be the expression of a competition aversion that becomes more pronounced between three to seven years.

5.2 Description of experimental approach and general working model

Study 1 assesses the possible link between children's relative egalitarianism and their relative aversion for either competition or risk in economic games. We consider these candidate proximate mechanisms because risk and competition can engender both advantageous and disadvantageous inequity. The developmental story would therefore be one in which egalitarianism emerges between five to seven-years (but not prior) as a consequence of children's growing aversion to risk and competition.

To assess this hypothesis, we partnered a sharing task (the Social Preferences Game, Fehr et al., 2008, which served as our measure of relative inequity aversion) with three economic games that measured relative aversion to risk and competition. Each of these games included a social component (e.g., making choices for oneself and a partner) that would allow us to better comment on how risk and competition aversion correspond to disadvantageous inequity (having less than another) and advantageous inequity (having

more than another). Following these economic games, we presented children with a vignette that described an inequity perpetrated by one protagonist (a thief) onto a second (the victim of that theft). The purpose of this latter game was to determine whether relative egalitarianism would predict how children would choose to resolve a pre-existing inequity. The particular details of each game are discussed with more depth in the methods section (§5.3). Subsection 5.4 details the hypotheses associated with each of these games.

5.3 Methodology for Study 1

5.3.1 Participants

Ninety-six children participated in the study, but six of these children were dropped from analysis on the basis that they did not complete the task or could not be categorized into a behavioral category based on the Social Preferences Game, yielding an attrition rate of roughly 6%.

Our final sample included 90 children: 30 three-year-olds between 34-50 months (M±SD = 42.50±4.6,15 girls); 30 five-year-olds between 58-74 months (M±SD = 60.50±4.42, 17 girls); and 30 seven-year-olds between 82-98 months (M±SD = 90.18±5.53, 15 girls). Children were recruited from the Emory University Child Study database and reflected predominantly upper and middle-class families from metro-Atlanta, Georgia. All experimental sessions were conducted at our lab facilities on the Emory University campus.

5.3.2 General Overview: Materials, setting, and design

All experimental sessions were conducted at our university laboratory by a female experimenter unfamiliar to the child. Prior to the start of the experimental session, children were introduced to a make-shift toy store containing various prizes (e.g., stickers and toys, all worth <$1 USD). To ensure that prizes were incentivizing across ages, participants identified and ranked their three favorite prizes. The Experimenter explained that toys could be purchased with coins (white poker chips of uniform size) that would be accumulated over the course of the games, with greater amounts of coins able to buy the best quality prizes. Before the start of the game and throughout the experimental session children were prompted to answer a series of control questions about the purpose and usage of the coins. The game did not proceed until participants correctly described how the coins could be redeemed for prizes as the conclusion of the testing session.

In a within-subjects design, children next participated in each of the following five games: the Social Preferences Game, the Cup (Risk) Game, the Basket (Competition) Game, the Wheels of Fortune, and the Restorative Justice Vignette. Coins accumulated after each game were stored in opaque containers in an attempt to minimize the child's ability to estimate their current earnings and prevent this endowment from influencing their decisions in each game.

5.3.3 Social Preferences Game

Adapting the methodology described in Fehr et al. (2008), we assessed children's relative egalitarian behavior in a forced-choice sharing task. In this game children decided between pre-determined allocations of coins, one of which was always equitable

and one of which benefitted either the child or their anonymous, fictitious partner. The original Fehr et al. study included a manipulation of parochialism that described the child's anonymous sharing partner as either a peer from the same school (in-group condition) or an unfamiliar child from a different school (out-group condition). Egalitarian sharing was more frequent in the in-group condition. However, in multiple pilot attempts and cross-cultural replications we were unable to replicate this effect and subsequently chose to suppress this manipulation. Instead children were told that they were partnered with an anonymous same-age, same-gender peer who would be coming to the lab later that day.

At test, arrangement of the coins was carefully orchestrated to underscore both the difference between potential recipients (child or partner) and the two pre-determined allocations (egalitarian choice or alternative). Before the start of the game the Experimenter assigned bowls of differing color (red or blue) to the child and the fictitious partner. The identical red bowls assigned to the participant were placed on the table in front of the child, and the identical blue bowls for the anonymous partner were placed on the opposite side of the table[7]. Finally, the difference between allocations was made salient by spatially segregating the two pre-determined choices to the right and left of the child. Coins were placed on these up-turned bowls, and the game did not proceed until children accurately identified to whom the coins on each side of the table belonged (see Figure 1).

[7] Colors denoting which bowls belonged to the child and her partner were also counterbalanced across participants to control for potential color bias.

Figure 1: Experimental situation for the Social Preferences Game.

In a within-subjects manipulation, each child was presented with a series of three conditions, each of which pitted an egalitarian distribution (e.g., one coin to the child, one to her partner) against an inequitable distribution as follows:

(a) In the *prosocial condition*, the egalitarian (1:1) choice was pitted against an alternative (1:0) that created a material gain for the child but no payoff to the partner. In this condition, children selecting the egalitarian solution are characterized as prosocial as this choice provides benefits to the partner without cost to the child.

(b) In the *sharing condition*, the egalitarian choice (1:1) was pitted against an alternative (2:0) that results advantageous inequity for the child but disadvantageous inequity for the partner. This alternative distribution doubles the child's payoff and negates any payoff to the partner. The egalitarian solution comes at a cost to the child but can be characterized as sharing because it confers a payoff to the partner.

(c) In the *envy condition*, the egalitarian (1:1) choice was pitted against an alternative (1:2) that creates advantageous inequity for the partner but disadvantageous inequity for the child. Here, the egalitarian solution preempts inequity between players but at cost to the partner who would otherwise receive double the payoff. Subsequently, children who pick the egalitarian distribution may do so because they are inequity averse, or because they are envious of their partner's greater payoff in the alternative distribution.

At test we recorded as the dependent measure the child's choice (egalitarian or alternative choice) for each of the above conditions. Children indicated their choice by gesturing to the right or left side of the table. Coins from the selected allocation were placed into opaque containers corresponding to the child or the anonymous partner. Coins from the rejected allocation were removed from the bowls, and then the table was re-set for the next condition. To control for possible order effects and side bias, the presentation of conditions (as well as the location of the egalitarian payoff relative to the child) were counterbalanced across participants.

5.3.4 The Cup (Risk) Game

Adapting a protocol described by Gneezy et al. (2008), children were presented with ten inverted opaque cups. One coin was hidden under each of nine cups, and a placeholder (a toy tiger described to participants as a "robber") was placed under the 10^{th} cup. The Experimenter explained that they would be playing a guessing game. The child could name how many cups should be lifted, and she would be allowed to keep any coins under the selected cups. However, if a cup was lifted and the "robber" was revealed, any

coins accumulated from the other cups would be forfeited. Thus, children learned that this placeholder represented a total loss.

The Experimenter demonstrated how the coins and "robber" would be randomly hidden under the cups. During a rigged practice trial, the Experimenter demonstrated what would occur if the child hypothetically chose four cups, one of which contained the robber. In succession the Experimenter lifted the first three cups and asked the child what would happen to each of the revealed coins. When the fourth cup was lifted and revealed the robber, the child had to explain what happened to the coins (e.g., that they would be forfeited) before the game could continue. If the control prompt was answered correctly, the child turned her back and the cups were re-shuffled (see Figure 2).

Figure 2: Experimental situation for the Cup (Risk) Game. Here the experimenter models what happens with the "robber" is found.

In a within-subjects design, this guessing game was played twice. In the Self Condition the coins, as well as the risk associated with them, were absorbed by the child. In the Other Condition, children decided the number of cups lifted for an anonymous partner who would keep any accumulated coins (and who would also absorb the loss upon finding the robber). At test children indicated and named the cups to be lifted. The child could not change this decision once the first cup was lifted. The order of conditions was counterbalanced across participants, and any coins won were placed into the same opaque containers described previously. For dependent measures we recorded the

number of cups selected as well as whether the child won or lost the game by finding the robber. This later measure was recorded to control for the possibility that loss in one condition would influence children's decision in the next (or indeed, in any of the subsequent games).

5.3.5 The Basket (Competition) Game

Children were informed that the purpose of the game was to sink as many balls (of 10) as possible into a basked placed two meters away. Unlike our proposed risk game in which the child's decision may be relative to an objective standard (i.e., greater or lesser than chance odds of a loss), here the standard children could use to make a decision was based on their own skill in an explicitly competitive game. During a practice round, the purpose of which was to allow children to gauge their relative skill, children were given the opportunity to shoot five balls into the basket. (The number of balls successfully sunk during this practice round was recorded to be used as a covariate in later analysis.)

At test children were presented with two options. In Option 1 (solo), children could opt to play the game alone, but were informed that they must sink a minimum of five balls (50%) in order to win the prize of 20 coins. If less than five balls were sunk, the child would win nothing. In Option 2 (competition), children could compete against an anonymous partner. Each player would have an opportunity to shoot the ten balls, the winner receiving the 20 coins and the loser receiving nothing. Children who selected this option were always allowed to play first. The Experimenter then offered to find another child to play against the participant, but this role was always filled by a confederate adult

who was instructed to make four successful shots. Therefore, in both scenarios (solo or competition) the probability of winning was equivalent (i.e., making 50% of the shots to win the game).

The Competition Game was played only once. During pilot testing we asked children to make the decision between solo and competitive play for themselves, but we also asked them to guess what an anonymous partner might do. When this directive proved too confusing this self/other manipulation was discarded.

As dependent measures, at test we recorded the child's choice (solo or competitive play) as well as the number of balls shot successfully. In addition, we noted whether the child earned the 20 coin payoff.

5.3.6 The Wheels of Fortune Game

This game was included as a second measure of risk aversion. Whereas the Cup Game assesses children's understanding of chance (objective probability), this game is more representative of relative probability (e.g., Schlotmann & Tring, 2005) in which children weigh competing odds against one another.

Children were presented with two different spinner boards with coins lined along each side. A detachable spinner could be placed on the board of the participant's choosing. Wherever the narrow end of the spinner landed indicated the payoffs to either the child or their anonymous partner (depending on the condition as described below; see Table 1.

In a forced choice task, one board represented a "sure bet" (100% chance of winning three coins, such that three coins were positioned around each side of the board).

In succession this sure bet was pitted against an alternative gamble (see Fig. 3). In the "low risk" condition, the alternative board had a 50% chance of a six coin win (with collections of six coins positioned on opposite sides of the board). In the "high risk" condition, the alternative board represented a 25% chance of a twelve coin win (with all twelve coins appearing on one side). These objective probabilities and their associated payoffs therefore controlled for expected value by making payoffs equivalent across choices.[8]

In a second within-subjects manipulation, participants decided which boards should be played for themselves (self condition) and then again for an anonymous partner (other condition). These conditions and their relative payoffs are summarized in Table 1.

Decision for	**LOW RISK**	**HIGH RISK**
SELF	100% chance of 3 coins versus 50% chance of 6 coins	100% chance of 3 coins versus 25% chance of 12 coins
OTHER	100% chance of 3 coins versus 50% chance of 6 coins	100% chance of 3 coins versus 25% chance of 12 coins

Table 1: Synopsis of experimental design for Wheels of Fortune Game

In a practice trial the Experimenter demonstrated how a hypothetical choice would work for both the sure bet and one of the gambles. The Experimenter placed and animated the spinner and then asked the child to explain how many coins were won based on where the spinner landed. The game did not proceed until children accurately answered these control prompts. Furthermore, each test trial was preceded by a control

[8] Expected value was calculated as (probability of win x payoff) + (probability of loss x payoff). For example, the expected value for the sure bet condition would be (1.0 x 3) + (0 x 3) = 3. The expected value for the "low risk" condition would be (.5 x 6) + (.5 x 6) = 3. Similarly, the expected value for the "high risk" condition would be (.25 x 12) + (.75 x 0) = 3. Thus, across the choices, the most likely payoff the child could expect to receive would be 3 coins.

prompt in which children indicated who would receive any won coins (self or other) and how many coins could be won on each board.

Figure 3: Experimental situation for the Wheels of Fortune Game. Here the child opts for the gamble in the Self Low Risk condition.

Children indicated their choice by pointing to the relevant board. The spinner was then placed by the Experimenter but animated by the child. To control for potential side bias the location of the sure bet relative to the child was counterbalanced across conditions, as was the order of the conditions (self low risk, self high risk, other low risk, and other high risk).

At test, we noted the child's decision (sure bet or gamble) in each of the four conditions (self low risk, self high risk, other low risk, and other high risk) as well as the

outcome of each spin. (This later measure was included to control for potential wealth effects in analysis to determine whether a win or loss in one condition could effect decisions in subsequent conditions.)

After each choice, any coins won were placed in the opaque containers described previously. The boards were reset, and children were again presented with control prompts before the next condition could progress.

5.3.7 Restorative Justice Vignette

Whereas the child's choices on the Social Preferences Game served as our primary measure of relative egalitarian tendencies (e.g., propensity to avoid or manufacture inequity), we included this follow-up task to probe how children *rectify* a perceived inequity. We questioned whether children's relative egalitarianism in the Social Preferences Game (**§** 5.3.3) would predict, for example, whether they chose to restore justice between aggrieved parties by punishing versus compensating protagonists. This game was intended to be more exploratory, serving as a segue to the costly sacrifice experiments detailed in Study 3.

In the vignette (which was acted out by two identical dolls animated by the experimenter) two protagonists described as friends (Jack and Jim) work hard together and earned a lot of money. Because they both worked hard, the friends agree to split the money. However, when Jack momentarily turns his back, the other protagonist, Jim, steals his friend's share and takes all the money for himself.

At the end of the story, children were asked the following questions:

(1) What happened in the story? (comprehension control)

(2) Do you think it's fair? Why or why not?

(3) There are two ways we can fix the story. We can give money to Jack [the victim], or we can take money from Jim [the thief][9]. Which one should we do? Should we give or take? Why?

(4) Who is nicer? Jack [the victim] or Jim [the thief]?

The question of interest was whether children perceive this violation of equity to be unfair, and if so, how they are willing to rectify the situation and restore equity.

We recorded as dependent measures the child's responses to these four questions as well as any spontaneous verbalizations regarding rationales for these choices.

5.4 Hypotheses for Study 1

The organization of our hypotheses is as follows. First, we detail our predictions for the Social Preferences Game and the three economic games—the Cup (Risk) Game, the Basket (Competition) Game, and the Wheels of Fortune Game. Next, we present our hypotheses regarding the relationship between our measure of inequity aversion (as indexed by the Social Preferences Game) and our measures of risk and competition aversion.

The hypotheses for Restorative Justice Vignette are presented last. This game was not directly tied to our model of proximate mechanisms. It was intended to probe possible links between children's aversion to inequity and their chosen means of rectifying it.

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[9] The names and corresponding actions of the protagonists were counterbalanced across participants. Labels ("thief" and "victim") were used strictly for coding purposes; with children the Experimenter only ever referred to dolls by name.

5.4.1 Developmental Predictions for the Social Preferences Game

Following trends established in dictator games (Larsen & Kellogg, 1974; Libby & Garrett, 1974; Rochat et al., 2009; Ugurel-Semin, 1959) and ultimatum games (Lucas et al, 2008; Murnighan & Saxon, 1998; Sally & Hill, 2006) and confirmed in Fehr et al. (2008), we predict inequity aversion to increase between three- to seven-years as indexed by children's increasing tendencies toward egalitarian sharing.

Furthermore, on the basis of this literature we anticipate that by seven years, children will choose egalitarian outcomes over inequitable outcomes in each of the three sharing conditions (prosocial, sharing, and envy).

In contrast, we predict that younger (three-to-five-year old) children will be less egalitarian, and that this will be mediated by the sharing conditions. Payoffs in the prosocial (1:0) condition are equivalent between choices; we anticipate that children will select the egalitarian option at chance levels. In the sharing (2:0) condition we expect that children at this age will opt for the alternative distribution that creates advantageous inequity (e.g., more coins to the child). However, in the envy (1:2) condition, younger children will opt toward the egalitarian choice that prevents disadvantageous inequity (e.g., greater material wealth for the partner).

5.4.2 Developmental Predictions for The Cup (Risk) Game

The Cup Game served as a measure of children's tolerance for gambles when the outcome is framed as non-competitive. In this guessing game, children must decide how much risk to take both for themselves and for an anonymous partner, but these outcomes are not dependent upon social competition proper, just objective chance. Based on our

review of the literature, we anticipate that seven-year-old children will show signs of risk-aversion by engaging in more prudent economic decisions (e.g., sure chances of winning something) relative to their younger (three- to five-year-old) counterparts. Furthermore, because the gamble is not framed in a competitive context, we anticipate that by seven children will be equivalently risk-averse for self and other.

5.4.3 Developmental Predictions for The Basket (Competition) Game

Competition offers a useful framework for assessing the relative importance of social comparisons in decision-making. Competition can be endogenous (driven by a general sense of wanting more), or exogenous in nature (driven by the desire to have *more than* someone else). When children compete *against someone*, the outcome necessitates that a win for one partner is a loss for the other. Competition against someone inherently creates advantageous inequity (for the one who wins) and disadvantageous inequity (for the one who loses). In contrast, competition in the absence of a partner means that wins and losses must be established in relation to an objective standard. In solo play, for example, a child might have to reach a certain criterion in order to win. Solo play creates inequity only if the child out-performs chance; wins are not guaranteed, and furthermore, they do not come at the expense of a partner.

The Basket Game measures children's competitive tendencies at a ball tossing game and controls for risk tolerance by making the chance of winning tokens equivalent between choices in which children may opt to play alone (i.e., solo; competition-averse) or against another player (i.e., competition-tolerant). Our review of the literature predicts

that three year old children will be more likely to play in the competitive condition, whereas older children (five to seven years) will engage in solo play.

5.4.4 Developmental Predictions for The Wheels of Fortune Game

The Wheels of Fortune Game involves elements of both risk and competition, as children must decide between a sure bet (a 100% chance of a three token win) and a series of risky gambles (a 50% chance of a six token win; 25% chance of a twelve token win) for both themselves and a partner. Consistent with other studies utilizing a similar methodology (see Schlotmann & Tring, 2005), we predict that older (seven-year-old) children will be characterized by greater risk-aversion relative to their younger (three- to five-year-old counterparts), as indexed by their preference for sure bets over gambles. Our review of the developmental literature provides mixed predictions about how such choices might differ between self and other. Given that children at seven manifest risk *and* competition aversion, we think it is likely that when these two pressures are conjoined (as in this game), seven year old children should be stable in their preference for sure bets for both self and other.

5.4.5 Developmental Predictions Regarding the Association between Inequity Aversion, Risk Aversion, and Competition Aversion

The ultimate goal of Study 1 is to link developmental differences in these economic games to children's relative inequity aversion. Children's responses on the Social Preferences game act as our measure of relative egalitarianism. As a general working model, we hypothesize that there will be a developmental trend toward

egalitarianism that corresponds to children's increasing risk and competition aversion (Harbaugh et al., 2001; Levin et al., 2007). We can test this hypothesis in two ways:

(1) The Social Preferences Game includes three sharing conditions, each of which pits an egalitarian (1:1) distribution against an alternative that creates a material disparity between partners. Our measures of risk-aversion and competition-aversion should correlate with children's egalitarian choices in each of these games. If our developmental predictions are correct, the strength of any associations should be greatest in seven-year-old children.

(2) By aggregating children's responses across the three sharing conditions of the Social Preferences Game, it is possible to assess the *consistency* of children's egalitarian inclinations. Based on the pattern of their choices in these three conditions, children can be sorted into behavioral profiles that capture, for example, the relative tendency to be egalitarian, self-maximizing, generous, or spiteful. Risk and competition should therefore predict individual differences in the frequency of these behavioral categories at each age (three, five, and seven).

5.4.6 Hypotheses for the Restorative Justice Vignette

At the conclusion of the Social Preferences Game and the three associated economic games, we presented children with a vignette that assessed children's attitudes regarding restorative justice, e.g., the propensity to rectify an inequity. This game was

exploratory and not tied explicitly to our model of proximate mechanisms. Prior investigations (Robbins & Rochat, 2011) document that by age five (but not prior) children rectify inequity by punishing a protagonist who shares unfairly. At this age children also compensate a victim of inequitable sharing by giving that protagonist proportionally more resources (Fraser et al., 2007; McGillicuddy-De Lisi, 1994; Streater & Chertkoff, 1976; Zinser et al., 1991). However, no studies that we know of have compared the tendency to punish perpetrators of inequitable acts against the tendency to compensate victims of inequitable acts. We conjecture that children's relative egalitarianism might predict the manner in which they restore justice (e.g., punishing a transgressor versus compensating a victim).

In the vignette, two protagonists earned money together and split the profits. However, one protagonist (the thief) steals from the other (the victim). Following, we asked children a series of questions: (1) What happened in the story? (2) Is it fair? (3) Should we take from [the thief] or give [to the victim]? and (4) Who is nicer?

We hypothesize that across age, children will perceive the situation as unjust and the victim as the nicer of the two protagonists. However, on the basis of previous studies (Robbins & Rochat, 2011), we anticipated that age will mediate the method of restoring equity, such that younger children (three years) will not systematically prefer punishment or compensation. In contrast, because punishment can be viewed as a situation in which a harm is used to correct a prior transgression, we anticipate that older children (five and seven years) might opt toward compensation. Finally, we predict that children who are egalitarian in the Social Preferences Game will opt to compensate. Compensation creates material equity between players, whereas punishment leaves both protagonists at a

material disadvantage (the victim has nothing, and after punishment the thief will have nothing).

5.5 Results of Study 1

The results of Study 1 are broken into six sections, the first four of which present the our developmental findings for the Social Preferences, Cup (Risk), Basket (Competition), and Wheels of Fortune Games independently. The next two sections (§ 5.5.5 - 5.5.6) present our test of the proximate mechanisms by correlating egalitarian behavior to relative risk and competition aversion. The last section (§ 5.5.7) describes the results of the restorative justice vignette.

A brief note regarding potential order effects: Because the order of the games was constant across participants, it is possible that the number of coins accumulated by the child (and her partner) might influence behavior in latter games (e.g., acting more risk averse because one feels they have not earned enough coins, or because they have experienced loss on previous games). To control for this possibility, we ran a separate group of analyses (not reported here for the sake of brevity) in which the risk, competition and wheels of fortune were independently analyzed with the number of coins earned on the prior game entered as a covariate. Results yielded no significant main effects of this covariate, indicating that accumulated wealth did not influence the successive probability of a particular outcome at each of stage decision-making.

It is possible that this proxy measure (accumulated wealth) does not capture the psychological, affective experience of gain or loss that could be more motivating than material payoff. However, at least in terms of material gains, it does not appear that

success or failure on previous games was a significant factor in children's choices on these economic games.

5.5.1 Egalitarian Choices in the Social Preference Game

We hypothesized that the frequency of egalitarian (1:1) choices in the Social Preferences Game would be greatest at seven years independent of condition (prosocial, sharing, and envy). We also anticipated that for younger (three- to-five-year old) children, egalitarian choices would differ as a function of condition: children at this age would opt for the choices that conferred the greatest payoff.

We analyzed the proportion of egalitarian (1:1) choices for each of the three conditions (prosocial, sharing, and envy). Figure 4 depicts the proportion of egalitarian choices in each condition for each age group.

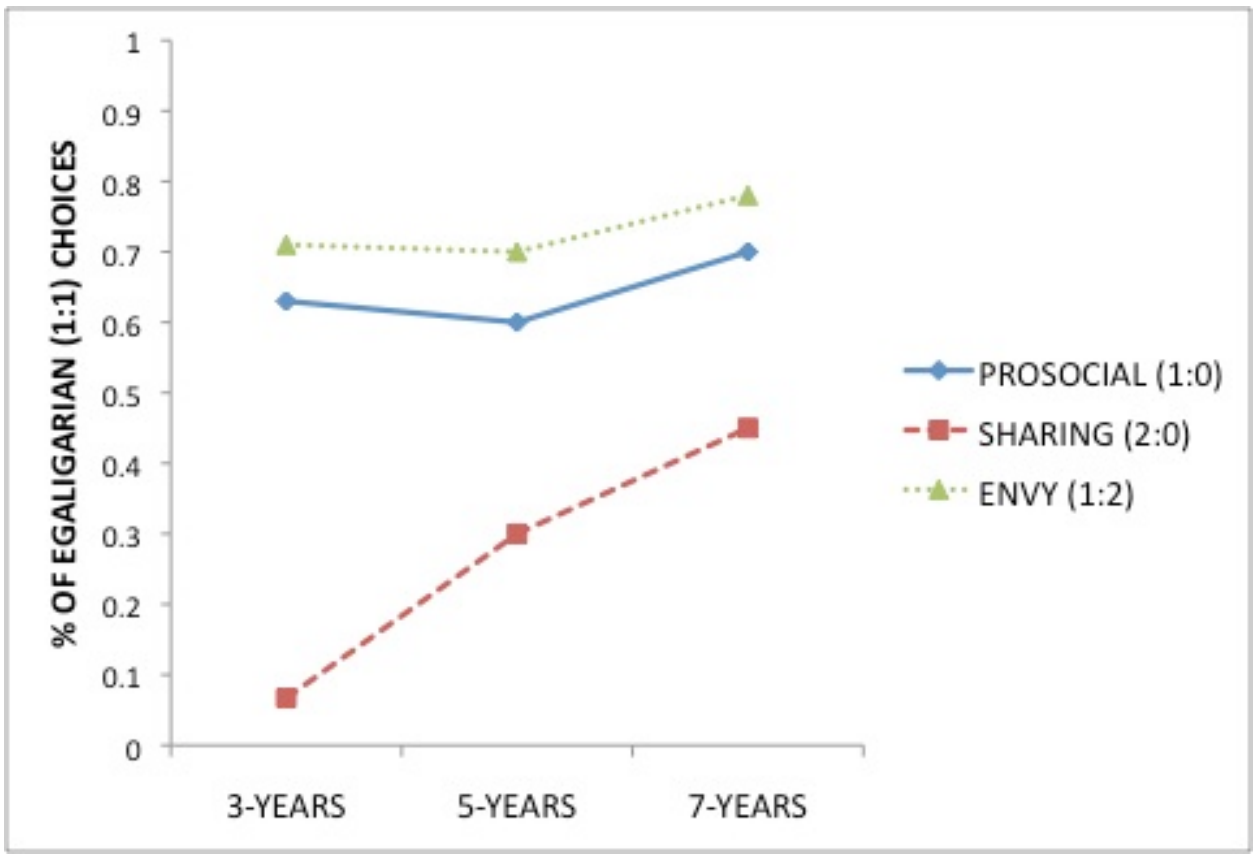

Figure 4. Percentage of egalitarian (1:1) choices in the Social Preferences Game as a function of age and condition.

In the prosocial condition (1:0) game, the frequency of the egalitarian choices did not differ from chance for three- or five-year-olds. A significant majority (70%) of seven-year-olds opted for the egalitarian choice (binomial test: $p < .05$).

In the sharing (2:0) condition, the alternative distribution created advantageous inequity that doubled the child's payoff, but at the expense of the partner. Although the egalitarian option benefits both players, it comes at a personal cost: children earn less than they could have by picking the alternative distribution. In this condition only 6.7%

of three-year-olds and 30% of five-year-olds were willing to share equitably (binomial test: both $p < .05$). Seven-year-olds were at chance levels.

Finally, with regard to the envy (1:2) condition, the egalitarian choice prevented disadvantageous inequity for the child, but at the expense of the partner who would otherwise receive double the payoff. A significant majority of three-year-olds (71%), five-year-olds (70%), and seven-year-olds (78%) chose the egalitarian option (binomial tests: all $p < .05$). Thus, at all ages groups acted to minimize disadvantageous inequity.

The pattern that emerges from these data demonstrates that when the personal material payoffs between the egalitarian and alternative choices are identical (as in the prosocial condition), younger (three- to-five-year-old) children do not systematically favor one outcome over the other. In contrast, seven-year-olds in these conditions take advantage of the opportunity to share at no cost to themselves by opting for the egalitarian choice. In the sharing condition, the egalitarian choice comes at a cost and creates disadvantageous inequity for the child. In this condition, three- and five-year favored the alternative distribution that gave them more, whereas seven-year-olds were at chance. In the envy condition that created disadvantageous inequity for the child, across ages children favored the egalitarian distribution. Taken together, these data suggest that egalitarianism increases with age, a confirmation of the developmental trajectory established by Fehr et al. (2008).

At the same time, within these cohorts we noted significant individual variation with respect to the *consistency* of egalitarian choices across conditions, the analysis and implications of which are discussed further in §5.5.6.

5.5.2 Results of the Cup (Risk) Game

Risk in the Cup Game pitted children's choices against chance. We operationalized risk-averse children as those who chose 1-4 cups (4 being the optimal solution). Risk-tolerant children were defined as those who chose 5-9 cups.

Contra predictions, we observed no developmental trends in the self condition. A significant majority of three-year-olds (76.7%), five-year-olds (87.5%) and seven-year-olds (90.0%) were *risk-averse* and picked four or fewer cups (binomial tests: all p <.05). The same trend was observed in the other condition. A significant majority of three-year-olds (76.7%), five-year-olds (73.3%) and seven-year-olds (87.5%) were *risk-averse* and picked four or fewer cups for their partner (all $p < .05$).

Although on the whole children tended to be risk-averse, the magnitude of this aversion might be greater for self than other. To test this possibility, a repeated-measures ANOVA analyzed the number of cups chosen as a function of condition (self or other) and age (3, 5, or 7 years). In partial confirmation of our hypotheses, results yielded a main effect of condition ($F_{1.86} = 6.86$, $p = .010$, $\eta^2 = .074$) but not age. At all ages children chose significantly fewer cups for themselves ($M \pm SD = 2.89 \pm .1.63$) relative to their partner ($M \pm SD = 3.32 \pm .1.86$).

It is possible that the relatively small number of cups chosen across ages and conditions reflects a misunderstanding of the game. We think this is unlikely for two reasons. First, at all ages children appeared to grasp the affordances of the game. Less than 10% of children selected 1 cup (an outcome that would leave them with nothing in the case of finding the robber), and no children picked 10 cups. Second, it both

conditions, we observed nearly the full range of choices (1-9 cups). Thus, the small number of cups chosen in both conditions is not a function of a truncated choice set.

Another alternative is that children chose cups based how the experimenter modeled the task. Because the experimenter modeled what would happen hypothetically if children chose 4 cups, one of which contained the robber, children may have adjusted their decisions and opted to pick fewer cups. This may explain why roughly 67% of children picked between 2-4 cups, but it does not explain why children would reliably choose fewer cups for themselves compared to their partner.

A final explanation, and the one we propose is most probable, is that these findings are an artifact of the way risk was construed in this task. Developmental differences in risk-aversion typically utilize designs that explicitly contrast the probabilities of two outcomes (Kass, 1964; Hushnir & Gopnik, 2005; Perner, 1979). Comparing the probability of success to such an abstract referent like chance may have proven too difficult for children, particularly in a one-shot interaction. This may account for why children did not demonstrate the kind of risk-tolerance documented in other studies (see for example Kuzmak & Gelman, 1986).

We conclude that across ages, children are more risk-averse when making decisions for themselves as opposed to a partner, at least according to this operationalization of risk.

5.5.3 Results of the Basket (Competition) Game

To determine whether children in all age groups were equally skilled at throwing, we analyzed the number of balls sunk during the practice round in a univarate ANOVA.

There was no effect of age: on average, children made 68.3% of attempted shots during practice.

In general children were competition-averse, opting to play solo (63%) rather than compete (37%), binary test: $p = .016$. Consistent with predictions, the proportion of solo versus competitive choices differed across age. Three and five-year-olds were at chance levels, but a significant majority of seven-year-olds (70%) opted to play solo (binomial test: $p = .047$).

This effect of age raises the possibility that although the two conditions (solo and competitive play) were construed as equally risky, children did not experience them this way. Children's relative success in the practice round may have influenced them to play alone or competitively. Follow-up tests suggest this was not the case. A binary logistic regression that analyzed the proportion of competitive choices as a function of accuracy during practice yielded no significant results, $\beta(SE) = 1.33(.766)$ Wald chi-square = 3.00, $df = 1$, $p = .083$).

The general finding that children older prefer to play alone may also point to locus of control: children prefer the option that will give them the most certainty over the outcome. This is relevant given that children did not receive any information about the relative skill of their partner prior to their choice.

5.5.4 Results of the Wheels of Fortune Game

We analyzed the proportion of sure bets as a function of condition (self and other), level of risk (low and high) and age (three, five, or seven years). In general we found an effect of condition but not age or level of risk. Collapsed across those factors, a

significant majority of children (56.2%) opted to gamble for themselves and chose the sure bet for their partner (54.9%), Fisher's exact test = .046. These findings do not support our hypothesis that children would be risk-averse, but they are consistent with studies that document risk-tolerance in children of this age when gambles are framed as gains (as they were here). Greater risk-aversion tends to manifest when gambles are framed as losses (Schlottmann & Tring, 2005; Levin & Hart, 2003; Levin et al., 2007).

In a follow-up analysis we examined the within-subjects consistency of these choices. We categorized as risk-averse those children who always opted for the sure bet. Strategic children changed choices between low and high risk trials (e.g., opting for the sure bet once and a gamble once). Risk-tolerant children always opted for the gamble. No age effects were noted in the other condition. In the self condition, roughly the same proportion of children were risk-averse and risk-tolerant at three, five, and seven years. However, significantly fewer three-year-olds (6.7%) were strategic (e.g., switching their choices between the low and high risk conditions) compared to 18.8% of five-year-olds and 36.7% of seven-year-olds. This significant trend indicates that older children (83.3%) changed choices between low and high risk trials, moving from gambles in the low risk condition to sure bets in the high risk condition ($\chi^2_2 = 6.42$, $p = .040$).

We feel confidant that these results are not random, and that children were capable of integrating the value of the outcome with its likelihood of occurring (e.g., expected value). If they had been driven to favor the outcome with the larger absolute payoff, children should have chosen the gamble no matter the level of associated risk and no matter the recipient. Likewise, if children were attracted to the outcome with perceptual symmetry, they should have a bias toward the sure bet, e.g., the outcome in

which there were three coins positioned on each side of the board. Instead, younger children (three to five years) were at chance levels in their choices, demonstrating no systematic bias toward absolute or symmetric outcomes, and seven-year-old children were selective in their choices, changing their bets as a function of risk and recipient.

At first glance children's willingness gamble for themselves (but not others) in the Wheels of Fortune might seem inconsistent with the results of our Cup Game, in which children were more risk-averse when making decisions for themselves relative to a partner. We argue that these two tasks assess different understanding of risk. Indeed, choices in the Wheels of Fortune did not significantly correlate with the number of cups chosen for self ($r^s_{(90)}$ = -.021) and other ($r^s_{(90)}$ = .010) in the Cup Game.

Furthermore in the Cup Game, children compare their probability of winning to chance (e.g., a 50% or greater likelihood of finding the robber and loosing everything). In this game there was no explicit "sure bet" that would ensure the child could walk away with at least some payoff, which may have biased children toward lower levels of risk for themselves. In contrast, in the Wheels of Fortune game children could directly compare two outcomes to each other, rather than to chance. Prior studies (Perner, 1979; Kushnir & Gopnik, 2005; van Leijenhorst et al., 2008) suggest that this kind of experimental design makes information about probability more salient to young children than designs in which judgments of probable outcomes are done in isolation, without explicit reference to alternative outcomes. These games may therefore tap into different conceptualizations of risk, with uncertainty characterizing the Cup Game and probability characterizing the Wheels of Fortune.

A second possibility for this recipient effect is that children construed the task as explicitly competitive. Here children might opt for personal gambles (which could increase their payoffs above and beyond the sure bet) while choosing sure bets for their partner (which are certain to be less than a win in the gambling choice). We think this possibility is unlikely given non-significant associations between these variables. Children who gambled did not tend to choose sure bets for their partners in either the low ($r^s_{(90)}$ = -.097) or high risk conditions and $r^s_{(90)}$ = -.070). On the other hand, children could maximize their winnings by opting for the sure bet if their partners simultaneous lost a gamble. Again this association was non-significant: children who opted for the sure bet did not chose the gamble for their partner in either the low risk ($r^s_{(90)}$ =.068) or high risk ($r^s_{(90)}$ = -.132) conditions. These results indicate that children do not actively seek to minimize their partner's payoffs, suggesting that the game was not construed as explicitly competitive for most children.

In all, these analyses suggest that children are more sensitive to outcomes that impact them directly, whereas choices that impact partners are approached with more ambivalence.

5.5.5 Test of the developmental hypotheses: Correlations between inequity aversion, risk aversion, and competition aversion

To determine whether children's relative risk and competition aversion predicts inequity aversion (as indexed by egalitarian choices in the Social Preferences Game), we ran a correlation analysis. We assessed for each age group the associations between egalitarian choices and children's choices in the Cup (Risk), Baskets (Competition) and

Wheels of Fortune Games with each condition of the Social Preferences Game (see Tables 2-4).

Table 2: Correlations between egalitarian choices and risk and competition aversion in the Prosocial Condition of the Social Preferences Game

PROSOCIAL (1:0) CONDITION							
	Cup Game		Basket	Wheels of Fortune			
	Risk Averse (Self)	Risk Averse (Other)	Solo Play	Self Low Risk (Sure Bet)	Self High Risk (Sure Bet)	Other Low Risk (Sure Bet)	Other High Risk (Sure Bet)
3-YEARS	-.312	-.042	.144	-.191	-.063	-.120	.071
5-YEARS	.093	-.010	.106	-.018	-.069	.033	-.148
7-YEARS	.182	.061	.372*	.356*	.480**	.412*	.418*

Note: Single asterisks indicate $p < .05$, double asterisks indicate $p < .01$ based on Spearman correlations. $N = 30$ for each age group.

In support of our hypotheses, amongst seven-year-olds egalitarianism significantly correlated with risk-aversion in the four conditions of the Wheels of Fortune game. Also consistent with hypotheses, competition aversion was significantly correlated with egalitarianism in children at this age. Contra expectations, we observed no associations between our measure of risk aversion in the cup game and egalitarian choices.

Table 3: Correlations between egalitarian choices and risk and competition aversion in the Sharing Condition of the Social Preferences Game

SHARING (2:0) CONDITION							
	Cup Game		Basket	Wheels of Fortune			
	Risk Averse (Self)	Risk Averse (Other)	Solo Play	Self Low Risk (Sure Bet)	Self High Risk (Sure Bet)	Other Low Risk (Sure Bet)	Other High Risk (Sure Bet)
3-YEARS	.149	.247	.391*	-.183	-.239	.031	-.060
5-YEARS	-.155	.230	.111	.262	-.073	.455*	.257
7-YEARS	.046	.357*	-.049	.566**	.564**	.488**	.394*

Note: Single asterisks indicate $p < .05$, double asterisks indicate $p < .01$ based on Spearman correlations. $N = 30$ for each age group.

As predicted, in the sharing condition our measure of risk aversion in the Wheels of Fortune game correlated significantly with egalitarianism, but primarily for seven-year-olds. Egalitarian seven-year-olds tended to be risk averse in the cup game, but only for their partner. This would be consistent with the idea that at this age children tend toward choices that do not create material disadvantage for their partners. Contra hypotheses, competition aversion did not correlate with egalitarian behavior amongst seven-year-olds.

Table 4: Correlations between egalitarian choices and risk and competition aversion in the Envy Condition of the Social Preferences Game

ENVY (1:2) CONDITION							
	Cup Game		Basket	Wheels of Fortune			
	Risk Averse (Self)	Risk Averse (Other)	Solo Play	Self Low Risk (Sure Bet)	Self High Risk (Sure Bet)	Other Low Risk (Sure Bet)	Other High Risk (Sure Bet)
3-YEARS	.144	-.312	-.516**	.327	.196	-.296	-.205
5-YEARS	,059	-.129	-.031	.055	-.408*	-.027	-.339
7-YEARS	.149	-.218	-.100	.149	.144	-.040	-.037

Note: Single asterisks indicate p < .05, double asterisks indicate p < .01 based on Spearman correlations. N = 30 for each age group.

In the envy condition we observed few correlations between egalitarian choices and our measures of risk and competition aversion, at any age. One interpretation of these findings is in this game, the egalitarian choice actually *implies* envy: children who opt for the (1:1) option do so to avoid disadvantageous inequity (e.g, the partner gaining more). Risk and competition can result in situations in which a partner gains resources; this may help to explain why children who opted toward egalitarianism in this condition were ambivalent regarding choices in the Cup, Basket, and Wheels of Fortune games.

5.5.6 Predicting Individual Differences in Egalitarianism

One important finding in the Fehr et al. (2008) study is that there is significant heterogeneity in sharing behavior: Even within age cohorts children are not necessarily *consistent* in their egalitarianism. Fehr and colleagues created behavioral profiles of the children in their study by examining the *pattern*[10] of egalitarian choices made across the three sharing conditions. Children could be categorized as strongly egalitarian (picking the 1:1 option in all conditions); weakly egalitarian (choosing the egalitarian option when it did not come at a personal cost); strongly generous (acting to maximize payoffs to the partner even at a personal cost); weakly generous (maximizing payoffs to the partner but only when doing so did not come at a personal cost); or spiteful (acting to minimize partner's payoffs regardless this came at a personal cost). Fehr et al. found in particular that the proportion of strongly egalitarian children increases between the ages of three to seven.

To assess individual differences in our sample of three- to seven-year-olds, we sorted children into behavioral categories based on those of Fehr et al., with a few modifications. The goal of this follow-up analysis was to determine whether our measures risk and competition aversion could explain *patterns* of egalitarian behavior at the aggregate level.

Based on their responses across the three conditions of the Social Preferences game, children were categorized into one of four behavioral profiles. *Egalitarian* children were those who selected the 1:1 option in all games. *Self-maximizing* children

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[10] Note that patterns of behavior are not synonymous with the overall percentage of egalitarian choices. However, based on these patterns we can extrapolate the percentage of egalitarian choices within each profile: egalitarian (100%), self-maximizing (0-67%), generous (33%), and spiteful (33%).

chose distributions that would give them the most payoffs, regardless of whether this came at the expense of their partner. *Generous* children picked the distributions that favored their partner, even when doing so came at a personal cost. Finally, *spiteful* children acted to minimize their partner's payoffs, even when doing so came at a personal cost. Figure 5 depicts the distribution of these profiles as a function of age.

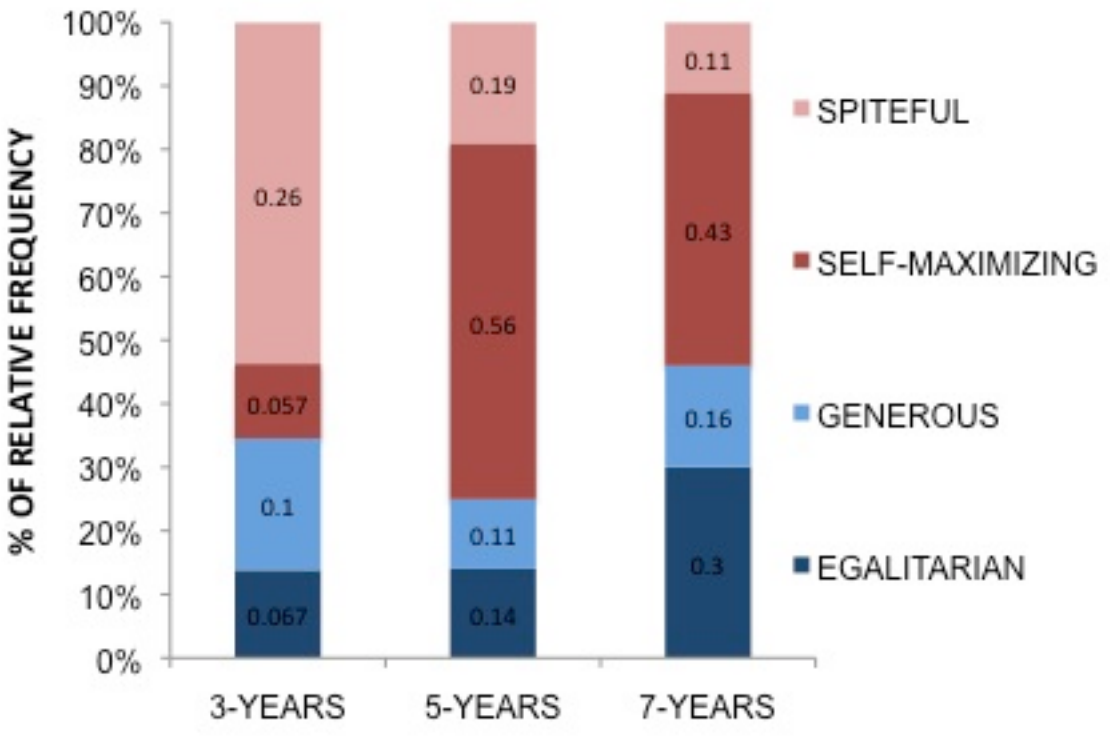

Figure 5. Distribution of behavioral profiles distilled from egalitarian choices across the three conditions of the Social Preferences Game.

Note that in the original Fehr et al. (2008) report, there was no self-maximization profile. Fehr et al. had categorized these children as either weakly egalitarian (opting for the equitable outcome unless doing so came at a cost) or weakly generous (opting to maximize the partner's outcome unless doing so came at a cost). Across conditions, both

of these behavioral profiles place the child at a material advantage (4 coins) relative to their partner (3 coins). Because these ultimate outcomes are indistinguishable, and because the child earns more than her partner, we have chosen to collapse these children into one group that we call self-maximizing.

We assumed that developmental differences at the level of the individual conditions in the Social Preferences game would translate to developmental differences at the level of the behavioral profiles. Contra predictions, however, the distributions of these profiles did not significantly vary across ages, $\chi^2_{(6)} = 7.20$, $p = .302$. Although within each age group the proportion of children falling into each category differed from what would be predicted by chance ($p < .05$ for all independent chi-square tests), these distributions themselves were similar across age. There was a marginal tendency for the proportion of egalitarian profiles to increase over age, but this trend was ultimately non-significant ($\chi^2_{(2)} = 5.20$, $p = .074$).

Thus, we note a discrepancy between developmental trends at the level of individual sharing conditions in the Social Preferences Game and the *lack* of developmental differences at the level of aggregated data (e.g., the behavioral profiles distilled from the sharing conditions). This could be the result of several factors: First, the most parsimonious explanation is that we lacked the statistical power to replicate the analysis of behavioral profiles reported in Fehr et al. who had nearly triple the sample size. Second, the (1:1) choice did not entail the same consequence or meaning across conditions. For example, in the prosocial (1:0) and sharing (2:0) conditions, the egalitarian solution prevented *advantageous* inequity (the child getting more). The alternative choice in these conditions may have biased behavioral profiles toward self-

maximization or spitefulness. Note also that in only the envy (1:2) condition did the egalitarian choice preclude *disadvantageous* inequity (partner getting more). Since the most robust (and consistent) developmental effects came from the analysis of this condition, it is possible that the envy condition carried the greatest weight in the computation of the behavioral profiles, thus washing out any developmental differences.

To determine whether our proximate mechanisms could predict individual differences (despite the lack of developmental differences), we proposed a series of follow-up analyses. These hypotheses were speculative, but still grounded in the observations from our review of the literature (see Figure 7). In what follows we assess each profile independently as a function of our measures of risk aversion and competition aversion. Because there were no developmental differences in the distribution of profiles, age was not factored into any of the following analyses.

Table 5: Summary of predictions for the analysis of individual differences based on behavioral profiles derived from the Social Preferences Game.

BEHAVIOR	CHARACTERIZED BY	PREDICTIONS
EGALITARIANISM *equal payoffs to both parties*	Aversion to disadvantageous inequity (having less) & Aversion to advantageous Inequity (having more)	**Cup (Risk) Game:** Risk averse for self and other **Basket (Competition) Game:** Opt to play solo **Wheels of Fortune:** Sure bet for self and other across all trials
SELF-MAXIMIZATION *maximizing personal gain even at the cost of minimizing payoffs to one's partner*	Aversion to disadvantageous inequity (having less)	**Cup (Risk) Game:** Risk averse for self, risk tolerant for others **Basket (Competition) Game:** Opt to compete **Wheels of Fortune:** Gambles for self but sure bets for others
GENEROSITY *maximizing gains to one's partner even at the cost of personal material loss*	Aversion to advantageous inequity (having more)	**Cup (Risk) Game:** Risk tolerant for self, risk averse for other **Basket (Competition) Game:** Opt to play solo **Wheels of Fortune:** Gambles for self, Sure bets for others
SPITE *Minimizing gains to one's partner even at the cost of personal material loss*	Aversion to disadvantageous inequity (Having less)	**Cup (Risk) Game:** Risk averse for self, risk tolerant for other **Basket (Competition) Game:** Opt to play solo **Wheels of Fortune:** Sure bets for self, gambles for others

Egalitarian Profile: Egalitarian children were those who split equitably in all conditions of the Social Preferences game. We predicted that these children would manifest aversion to advantageous and disadvantageous inequity and would therefore avoid outcomes that would privilege either themselves or their partner. We anticipated

that these children would be risk averse for both players in the Cup game (e.g., choosing fewer than four cups; see operational definition in §5.5.2). They would also opt to play solo in the Basket (Competition) Game, as competition would create a definite material advantage for one player, whereas playing alone does not guarantee a win and therefore does not necessarily create material gain for the child (or a gain that came at the expense of a partner). Regarding the Wheels of Fortune, children were expected to choose sure bets for all four conditions, which would result in identical payoffs for the child and her partner.

To test these hypotheses we regressed our measures of risk and competition aversion on our dependent measure, the proportion of egalitarian profiles.[11] Results of this binary logistic regression yielded an effect competition: children who opted to compete were significantly *less* likely to be egalitarian, $\beta(SE) = -2.43(1.13)$, Wald $\chi^2 = 4.57$, df = 1, $p = .033$. Contra hypotheses, we found no significant effects of risk aversion in the Cup Game, either for self or other. Sure bets in the Wheels of Fortune were also non-predictive. Follow-up tests indicate that egalitarian children were at chance levels regardless of condition or level of risk (all Fisher's exact tests >.05). These findings suggest that competition aversion is predictive of egalitarian profiles, but aversion to risk (as measured in the Cup and Wheels of Fortune games) does not seem to hold much predictive power.

Self-Maximizing Profile: Children categorized as self-maximizing opted to increase their payoffs across conditions, even if doing so came at the expense of their

[11] Independent factors were entered into the binary logistic regression as follows: Cup Game (risk aversion for self = 1; risk aversion for other = 1); Basket Game (solo play = 1); and Wheels of Fortune (sure bets for self low risk, self high risk, other low risk, and other high risk, all = 1).

partner. We hypothesized that in the Cup Game, these children would be risk-averse for themselves but risk-tolerance for their partners (since choosing a greater number of cups entailed a higher probability of loss). Regarding the Basket Game, we anticipated that children would opt to compete because if successful they maximize their payoffs but not those of their partner. For the Wheels of Fortune we anticipated that children would gamble for themselves (since this entailed the possibility of winning more) but would opt for the sure bet for their partners.

The binary logistic regression described previously yielded a main effect of risk, (β(SE) = .611(.220), Wald χ^2= 7.559, df = 1, p = .006). Contra predictions, self-maximizing children were significantly more likely to pick more cups for themselves (M = 3.43, SD = 1.87) than their partner (M = 2.47, SD = 1.28). This raises the possibility that children focused more on the absolute value of the potential payoff, perhaps to the exclusion of the probability tied to that payoff. This interpretation is supported by the fact that the range of choices was smaller for non-self-maximizing children (1-6 cups) than for self-maximizing children (1-9 cups).

Our predictions regarding competition were confirmed (β(SE) = 1.09(.535), Wald χ^2 = 4.15, df = 1, p = .042). Self-maximizing children were significantly more likely than non-self-maximizing children to play against someone else in the Competition Game.

Contra expectations, in the Wheels of Fortune self-maximizing children chose neither gambles for themselves nor sure bets for their partners. In point of fact, self-maximizing children were *more* likely to gamble for others, particularly in the high risk condition (β(SE) = -1.546 (.646), Wald χ^2= 5.73, df = 1, p = .017). This pattern of results

suggest that self-maximizing children did not construe the games in terms of getting more, but rather getting *more than* someone else.

In sum, risk and competition were significant predictors of self-maximizing behavior, though these trends were not always in the predicted direction.

Generous Profile: Children characterized as generous opted to maximize their partners' gains in all conditions of the Social Preferences game, even when doing so came at a personal cost. It was hypothesized that in the risk game, these children would be more risk-tolerant for self and less risk tolerant for their partner. In the Competition Game we expected children to play alone, because although competition could result in gains for the partner, it could also result in a loss. Regarding the Wheels of Fortune, we predicted that children would be at chance in choosing sure bets for themselves, since their larger concern would be payoff to their partner rather than payoffs to themselves. They would, however, be more inclined toward sure bets for their partners to ensure that they would receive a certain payoff.

Results yielded no main effects of risk, competition, or joint competition-risk (as measured by the Wheels of Fortune task). This is not to say that predicted effects were in the incorrect direction; generous profiles could not be predicted with any systematicity using proximate mechanisms proposed here. This suggests that other proximate mechanisms may confer more explanatory power in accounting for generous tendencies. There are reasons for suspecting that risk and competition may not factor significantly into the decisions of generous persons. An alternative candidate mechanism to explain generosity could be empathy (e.g., Preston & de Waal 2002) or social proximity, both of

which would predict that the degree to which children affiliate with their partner could translate to increased sharing of resources. That children act with generosity toward in-group members (Moore, 2009; Olson & Spelke; Zinser et al., 1991) and needy or emotionally distressed others (Hull & Reuter, 1977; McGillicuddy-De Lisi et al., 1994) in other sharing tasks would support this possibility.

Spiteful Profile: Children characterized as spiteful acted to minimize their partner's gains in the Social Preference Game, even when doing so came at a personal cost. On this basis, it was predicted that in the Risk Game these children would be more risk-tolerant for others but not themselves (thus increasing the chance of a loss for the partner). In the Competition Game these children would forestall any possibility for their partners to earn coins by opting to play solo. Finally, in the Wheels of Fortune we predicted these children would select sure bets for themselves, but would be willing to gamble for others to increase their chance of loss.

Results confirmed our hypotheses regarding risk and competition, and partially supported our predictions for the Wheels of Fortune. Spiteful children chose significantly fewer cups for themselves relative to their partners ($\beta(SE) = -.742(.267)$, Wald $\chi^2 = 7.27$, df = 1, $p = .005$). Regarding competition, these children were significantly more likely to play solo than to compete ($\beta = 2.19(.796)$, Wald $\chi^2 = 13.43$, df = 1, $p < .01$. Spiteful children were at chance regarding their own choices in the Wheels of Fortune, but they were significantly more likely to choose the gamble in the low risk condition ($\beta = 2.23(.837)$, Wald $\chi^2 = 7.08$, df = 1, $p = .008$). A marginal trend to gamble

for the other in the high risk condition was also observed (β(SE) = .766, Wald χ^2 = 3.01, df = 1, p =.083).

Children who are spiteful in sharing (acting to minimize others' gains) may be motivated to reduce a partner's gains in risky or competitive contexts. When they must choose between sure bets and gambles for themselves, these children are random, perhaps because these outcomes are not tied directly to any consequences for their partners. It would therefore seem that social comparison is particularly relevant for spiteful children. In the parlance of the inequity aversion (Fehr & Schmidt, 1999), these children may be driven less by self-regard (in the sense that they do not actively seek personal gains) and more by other-regard (in the sense that they are envious rather than compassionate toward others).

Summary of tests of the behavioral profiles: In general, across behavioral profiles we found the most confirmatory evidence for competition as a proximate mechanism. Relative competition-aversion or competition-tolerance accurately predicted all but the generous profile. The evidence for risk was less consistent (and in some cases disconfirmed hypotheses). At the level of methodology, our games may have been inappropriate measures of risk-aversion at this age (see previous discussion in §5.5.2 and 5.5.4). At the level of theoretical interpretation, these findings could suggest that *economic* risk is not a relevant feature in children's distributive acts. *Social risk* is more ambiguous but may also be more relevant to children's experiences of risk in day-to-day life.

5.5.7 Summary of proximate mechanisms: Do risk and competition aversion predict inequity aversion?

The results of our correlation analysis suggest that risk and competition are related to inequity aversion: by age seven, egalitarian choices are associated with decreased propensities to compete and to choose gambles over sure bets (both for oneself and a partner).

A complimentary analysis assessed the consistency children's egalitarian choices across the different sharing conditions of the Social Preferences Game. Based on the pattern of egalitarian choices, children were characterized as egalitarian, self-maximizing, generous, or spiteful in their distribution of resources. Sample size may not have been sufficient to detect developmental differences at all levels of these behavioral profiles. However, risk and competition were significant predictors of all but the generous profile.

Collectively, these multiple lines of evidence suggest that risk and competition aversion may be good candidate mechanisms for explaining the emergence of inequity aversion in development.

Our proximate mechanisms may help to explain *why* individuals are inequity averse, but questions still remain about how individuals choose to *rectify* inequity. The Restorative Justice task that followed our economic games attempted to address this question.

5.5.8 Results of the Restorative Justice Task

At the conclusion of the economic games, children listened to a vignette about two protagonists who worked together and decided to split the profits. One character

violated this agreement by stealing the money and keeping it for himself. As our dependent measures we recorded children's responses to the following questions: (1) What happened in the story; (2) Was it fair; (3) Should we fix the situation by taking from the thief or giving money to the victim and (4) Who is nicer?

Investigations of children's restorative justice suggest that even young children (three to four year olds) are sensitive to the moral valance of an individuals act and prefer to associate with kind, helpful persons over those who are unkind (Kenward & Dahl, 2011). Robbins & Rochat (2011) demonstrate that when punishment occurs to rectify an inequity, it is oriented toward norm violators (in this case a stingy puppet who did not share equitably) at five years but not prior. We therefore anticipated that children in all age groups would find the transgression in the vignette unfair and describe the victim of the transgression as nicer than the thief. With regard to restorative justice, we anticipated that children would opt to correct the transgression via punishment of the thief.

Question 1 was included as a control prompt to ensure that children understood the story. However, during pilot testing it became clear that children oriented their re-telling by focusing on thief or theft (e.g., "he took all the money" or "he broke the rules"), or focusing on the victim ("he was hurt" or "he has less now"). We coded these responses as theft-oriented or victim-oriented (inter-rater reliability: $\kappa = .80$). A significant majority of three-year olds (90%), five-year-olds (88%) and seven-year-olds (75%) were theft-oriented and emphasized the role of the thief in the vignette (all binomial tests: $p < .05$).

With regard to Question 2 (is it fair), a significant majority of three-year-olds (86.7%), five-year-olds (90%) and seven-year-olds (96.9%) reported that the transgression in the vignette was unfair (binomial tests: all $p < .05$).

Question 3 asked children to choose between two solutions for restoring justice: punishing the thief or compensating the victim. Results yielded a significant interaction of age and solution, $\chi^2_{(2)} = 9.98$, $p = .007$, Cramer's V = .329. Three-year-olds (80%) opted to punish the thief (binomial test: $p < .001$). Five-year-olds were at chance, neither favoring punishment of the thief nor compensation of the victim. There was a marginal trend for seven-year-olds (59.6) to compensate the victim (binomial test: $p = .08$).

In a follow-up analysis we questioned whether the manner in which children construed the vignette (theft-oriented or victim-oriented) could predict how they would choose to restore justice (punish the thief or compensate the victim). Fisher's exact tests revealed no associations between these two variables for either three- or five-year-olds. In contrast, amongst seven-year-olds the association between construal of the vignette and the child's solution to restore justice was significant, Fisher's exact test: $p = .010$ (see Figure 7). Seven-year-old children (79.2%) who were theft-oriented opted to punish the thief, whereas 75% of children who were victim-oriented opted to compensate the victim (binomial tests: both $p < .05$).

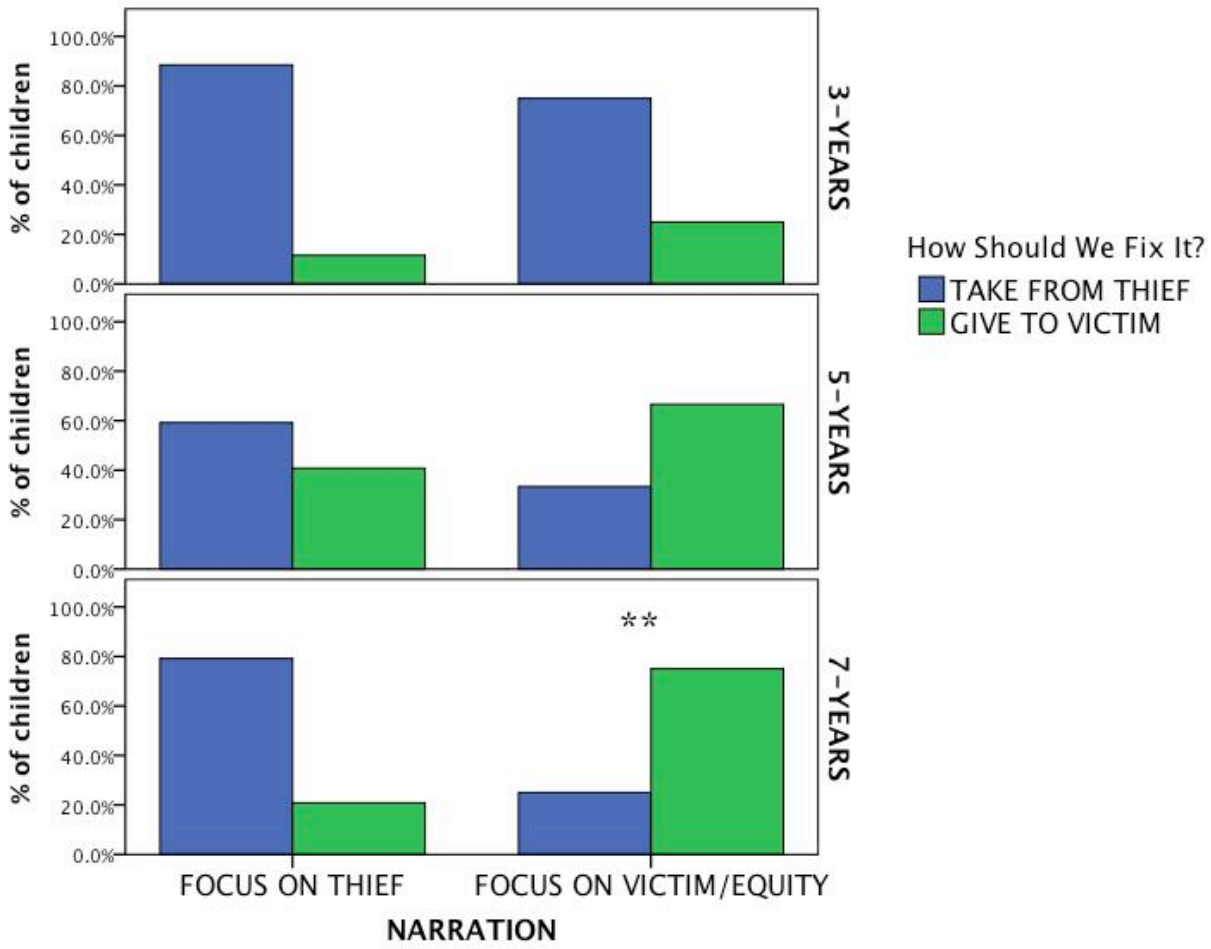

Figure 6. Relationship between focus of narration (on thief, on victim) and method of restoring justice (punishing thief, compensating victim) as a function of age.

Question 4 asked children to identify which of the two protagonists was nicest. Children at three years (93.3%), five years (100%) and seven years (100%) chose the victim as the nicer of the two characters (binomial tests: all $p < .01$).

We also ran a follow-up analysis to assess the relationship between relative egalitarianism (as captured by the behavioral profiles created in the Social Preferences Game) and the inclination to punish or compensate to restore justice. If, for example,

generous children are driven by a concern for another's welfare, we might expect that these children would be significantly more inclined to compensate the victim over punishing the thief. Correlation analyses revealed no significant associations between children's restorative tendencies and their relative egalitarianism (as captured in the behavioral profiles determined by the Social Preferences Game). We interpret these findings as evidence that mere inequity aversion is not enough to explain selective acts of restorative justice. The manner in which children distribute resources when they are recipients does not necessarily predict how they will opt to rectify a transgression between third parties.

To summarize, at all ages children tended to describe the transgression depicted in the vignette as unfair, but their method of restoring justice to the nicer, victimized depended on age as well as the way in which children oriented their retelling of the story. At seven years, but not before, children showed signs of preferring to compensate the victim, perhaps because in general, punishment of the thief might be seen as perpetrating one harm to correct another. This "double transgression" might be discomforting to older children, but not to their younger counterparts. Furthermore, at seven year (but not prior) children's method of restoring justice was significantly associated with their construal of the vignette.

5.6 General Discussion for Study 1

Developmental accounts of inequity aversion point to increased egalitarianism over development, with self-maximization of resources typically characterizing younger (three year old) children and propensities toward equitable distribution of resources more

characteristic of five to seven year olds. This effect of age is constant across methodologies, including the dictator games (e.g., Rochat et al., 2009; Urgel-Semin, 1959, but see Hook & Cook, 1979 for an early review), forced choice paradigms (Fehr et al., 2008; Moore, 2009) and strategic bargaining games (e.g., the ultimatum game; Harbaugh et al., 2003; Lucas et al., 2008; Sally & Hill, 2006).

It remains an open question what drives the propensity to become more egalitarian with age, and what can account for the considerable individual differences in children's sharing behavior. The goal of Study 1 was to propose and assess two proximate mechanisms (risk and competition aversion) that could account for these developmental and individual differences. To test this hypothesis we first used the Social Preference Game developed by Fehr et al (2008) to measure children's relative egalitarianism. In this forced choice game children chose between equitable and inequitable distributions of tokens. The results of the replication presented here confirm the original findings that by seven years there is a significant trend toward egalitarianism, at least at the level of individual choices. Across the three conditions in the game, seven-year-olds were more egalitarian than five and three-year-olds.

In general, our results confirm our *developmental hypotheses* that at seven-year olds relative risk aversion and competition aversion correlate with inequity aversion (as indexed by egalitarian sharing), with the caveat that this depends on how risk is conceptualized.

At the same time, there were significant *individual differences* regarding how children share *across* games. The frequency of egalitarian choices across games can be distilled into a behavioral profile that characterizes children's relative propensities to be

egalitarian (always splitting equitably), self-maximizing (favoring personal gain over the welfare of a partner); generous (favoring another's welfare even at a personal cost); or spiteful (minimizing another's welfare even at a personal cost). At this aggregate level, we once again found support for our proximate mechanisms. Independent of age, relative-risk and competition aversion seemed the most predictive of self-maximizing and spiteful behavior; our proximate mechanisms seemed less efficient at predicting egalitarianism and generosity. These data would suggest that other proximate mechanisms (e.g., empathy, parochialism) might be more predictive of sharing that is characterized primarily by other-regard rather than self-regard (Fehr & Schmidt, 1999).

At both levels of interpretation, one outstanding question is whether children primarily construe inequity in terms of loss (e.g., I have less than my partner; my partner has less than me) versus gains (e.g., my partner has more than me; I have more than my partner). These two ways of construing an exchange have equivalence of meaning, but may carry very different psychological weight. The potential asymmetry between the child's experiences of losses and gains is the motivation for Study 2.

Finally, the results of the Restorative Justice task suggest that inequity aversion is not enough to account for moral actions taken to rectify unfair acts (i.e., taking an ethical stance). We explore the relationship between inequity aversion and moral reasoning in more detail in Study 3.

CHAPTER 3

1. Loss aversion and asymmetry in the experience of inequity aversion (Study 2)

As a description of behavior, inequity aversion posits that egalitarian individuals are motivated by both self-regard (what I have) and other-regard (what you have). The question under investigation here is to determine which one of these two forces is the more influential. Which is the perspective that individuals are more likely adopt when they make decisions?

Consider the following example: You and I receive an endowment. You have $70. I received $30. When we discuss what has happened, how do we describe the situation? We could say that what we have is merely "different." We might also construe the situation in more relational terrms. If so, am I more inclined to say that "I have less than you," or do I construe the situation as "You have more than me"? Both are objectively true. The question is whether they have the same equivalency of meaning. This would hint at the element of social comparison that Gintis et al. (2005) describe as one of the fundamental characteristics of inequity aversion. However, it is also possible that I can consider the situation without any regard for your outcome. I could also frame the situation solely in terms of my own expectations: "I got a little, but less than I wanted."

6.1 What is loss aversion?

Loss aversion is a hypothesis about how individuals affectively experience having more and having less. In informal terms, it is the intuition that "losses loom larger than gains" (Tversky & Kahneman, 1991), and it captures the subjective experience that the positivity associated with winning is not outweighed by the negativity of loosing.

Loss aversion is part of a larger suite of ideas (commonly referred to as "prospect theory") that examine how individuals conceptualize risk (although risk is not necessary to elicit loss aversion, as discussed in more detail below). The prediction is that some individuals are risk-tolerant in gambles because they frame the situation in terms of gaining something, which mitigates a loss. Other individuals, however, are risk-averse and eschew gambles because they prefer avoiding losses to the possibility of greater gains. So-called "framing effects" shift preferences even within individuals. This can be accomplished by either changing the probability of a win coupled with the value of that win (e.g., the expected value of the outcome; see §2.2.4 for a fuller articulation). It can also be accomplished by changing an individual's point of reference. For example, consider the Wheels of Fortune described in the Study 1. A 100% chance of a three coin win (sure thing) is pitted against a 50% chance of a six coin win (gamble). Results in adults (Daws, 1998; Shefrin & Thaler, 1992) but also children as young as five years (Schlottmann & Tring, 2005) indicate that individuals are typically risk-seeking (opting for the gamble) when the game is framed in terms of winning coins. But when the frame of reference is changed and the participants are informed that the choice is between a sure loss and an uncertain loss (despite the fact that the objective probabilities remain the same) most individuals become risk-averse and opt for the sure win (Strough et al, 2011).

Loss aversion may also be elicited in the context of riskless choice where there are no negative consequences associated with a decision. When asked to rate the (un)pleasantness of loosing or finding $100, for example, most participants claim that the loss of $100 is more potently negative than finding $100 is pleasant. In other words, the subjective magnitude of a negative outcome vastly outweighs the subjective magnitude of a positive outcome (Baumeister, Bratslavsky, & Finkenauer, 2001; Rozin & Rozysman, 2001; but see also Thaler 1999 for a comprehensive review). This is the psychology at play when retailers label a grocery product as "95% lean" versus "only 5% fat."

In one of the first studies to examine loss aversion in the context of riskless choice and social evaluation (here defined as making choices for both oneself and another), Polman (2012) gave participants a $25 Visa card. Following, participants could enter a lottery in which they might trade the card for a $40 Visa card versus a $40 Mastercard. In both cases, the participants would walk away with something (a $40 card). However, Polman found that the option to swap for a $40 Mastercard (as opposed to the $40 Visa card) was aversive. Receiving a $40 Mastercard was less pleasurable than receiving a card of identical value but that was identical in brand to the one they initially received (e.g., Visa). Participants determined that this outcome would be equally aversive a partner (Polman, ibid).

Loss aversion is close cousin of the endowment effect, in which individuals place a higher value on a good that they own than they do on an identical good that they do not own (Kanhneman, Knetsch, & Thaler, 1990). The joint influence of loss aversion and endowment effects may explain why individuals are often conservative in ultimatum games, and in bargaining situations more generally: I may offer a greater share of my

wealth to you than I would like (because I am proprietary toward it), but I do so because being rejected will hurt worse than the little sacrifice I must make to keep that from happening (Kanhneman et al., ibid). No evocation of fairness norms is required if the negative experience of loss is great enough.

6.2 Developmental evidence for a general negativity bias

The asymmetries that characterize adults' perceptions of losses and gains have roots deep in development. Loss aversion may tap into a general "negativity bias" (e.g., greater attention for behaviors or outcomes that are undesirable, harmful or unpleasant; Wang, Galinsky, & Murnighan, 2009) that is ubiquitous in adults, that is evident across multiple socio-cognitive domains, and that emerges early in development (Vaish, Grossman, & Woodward, 2008). We highlight a few key examples below.

In terms of social evaluation, adults are more inclined to punish deception than they are to reward honesty (Abbink, 2000; Brandts & Charness, 2003), and they are also more willing to blame individuals for negative, unintended consequences than they are to praise individuals for positive, but also unintended consequences (Knobe, 2003). Asymmetries also govern infants' early appraisals of antisocal and prosocial agents. Hamlin et al. (2010) showed infants a vignette in which a target character was either helped or hindered by two other agents; a third agent did not interact with the target character. At three-months and based on looking time data, infants viewed the hinderer as more aversive than the neutral agent, but helpers were not seen as more appealing than the neutral agent, suggesting that negative information is somehow privileged or prioritized in terms of its processing (Hamlin et al., ibid).

A general negativity bias also characterizes socio-emotional processing and social referencing. Twelve-month infants are more likely modulate their own behaviors in response to negative cues (e.g, fearful or angry expressions) than to positive ones (e.g., smiling, happy affect; Mumme, Fernald, & Herrard, 1996). If adults associate negative cues (i.e., frowning) with an unknown or novel object, infants are significantly less likely to approach or play with it. The magnitude of this effect trumps any increase in object exploration that results from associations between objects and positive cues (Campos et al. 2000; Campos et al., 1978). At two years the same asymmetry is evident in young children's exploration of hidden objects. Descriptors such as "scary" reduce exploration relative to descriptors that are neutral (Campos et al., 2000; Campos et al., 1978; Campos & Stenberg, 1981; Feinman, 1982).

A general asymmetry between negativity and positivity is also evidenced in infants' acquisition of language. Positive and negative emotion words appear in the child's lexicon around 20 months (Bretherton et al, 1986). Initially, positive and negative emotion words (i.e., happy, sad, scared, mad) are used with equal frequency (Dunn et al., 1987; Wellman et al., 1995). However, by three years the number of unique negative emotion words doubles, although the vocabulary for positive emotion words remains the same (Lagautta & Wellman, 2002).

Negative traits carry more weight in impression management than do positive traits (Falk & Fischbacher, 2006), and adults tend to remember negative behavior more vividly and accurately than positive behaviors (Fiske, 1980). Likewise, young children tend to over-report affectively negative events over those that were more positive or

neutral, and they later use more negative words in describing these memories to a care-giver (Fivush, 1991).

As might be predicted by the literature on social referencing, after three years children tend to allude to others' negative mental states more often than their positive ones, which is in turn associated with more sophisticated reasoning about causation (e.g., "he was sad because..." versus merely providing a description like "he was happy") (Dunn, 1998; Dunn & Munn, 1987; Lagautta & Wellman, 2002).

It therefore appears that an asymmetry between the relative importance or salience of negative versus positive information shapes children's experiences with the social world from a very early age. In the context of these well-documented developmental trends, and with regard to the current investigation, we might ask how such a negativity bias maps onto children's experiences with sharing. Is this greater sensitivity to negative outcomes (something akin to what has been described as loss aversion in adults) at the root of inequity aversion?

6.3 What is the link between loss aversion and inequity aversion?

LoBue et al. (2009) report that three-year-olds display negative affect in response to unfair outcomes, but no data suggest that this is mediated by positive affective responses to fair sharing. Children decry deviation from established rules surrounding a game (Kenward et al., 2011) but it is unknown whether they are equally inclined to reward (at least at the explicit level) abidance to conventional norms. Unfair outcomes are often accompanied by verbal or physical protest (Tomasello & Vaish, 2012) with correspondingly fewer explicit, positive reactions to equity.

A greater sensitivity to negative consequences may also drive children's own sharing behavior when they are responsible for proposing or accepting ways to distribute resources. In ultimatum games, five- to-six-year-olds sometimes make "hyperfair" offers to their partners (i.e., more than 50% of their resources). Although some have interpreted this as evidence that children at this age do not understand the rules of the game, it is also possible (following the rationale detailed prior) that children offer a greater portion of their resources to forestall the possibility of rejection (particularly if they would themselves expect higher payoffs were the situation reversed; Murnighan & Saxon, 1998; see also the Perfect Share condition of Rochat et al., 2009). With regard to the Social Preferences Game of Study 1, it is possible that five- to-seven-year-old children opt for egalitarian outcomes not because they favor equity (or hold in mind any sort of norms), but rather because they seek to minimize disharmony between players. Manipulations of parochialism in which children share more equitably with close friends and kin would support this intuition (Fehr et al., 2008; Moore, 2009). The collective evidence may point toward an emerging egalitarianism that is rooted less in principles of equity, and more in a desire to mitigate the experience of personal loss even (whether in the form of material disadvantages or fear of social rejection) and even if doing so precludes the possibility of greater personal gains.

Although inequity aversion in adults is framed in terms of social evaluation (comparing what I have to what you have), loss aversion is a theory of individual choice, causing some to call it inherently egocentric (Fagerlin et al., 2001). Few adult studies have examined loss aversion in the context of social evaluation (Polman, 2012). Investigations of loss aversion in children focus on framing effects (e.g., shifting

tolerance for risk when gambles are described as losses versus wins; Schlotmann & Tring, 2005). That we know of, no studies have directly investigated the more subjective and affective experience of loss aversion in children, nor are we aware of any studies that link this emerging sensibility to inequity aversion.

The purpose of Study 2 is to explore the potential relationship between loss aversion and inequity aversion. The question is whether a "losses loom larger than gains" mentality predicts children's more or less egalitarian sharing between three- to seven-years. Furthermore, we question whether any such loss aversion would be specific to experience of personal loss, or whether they would generalize to assessments of another's losses and gains.

6.4 METHODOLOGY FOR STUDY 2

6.4.1 General overview

With regard to inequity aversion, Fehr & Schmidt (1999) argue that disadvantageous inequity (e.g., outcomes in which the child has less than her partner) can carry greater weight than advantageous inequity (e.g., outcomes in which the child has more than her partner). The reason for this asymmetry is unclear. For example, the greater weight assigned to disadvantageous outcomes could be driven by a general distaste for personal loss relative to personal gain (e.g., loss aversion). Conceptually, it remains also remains an open question whether children construe these dual considerations (for self and others) equally in terms of losses or gains. For example, to say that "I have less than you" carries an equivalency of meaning with "you have more

than me," though at the level of individual psychology these may be experienced as very differently.

The goals of Study 2 were therefore three-fold: (a) determine whether children experience loss aversion; (b) to determine whether such a loss aversion is specific to the child's individual experience, or whether it generalizes to estimations about what a partner has received; and (c) whether loss aversion can predict children's relative inequity aversion in a sharing game.

To test these hypotheses, children first participated in a pre-test sharing game. Children could freely distribute "magical" sand between themselves and a partner. This was our measure of relative egalitarian sharing and therefore inequity aversion.

To test our loss aversion hypothesis, three, five, and seven-year-olds next played a guessing game in which they had to estimate the height of white sand in a tube. Children were trained to accurately estimate changes in the height sand in a transparent tube as one scoop (approximately 120 mL) of sand was added (gain) or removed (loss). Children made these estimations in two control conditions. In the Transparent Control children estimated gains and losses when the sand in the transparent tube was readily visible. In the Opaque Control, the point of which was to demonstrate that children's estimates are an artifact of the perceptual saliency of the sand in the transparent tube, children estimated gains and losses after a sleeve was fitted over the tube, rendering it opaque. These two conditions (Transparent Control and Opaque Control) were designed to assess whether children have a general negativity bias that would not be tied to any social evaluation (as in the Loss Aversion condition).

Following, the white sand was replaced with "magical" blue sand, greater quantities of which children were informed could be exchanged for high quality prizes (as determined by the child) at a makeshift toy store in our lab. To determine whether children would over/under-inflate their estimations in response to this change in context, the tube remained covered by the opaque sleeve throughout the remainder of the game. In this Magical Sand Game, children estimated both gains and losses for themselves (self trials) as well as an anonymous, fictitious partner (other trials) who was similarly described as desiring the magical sand that could be exchanged for prizes.

The next section describes the methodology of Study 2. It also details our specific hypotheses about the developmental trajectory of any potential loss aversion, as well as its relation to inequity aversion.

6.4.2 Participants

We sampled a total of 60 children living in metro-Atlanta, GA, including 20 three-year-olds ranging from 34-50 months (M±SD = 42.67±5.01, 10 girls), 20 five-year-olds ranging from 58-74 months (M±SD = 64.82±4.98, 10 girls), and 20 seven-year-olds ranging from 82-98 months (M±87.42±5.80). Approximately half of participants were tested at our lab on the Emory University campus, and the remaining children were tested at preschools in the greater-metro Atlanta area. This sample does not reflect six participants who were dropped from analysis on the basis that they did not complete or comprehend the game, yielding an attrition rate of 9%.

6.4.3 Sharing Pre-Test

Prior to the "magical sand game," children were presented with two bowls, one of which belonged to the child, and one of which was described as belonging to a same-age, same-gender anonymous partner who could not be at the lab that day. Children were told that whatever they gave to this partner (who was, in reality, fictitious) would be given to the partner at a later time. The location of the partner's bowl (e.g, to the child's right or left) was counterbalanced across participants, and the game did not proceed until children correctly responded to prompts about which bowl belonged to which player.

Next, children were given a jar of white sand (approximately 1920 mL or eight cups in volume) and a ½ cup (120 mL) scoop. Children were instructed to "scoop the sand however you want." No explicit directions were provided about sharing the sand. Children were told that they could scoop as little or as much as they wanted, and that they could stop whenever they liked (the entirety of the jar did not have to be distributed). The use of sand (a continuously measured resource) in this measure of relative inequity aversion was to create continuity between this game and the loss aversion game that followed. As a dependent measure we recorded the volume of sand (in mL) distributed to each participant.

6.4.4 Training Task

Following the sharing pre-test children visited the make-shift toy store in the lab. They were asked to identify and rank three prizes (i.e., great, medium, okay). They were told that later in the game they would have an opportunity to win one of these prizes.

In the training task that followed, the experimenter showed children a long (18 inch) cylindrical tube 1.5 inches in diameter with a volume of four cups (approximately 960 mL). The bottom of the tube was fitted with a ball joint and valve that enabled easy emptying of the container. The halfway mark was marked with a highly visible line that encircled the tube. Children watched as the experimenter used the 120 mL scoop[12] to fill the tube with white sand to the halfway mark. This halfway mark would serve as a reference point throughout the training and the three conditions that followed.

Addition (Gain) Training: Children were informed that they would be playing a fun guessing game with the tube, scoop, and white sand. First the experimenter modeled adding one scoop of sand to the tube, calling attention to the new height of sand in the tube (e.g., "Look how tall the sand is! Now it's up here!").

In this training session, and in all the conditions that followed, the midway line was always used as the reference point from which the child's estimation would be anchored.

The volume of this scoop was siphoned out via the valve at the bottom of the tube, restoring the height of the sand to its original halfway mark (e.g., "Look! The sand is back at the line"). The experimenter then added the same scoop back to the tube and invited children to measure for themselves the new height of sand in the tube. The experimenter highlighted the correct height measurement corresponding to the one scoop addition by using a ruler (anchored at the halfway mark) to show children the correct height. The experimenter called attention to this point by repeated pointing and placing a

[12] The 120 mL (1/2 cup) scoop was chosen because it created a ±12% change in the volume of the tube which based on pilot testing seemed to be an ideal level of discriminability.

sticker at this location. The experimenter once again emphasized that "this is where the sand is when you add one scoop." Again, the volume of this scoop was removed so that the height of the sand returned to the halfway mark. The sticker denoting the actual height of the sand was also removed.

While the sand was still at this halfway mark, the experimenter asked the child to guess how tall the sand would be with the addition of one scoop. Children denoted their estimation by placing a sticker on the tube. The experimenter measured the distance from the halfway mark to the child's estimation based on placement of the sticker. The experimenter and child then discussed whether this estimation was accurate, comparing the placement of the sticker with the accurate measurement indicated by a ruler. The experimenter then asked the following prompt: "We added one scoop. This is where the sand should be. Is your guess right?" If the child's guess was incorrect, the experimenter then said the following: "Is your mark too high or too low? Where should it be?" These prompts were repeated until the child could accurately explain how their estimation was either consistent or inconsistent with the correct, objective measurement. Children repeated this cycle of estimation and feedback a minimum of three times and up to as many repetitions as it took for the child to provide an accurate estimate (within +/- 2cm of the objective measure).

Subtraction (Loss) Training: Next the experimenter modeled how the subtraction of one scoop from the tube worked. Starting from the halfway mark, the experimenter then removed the volume of one scoop, calling attention to the new height of the sand in the tube (e.g., "Look how tall the sand is! Now it's down here!"). The volume of the

scoop was added back to the tube so that the sand was once again at the halfway mark.[13] The experimenter then subtracted another scoop and invited children to measure for themselves the new height of sand in the tube. The experimenter highlighted the correct height measurement (again, anchored at the halfway mark) that corresponded to the one scoop subtraction by using a ruler to show children the correct height. The experimenter called attention to this point by repeated pointing and placing a sticker at this location. The experimenter once again emphasized that "this is where the sand is when you take away[14] one scoop." Again, the volume of this scoop added back to the tube so that the height of the sand returned to the halfway mark. The sticker denoting the actual height of the sand was also removed. While the sand was still at this halfway mark, the experimenter asked the child to guess how tall the sand would be with the addition of one scoop. Following the method outlined above (but using terminology consistent with this subtraction training), children participated in as many cycles of estimation and feedback as were needed for the child to achieve accuracy. Order of the training sessions (addition or subtraction) was counterbalanced across participants.

6.4.5 Establishment of estimation baseline (Transparent Control and Opaque Control Conditions)

The *Transparent Control* followed the addition/subtraction training. (To emphasize how the addition/subtraction maps onto the loss aversion hypothesis, we now refer to these as gain and loss trials. This is a conceptual distinction; the same language

[13] In the interest of making this addition as quick and neat as possible, the experimenter used a funnel that could be removed from the top of the tube as needed.
[14] We avoided terminology such as "subtract" and "remove" that may not yet have been in the vocabulary of younger children.

was used to describe the task to participants.) In two trials (gain and loss) that were counterbalanced across participants, children were asked to make one final guess regarding the height of the sand in the tube as one scoop was either added or taken away. Again, the height of the sand was "reset" to the halfway point prior to each gain/loss trial. The purpose of this Transparent Control was to establish a baseline measure of the child's relative accuracy (and to control for the possibility that some children did not yet grasp the concept of conservancy). This baseline measure was to be used later as a covariate. We recorded as a dependent measure the child's estimation of the height (e.g., the distance from the halfway mark to their sticker, in cm).

To ensure that children had grasped the affordances of the game (and to establish how the guessing game would work during the Loss Aversion condition; see more below), we next ran an *Opaque Control.* A sleeve was fitted over the tube, rendering it opaque. The sleeve was marked with a line at the halfway point to remind children of this reference. Children once again estimated the height of sand in the tube for gain and loss trials by placing a sticker on the tube to indicate their guess. The sand was always reset prior to each trial, and the experimenter would remove the sleeve to verify for the child that they were starting from the same halfway point as they had done during training. The purpose of the baseline established in the Opaque Control was to determine the accuracy of children's estimations in a non-social context that was nonetheless similar in appearance to the Self and Other conditions in the Magic Sand Game (as discussed below). As a dependent measure we recorded the child's estimation of height (e.g., the distance of their sticker from the halfway mark, in cm).

The order of the Transparent Control and Opaque Control conditions (and the gain/loss trials within each condition) were counterbalanced across participants. To reiterate, these conditions were non-social, presented as a guessing game without any reference to value or partners. This made them conceptually distinct from the Self and Other conditions that would follow in the Magical Sand Game.

2.6 Magical Sand Game

After the Transparent and Opaque Control Conditions, the experimenter removed the opaque sleeve and emptied entirely the contents of the tube, removing all the white sand. Next the experimenter showed the child a jar of very rare, very special "magical" blue sand (of the type normally used in aquariums). This blue sand was of the same consistency and granular size as the white sand; the only distinguishing feature was the color.

Children were told it was time to play a new guessing game. In this game, the more magical sand the child accumulated, the better prize they could buy at the makeshift toy store. The game did not proceed until children could answer control prompts about the value of the blue sand and how it could be exchanged at the store. The purpose of switching to this "magical" blue sand and associating it to the toy store was to create a sense of value and make children invested in the game. Imbuing meaning and value to the "magical sand" would allow us to assess children's potential loss aversion above and beyond any systematic measurement biases revealed in the Opaque Control that was (at least visually) most comparable to this condition.

With the sleeve still off, children watched as the experimenter filled the transparent tube to the halfway point with the magical blue sand. The sleeve was fitted back over the tube, rendering it opaque. Next, the rules of the Magical Sand Game were established.

The experimenter showed children a stack of cards, half of which had smiley faces, and half of which had frowning faces. Children learned that in this new guessing game, they would draw a card, and the picture on the card would determine whether they gained or lost one scoop of sand. Thus, the deck represented a 50/50 chance of gain or loss. Children had to correctly respond to prompts about the cards before the game progressed.

Next, the experimenter introduced a manipulation intended to elicit social evaluation. Children were told that they would be making two guesses for themselves (Self Condition), and two guesses for the same-age, same-gender anonymous partner described previously (Other Condition). Like the child, the anonymous partner would be able to exchange "magical sand" at the store. Children were informed that at the end of the game, the person with the most sand would win the prize at the makeshift toy store. These manipulations were included to increase children's investment in the game, and to assess whether any over/under inflation of estimates were particular to the child's own sense of gain and loss.

In the Self Condition children estimated the height of the sand in two trials (loss and gain). Children drew cards from the deck (which was rigged to ensure that children participated in a gain and loss trial only once). Children once again answered control prompts about how the cards worked (as well as to whom they applied, the child or the

anonymous partner). Depending on the card drawn, the experimenter would add or remove one scoop of sand. Children indicated their guess by placing a sticker on the tube. The distance of this mark from the halfway mark was recorded (in cm). The experimenter reset the sand back to the halfway point and removed the opaque sleeve to confirm this for the child. The sleeve was replaced, and another card was drawn.

In the Other Condition children estimated the height of the sand, but this time the outcome of the loss and gain trials were specific to the child's partner. All other aspects of this condition (including the rigged deck of cards) were identical to the protocol detailed above. As a dependent measure we recorded the distance (in cm) from the halfway mark for both of the child's guesses for their partner.

The order the Self and Other conditions were counterbalanced, and gain/loss trials were counterbalanced within each condition. Children who started with the Self Condition participated in both the loss gain trials before changing to the Other Condition, and vice versa. This was designed to minimize confusion about to whom the estimation applied.

6.5 Hypotheses for Study 2

Our first question of interest is whether children between three- to seven-years would demonstrate an asymmetry in their estimations of losses and gains. The inequity aversion hypothesis posits that individuals should be uneasy with inequity of any kind, regardless of whether the source of that inequity is disadvantageous (having less than one's partner) or advantageous (having more than one's partner). At the same time, Fehr & Scmidt (1999) leave open the possibility that of these two parameters, the experience

of personal loss may be the more influential and privileged. This greater sensitivity to personal material loss may map onto the observation that in general, individuals experience losses more negatively compared to the positive experience of gains (e.g., loss aversion; Tversky & Kahneman, 1991). That is to say, individuals typically *overestimate* their losses while simultaneously *underestimating* their gains. Following this logic we make the following predictions:

(1) If children are loss averse and have a "losses loom larger than gains" perspective (Levine, 2003; Sclotmann & Tring, 2005), they will be less accurate in estimating losses relative to gains. More specifically, they will significantly *overestimate* losses relative to an *underestimation* of gains.

(2) Any such loss aversion would only manifest in the Magical Sand condition in which children are invested in the outcome of their estimations. In the non-social Opaque Control (in which there is no value attached to the estimations) children should show no asymmetry in the accuracy of their estimates in loss and gain trials.

(3) If loss aversion is driven primarily by self-regard (to borrow terminology from the inequity aversion hypothesis), then any asymmetry between children's estimations of losses and gains will only be observed for self-trials. If however loss aversion is driven by social comparison (Polman, 2012), we expect that this asymmetry will also characterize children's estimations of another's gains and losses in the other trials.

(4) Developmentally (and controlling for age-related differences in magnitude estimation and understanding of conservancy), we anticipate that loss aversion will emerge between five to seven years but before (three years). This corresponds to the age at which children begin to first show signs of inequity aversion (Fehr et al., 2008; Rochat

et al., 2009). If inequity aversion is driven primarily by a greater concern for personal material wealth relative to that of a partner (e.g., the experience of disadvantageous inequity), then it stands to reason that loss aversion (as defined by a greater sensitivity to losses) might manifest around the same time (though again, this may be specific to the self; see hypothesis 3). In contrast and based on the literature reviewed previously, we expect three-year-olds to show a general negativity bias (Vaish et al., 2008) that is not mediated by the experience of loss versus gains.

(5) If inequity aversion is driven by a desire to minimize personal losses, then we might expect children's sharing to correlate with the relative degree of their loss aversion. The rationale would be as follows: Children who experience losses more negatively may therefore be motivated to be more egalitarian in their sharing. If the experience of disadvantageous inequity is aversive enough (as evidenced here by overestimation in loss conditions), egalitarian children should mitigate this by splitting resources more equitably. We therefore predict that the magnitude of the child's relative *overestimation* of loss will correlate *negatively* with their inclination to share selfishly and self-maximize sand in the sharing pre-task, regardless of age.

Results are presented in two parts: a report of our analysis of the loss aversion measures (described in detail below) and the correlation between this loss aversion measure and our inequity aversion measure.

6.6 Results of Study 2

6.6.1 Analysis of Relative Loss Aversion (Magical Sand Game)

The first step in our analysis was to determine the magnitude of children's over/under-estimations. This was accomplished by subtracting their estimations from the objective measurement (e.g., the actual height of one scoop of sand, as anchored by the halfway mark). Greater values indicate a larger magnitude of error in estimation (e.g., less accuracy). We refer to this as the estimation score. Positive estimation scores indicate an *overestimation*, whereas negative estimation scores indicate *underestimation*.

First we compared children's estimations of losses and gains in the Transparent and Opaque Controls. This analysis served two purposes. First, it would demonstrate whether children, at baseline, are equivalent in their estimations of losses and gains. We could determine, for example, whether any overestimation of loss in the Magical Sand Game reflects true loss aversion versus a general tendency to ruminate on negative outcomes (Vaish et al, 2008).

Second, a comparison of the two controls (Transparent and Opaque Conditions) would determine whether estimation scores are dependent on the visibility of the sand prior to guessing.[15] This point is important, because exaggerated estimation scores in the Opaque Control relative to the Transparent Control would imply that estimations in the Self and Other conditions (in which the tube was rendered opaque by a sleeve) could be

[15] Recall that in both Transparent and Opaque Conditions the child guessed the height of the sand *before* sand was added/subtracted. The only difference between these conditions was that in the Transparent Control, children could actually see the level of the sand up to the halfway mark; in the Opaque Control this reference point was less perceptually available, so a line was drawn around the sleeve to remind children of this halfway reference.

resultant of a perceptual confound and not because children were more or less loss averse.

To address these concerns we analyzed children's estimation scores as the dependent measure in a 2 (condition: transparent and opaque) x 2 (trial type: loss or gain) x 3 (age: 3, 5, and 7 years) mixed design ANOVA. Results yielded no main effects or interactions. Estimation scores did not differ significantly Opaque and Transparent conditions. Furthermore, estimation scores were equivalent between trial types, suggesting that children did not have an inherent bias toward overestimating losses. We conclude that a general negativity bias and perceptual availability of the stimuli would not account for any loss aversion that might characterize estimations in Magical Sand Game.

We hypothesized that any signs of loss aversion (e.g, overestimation of loss relative to underestimation of gain) would be specific to the Self and Other Conditions of the Magical Sand Game in which the sand was valuable. In contrast, we did not anticipate estimations of losses and gains to differ in the Opaque Control, that although visually similar, was not imbued with any value. To test these hypotheses, we ran a 3 (condition: Opaque, Self, and Other) by 2 (trial type: loss and gain) x 3 (age: 3, 5, and 7 years) mixed design ANCOVA factoring children's accuracy on the transparent trials as a covariate. This ensured that estimations were in reference to children's estimations after the extensive training sessions. Results yielded significant main effect of condition, trial type, and age, $F_{4.112} = 4.47$, $p = .002$, $\eta^2 = .138$ (see Table 6 for descriptive statistics).

Table 6. Descriptive statistics (M±SE) for the Opaque Control, Self, and Other conditions as a function of age and outcome (loss or gain).

	OPAQUE GAIN	OPAQUE LOSS	SELF GAIN	SELF LOSS	OTHER GAIN	OTHER LOSS
3-YEARS	.907±.299	.589±.292	1.12±.404	2.27±.356	1.53±.388	1.95±.366
5-YEARS	.546±.297	1.12±.290	1.76±.402	1.11±.345	1.31±.386	1.08±.364
7-YEARS	.371±.289	.733±.291	1.15±.403	-.503±.356	.744±.388	.401±.366

A within-subjects contrast of condition revealed that estimation scores were significantly higher in the Self and Other conditions than in the Opaque Control Condition ($F_{1,56)}$ = 10.38 and 7.34, both $p < .01$). This would suggest that children's estimations were more exaggerated when they had a personal stake in the game (as Self and Other conditions) relative to the Opaque control. Follow-up tests further demonstrated that within the Opaque Control there was no difference between estimations of loss and gains at any age ($F_{1,56)}$ = .046) .

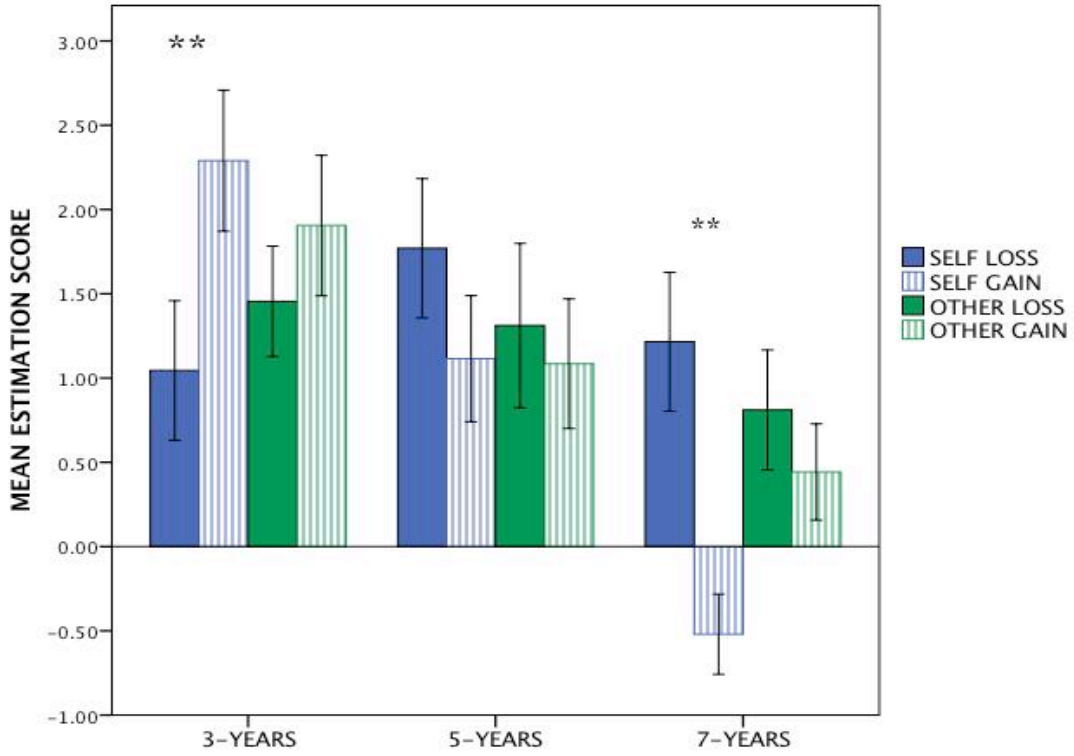

Figure 7. Mean estimation scores as a function of condition (self and other), outcome (loss and gain) and age (3, 5, and 7 years). Positive values indicate overestimation, negative scores indicate underestimation. Bars represent ±1SEM. *Asterisks indicate p < .01 based on pairwise comparisons.*

With regard to the Self Condition, simple effects tests indicated significant differences between the loss and gain trials for three-year-olds ($F_{1,56} = 7.03$, $p = .010$, $\eta^2 = .112$) and seven-year-olds ($F_{1,56} = 14.40$, $p < .01$, $\eta^2 = .205$), but not five-year-olds. At three years children significantly overestimated their gains (M±SD = 2.27±.356) relative to losses (M±SD = 1.12±.404), $p = .010$ based on pairwise comparisons. This tendency to overestimate gains was consistent across participants. A significant majority of three-year-olds (85%) overestimated their gains (binomial test: $p = .003$). In short, three-year-

olds tended to overestimate both gains and losses, though the magnitude of this overestimation was significantly greater for gains.

Per our hypotheses, at seven years children demonstrated signs of loss aversion by significantly *overestimating* their personal *losses* (M±1.15±.403) while also *underestimating* their personal *gains* (M±SD = -.503±.356), $p < .01$ based on pairwise comparisons (see Fig. 7). A significant majority of seven-year-olds (80%) overestimated losses, and 75% underestimated their gains (binomial tests: $p = .012$ and .041, respectively).

No developmental differences were noted for the Other condition. Three, five, and seven-year-olds did not differ in their estimations of loss or gains when making these determinations for a partner ($F_{1,56} = 2.41$, .691, and 1.58 respectively, all $p > .05$). In general, children of all ages tended to overestimate the losses and gains of their partner.

In summary and consistent with hypotheses, by seven (but not prior) children show signs of loss aversion on an estimation task by *overestimating* their losses while simultaneously *underestimating* their gains. Three-year-olds did not show signs of loss aversion (as characterized by the asymmetric estimation of losses and gains), although they did significantly overestimate their own gains relative to their lesser overestimation of losses.

Furthermore, these effects were specific to estimations children made for themselves, but for not others. These effects were also specific to contexts in which children had a motivation to be accurate; when no value or specific consequence was tied to the estimation (as in the Opaque Control), three, five, and seven-year-olds did not

differentiate between losses and gains, and their estimates tended to be more accurate (e.g., closer to the actual objective measurement) on the whole (see Table 6).

It should be noted that although they did not demonstrate an asymmetry between estimations of personal losses and gains, five-year-olds tended to overestimate their losses while also overestimating their gains, but to a lesser degree (see Fig. 7) in what could be a precursor of loss aversion proper.

In what follows we present the results of the sharing pre-test and the correlation analysis with children's estimation scores in the Magical Sand Game.

6.6.2 Sharing pre-test and correlations with loss aversion in the Magic Sand Game

In the sharing pre-test, children were given an opportunity to distribute sand freely between themselves and an anonymous partner. Table 7 depicts the descriptive statistics for this distribution.

To assess developmental differences in these distributions we created a self-maximization score that divided the amount of sand given to self as a function of the total volume of sand that was distributed (see Table 7, far right column). Greater values imply greater self-maximization of the sand. This self-maximization score was the dependent measure in a univariate ANOVA with age (three, five, and seven years) as an independent factor. Results yielded a significant main effect of age, $F_{2,56} = 3.25$, $p = .043$, $\eta^2 = .106$. In Bonferroni pairwise tests, three-year-olds (M±SE = .789± .048) were significantly more self-maximizing than seven-year-olds (M±SE = .615±.043), $p = .040$.

There were no meaningful differences between three- and five-year olds or five- and seven-year-olds.

Table 7. Descriptive statistics regarding children's free distribution of sand in the sharing pre-test as a function of age.

	Total Amount of Sand Distributed to Self (mL)	Total Amount of Sand Distributed to Partner (mL)	Self-Maximization Score
3-YEARS	M±SD = 226.25±148.34 Range: 10-475	M±SD = 84.25±120.45 Range: 0-310	M±SD = .789±.239 Range: .43-1.0
5-YEARS	M±SD = 365.94 Range: 75-750	M±SD = 210.00±143.88 Range: 0-750	M±SD = .722±.221 Range = .49-1.0
7-YEARS	M±SD = 351.59±195.60 Range: 10-850	M±SD = 175.02±194.18 Range = 0-750	M±SD = .614±.182 Range: .44-1.0

We hypothesized that if inequity aversion is driven by a greater sensitivity to losses than gains (as the emphasis on disadvantageous inequity might imply; Fehr & Schmidt, 1999), then relatively equitable children might also be the ones who are most loss averse. Recall that the larger estimation scores in the Magical Sand game indicate a greater overestimation (e.g., estimates that are further from the halfway mark that served as the baseline). A negative correlation would imply that as self-maximization in sharing *decreases*, overestimations of loss in the Magical Sand Game *increase*.

We had predicted that children's more or less equitable sharing would correlate with children's estimations of losses and gains regardless of age. Our results do not support this hypothesis. The propensity to self-maximize was only predictive for three and seven-year-olds. We found no associations amongst five year olds.

Amongst three year-olds, self-maximization correlated positively with their estimation of personal gain, $r_{19} = .661$, $p = .004$. This suggests that the more selfish a three-year-olds is, the more likely she is to *overestimate* what she has gained. The positive correlation between three-year-olds' overestimations of personal gains and their tendencies to self-maximize would suggest that at this age, children are motivated by gains (rather than by the fear of loss). That we found no significant correlation between self-maximizing behavior and children's overestimations of loss would also seem to support this interpretation. This pattern of findings is also consistent with the results of the Social Preferences game in Study 1. In that study, children chose between distributions of tokens that were either equitable, or that created a material advantage for the child or her partner. Three-year-olds significantly favored outcomes that would give them greater material gains, but were at chance levels regarding outcomes that provided greater or equal gains to a partner. It therefore seems that at this age, children's relative selfishness is tied to their tendency to overinflate the subjective experience of gains.

Amongst seven-year-olds there was a significant *negative* correlation between self-maximization and overestimations of personal loss, $r_{19} = -.480$, $p = .032$. The more inflated the sense of personal loss, the less self-maximizing (e.g., more generous) seven-year-olds tended to be when sharing. (In other words, the more egalitarian children demonstrated a greater sense of loss aversion.) This negative association might suggest

that children at this age are more egalitarian because they find the personal experience of loss aversive. These children may be motivated to reduce disadvantageous inequity (the sense of having less), but not at the expense of creating advantageous inequity (which is what self-maximization would entail).

We did not find any significant correlations between relative self-maximization and estimations of another's gains and losses for any age group. This lack of association may reflect the fact that children's estimations entailed no direct consequence for their partner, at least not in the same way that children often share a "common fate" in distributive games (like our sharing pre-test, or in the Social Preferences Game of Study 1) in which greater personal gains for one necessarily entail greater losses for another. From the perspective of a developing ethical stance, it may be the *conflict* between our subjective experiences that is the more relevant determinant of fairness reasoning. To resolve inequity is not only to resolve material disparities, but also to resolve tensions in the experience of intersubjectivity that arise as a consequence that disparity.

In conclusion, the results of our sharing task (which served as a proxy for inequity aversion) are consistent with previous findings (Fehr et al., 2008) that document the emergence of egalitarian behavior between five to seven years of age. Prior to this age, children's overemphasis on the experience of personal gains seems to predict their tendency to self-maximize resources. However, by seven years children showed signs of loss aversion by underestimating personal gains and overestimating personal losses. The magnitude of this overestimation correlated with children's sharing such that more egalitarian children were also more loss averse. We interpret these findings to mean that older (seven-year-old) children may be driven to share more equitably because they are

more sensitive to losses (without a mitigating sensitivity to gains). In short, the results of Study 2 demonstrate that inequity aversion is determined, at a proximate level, by loss aversion that manifests by seven years but not prior.

6.7 General Discussion for Study 2

The results of Study 2 suggest that in the context of a guessing game in which they are asked to make guesses about personal losses and gains (and that of a partner), children show signs of loss aversion by seven years, but not earlier. In confirmation of our hypothesis, seven-year-olds *overestimated* the magnitude of their losses, which was accompanied by a corresponding *underestimation* of their gains. As predicted, this tendency was specific to conditions in which the "magical sand" was imbued with value and children had a personal stake in the matter; asymmetries in children's estimations were not observed in our non-social (opaque) control. By seven years loss aversion was also correlated with inequity aversion: greater overestimations of personal loss indicated greater egalitarian distribution of resources in a sharing task. This may help to explain why children at this age are motivated to share equitably: In real-world scenarios, if the experience of personal loss is aversive enough and salient enough, then children may share equitably to offset this negativity, though perhaps not at the expense of creating personal loss for another. Taken together, these findings confirm our hypothesis that loss aversion is a proximal mechanism of inequity aversion in development.

One point requires further articulation: the role of social comparison in children's developing loss aversion (see hypothesis 3). Loss aversion seemed specific to estimations made for self, and not for others. These findings would seem to suggest that loss

aversion is only relevant to personal subjective experiences and is not generalized to appraisals of others (contra Polman, 2012, who finds that adults are equally loss averse when making decisions for themselves and a partner). However, as we suggest above, this personal subjective experience may be sufficient to explain inequity aversion as it emerges in development. Children who are inequity averse mitigate the experience of loss by sharing equitably. The corresponding positivity associated with getting more (i.e., advantageous inequity) may not be enough to justify the self-maximization of recourses, the consequence of which would be disadvantageous to a partner. Thus, the asymmetric experience of losses and gains would be enough to motivate egalitarian sharing independent of consideration for another's subjective experience. From this perspective, considering the subjective experience of one's partner would not be necessary to explain inequity aversion.

Questions remain as to whether such a guessing game is representative of the affective experience associated with losses and gains. It is true that many adult studies examine loss aversion in the context of gambling tasks that are accompanied by measures that probe participants' subjective feelings of positivity or negativity surrounding their choices (Baumeister, Bratslavsky, & Finkenauer, 2001; Polman, 2012). The present investigation infers affectivity but cannot definitively comment on it.

Finally, in our estimation game, seven-year-old children differentiated between gains and losses for themselves but not a partner. As explained above, a sense of personal loss aversion may account for egalitarianism (e.g., self- and other-regarding tendencies) independent of appraisals regarding a partner's subjective experience of losses and gains.

In light of this interpretation, it is still useful to consider why our methodology was not successful at eliciting similar asymmetries regarding estimations of a partner's losses and gains. We see four possibilities. First, an alternative raised in the results section suggested that estimations for self and other had no direct barring on one another, thus negating the necessity for social comparison. Second, children did not treat the magical sand as a shared resource if they considered it a personal endowment (since the same tube was used for both Self and Other conditions). Third, the nature of the anonymous partner may have been unconvincing to children who therefore treated estimations for their partner no differently than the control conditions that were non-social in nature. Finally, if children construed the game as explicitly competitive, our findings could represent a concerted effort on the part of the child to minimize their partner's winnings. However, we think this last scenario unlikely given that children tended to overestimate both losses and gains for their partners.

Returning to the question proposed at the start of this chapter, there are two ways in which one can experience disadvantageous inequity (the sense of having less). First, there is direct social evaluation—making assessments of what one has in reference to what another has. Disadvantageous inequity seems to imply (perhaps falsely) that I am sensitive to the fact that I have less *at the same time* as you have more. The data presented here do not support this interpretation. Our results provide no evidence, for example, that children overestimated their losses while also overestimating the gains of a partner.

What we do see evidence of (at least in seven year olds) is that children make very different estimations of personal loss and gain despite the outcomes are objectively

the same. We confirm only the intuition that "losses loom larger than gains" (Levin et al., 2003) for oneself, but not necessarily for others. Yet this asymmetry regarding self-appraisals may be enough to account for egalitarian behavior given that children find both disadvantageous inequity (looming losses) and advantageous inequity (minimized gains) aversive.

In conclusion, to ask whether there is equivalency in meaning between "I have less" and "You have more" might be missing the point with young children. For children at this age, to say that "I gained less" is also to say "I lost more," and this may be sufficient to explain the development of inequity aversion.

CHAPTER 4

7. Beyond inequity aversion: Costly Sacrifice (Study 3)

7.1 Fairness as rooted in social evaluation and understanding of intentions

Fairness entails consensus about what acts are unfair, but also how such unfairness should be rectified. Inequity aversion addresses the first half of this equation. The detection of "not sameness," we would argue, is a necessary but not sufficient precursor to acts that restore justice or equity between individuals. It is the adoption of an 'ethical stance' (Rochat, 2012) in relation to the way things *ought* to be done that is the purview of fairness, and of moral reasoning more broadly.

The roots this ethical stance may be grounded in the social evaluation and preference for prosocial tendencies that are expressed early in infancy. At three months, information about antisocial acts (e.g., hindering an agent trying to accomplish an unambiguous goal) are developmentally privileged, meaning that infants find antisocial acts aversive but not as a necessity of finding prosocial acts attractive (Hamlin et al., 2010). Between 6-12 months and based on reaching and looking time paradigms, infants demonstrate an inclination toward helpful versus hindering others. (Hamlin, Wynn, & Bloom, 2008). At 19-months, infants look longer when an experimenter divides items unequally between animate (but not inanimate) third parties, and by 21-months, infants expect individuals who collaborate on task to be rewarded equally relative to situations in which parties did not invest the same amount of effort (Sloane et al, 2012), what is tantamount to need and effort based proportional equity expressed later by six to eight year old children (Lerner, 1974; McGillicuddy-De Lisi et al., 1994; Streater & Chertkoff,

1976). Social evaluation and recognition of social norms becomes more explicit during the preschool years (Tomasello & Vaish, 2012). From two years of age children start noticing and react negatively to third party transgressions of a wide variety of exchange norms including property theft (Blake & Harris, 2009; Rossano et al., 2011; Vaish et al., 2009), dismissal of or refusal to recognize claims to ownership (Neary, 2011), lack of respect for rules of transfer (Vaish et al., 2010), and outright monopolization of resources (Benesen et al., 2007; Lucas et al., 2008). At three years the recognition of these norms is evidenced in children's implicit or non-verbal discomfort with inequitable outcomes. When presented with an unequal distribution of stickers, for example, three to five year olds engage in social referencing (e.g., visually comparing their allotment of stickers to that of their partner) and show negative (unhappy) emotional responses (LoBue, 2009).

Negative appraisals of norm violations are more common when inequity shortchanges the child in what Fehr & Schmidt (1999) describe as disadvantageous inequity or a "behindness" aversion. Children may be explicitly egalitarian in their distributions of resources by five years, but it is difficult to disentangle other-regarding tendency from self-interested motivations, particularly if an egalitarian outcome prevents a material disadvantage for the child (Harbaugh et al., 2003; Fehr et al., 2008; Lucas et al., 2008; Moore, 2009; Murningham & Saxon, 1998). Third-party sharing attempts to address this issue by removing self-interest as a possible motive for being equitable. For example, children who are not recipients in a sharing game might be asked to distribute resources between identical dolls. Across a variety of methodologies, reward types, and description of third parties, a consistent finding from such studies is that children as young as three years tend to share more equitably when self-interest is removed from the

equation (Anderson & Butzin, 1978; Moore, 2009; Olson & Spelke, 2008; Rochat et al, 2009; Tolan & Krantz, 1981). At this age children may even choose to rectify inequity by *perpetrating* inequity (e.g., departing from strict egalitarianism by sharing preferentially with partners who express greater need or have been more effortful in a task; see Kenward & Dahl, 2011).

Thus, accounts of inequity aversion explain the base conditions by which children eschew unfavorable outcomes in favor of egalitarian sharing, but they do not explain how children move beyond this tendency. It is unclear, for example, what steps children might take, be they punitive or restorative, to resolve a conflict whose origins lay in unfair resource distribution. In other words, inequity aversion is a level of description that cannot account for principled acts that would generalize across contexts and persons, transcending individual desires for personal gain.

7.2 Costly sacrifice and strong reciprocity

The issue of how and why individuals rectify inequity is an open question. Laboratory simulations (Fehr & Fischbacher, 2005) and field observations (Henrich et al., 2005) indicate that defectors in cooperative exchanges tend to be punished, even in anonymous interactions (Fehr & Gachter, 2000) and even when such punishment is costly (Boyd et al., 2005).[16] The motivation to punish may be driven by personal interest (e.g., vengeance), or it may be more principled in origin. Strong reciprocity falls into the later category. Above and beyond any sense of mere inequity aversion, strong reciprocity

[16] Note that the inclination to punish is culturally determined, reflecting specific cultural norms surrounding exchange relationships (see Henrich et al., 2006 for a comprehensive review).

corresponds to the propensity to sacrifice resources to sanction defectors or compensate victims in response to a perceived norm transgression (e.g., regarding fairness; Fehr et al., 2002). The goal of Study 3 is to elucidate the emergence and expression of this tendency as it unfolds in development.

From a developmental perspective, strong reciprocity is likely rooted in prosocial tendencies (e.g., for fairness or cooperation; Hamlin et al., 2007; Sloane et al., 2011; Schmidt & Sommerville, 2011) that are first expressed in infancy and become more refined and explicit during the third year of life. Strong reciprocity is also likely tied to the child's co-developing understanding of normativity (Harris et al., 2001; Kagan, 1981), self-concept (Kagan, 1981; Rochat 2001; 2009) possession (Tomasello, 2008; Warneken et al., 2007); reciprocity (Faigenbaum, 2005), and equity (Baumard et al., 2011; Rochat et al., 2009; but see Hook & Cook, 1979 for an early review), all of which reach a developmental synthesis between three and five years.

The preferences for fair or helpful individuals that are expressed in infancy appear to be redescribed in later childhood. For example, the early preference for helpers over hinderers that is inferred from looking time data in infants (Hamlin et al., 2007) may become more explicit in later childhood. For example, Kenward and Dahl (2011) adapted the methodology from the original helping/hindering infant studies (Hamlin et al., ibid; Kuhlmeier et al., 2003) and presented 3-4.5 year olds with a vignette in which a puppet who was struggling to accomplish a goal (i.e., climb stairs, use a tool) was either assisted or hindered by identical puppets. Following, children were given an opportunity to distribute biscuits to the protagonist of their choice. At three years children were relatively indiscriminate in their sharing of the reward, giving an equal number to the

helper and hinderer. In contrast, when biscuits were scarce, four-year-olds gave significantly more to the helper over the hinderer. When biscuits were more plentiful four-year-olds reverted back to strict egalitarianism, suggesting that the norm of equity overrides an early inclination to 'punish' a defector by sharing selectively. Kenward and Dahl suggest that the lack of helper-oriented sharing in three-year-olds might be resultant of a basic confusion regarding the identities/acts of the two puppets, though it should noted that egalitarian sharing at this age has been observed in multiple third party contexts (Anderson & Butzin, 1978; Olson & Spelke, 2008; Rochat et al., 2009).

Strong reciprocity is not reducible to inequity aversion, though they both hold at their cores a fundamental concern for self and other. This is evident in the way young (five year old) children share resources, adhering to strict egalitarian principles of equitable distribution (Fehr et al., 2008). Later, by seven years children engage in proportional equity by factoring relative need or effort into their decisions (Fraser et al., 2007; Leventhal et al., 1973; McGillicuddy-De Lisi et al., 1994; but see also Baumard, Mascaro, & Chevallier, 2011, who report evidence of proportional equity in three-year-olds using a third party sharing context). Such findings have been taken as evidence that children eschew inequity out of a concern for reciprocity (e.g., maintaining cooperative exchanges by either mirroring the actions of a sharing partner, or helping others with the understanding that it could result in personal benefits sometime in the future; Trivers, 1971).

Thus, although a propensity to help, cooperate, and share is an early fact of human sociality, it is unclear how such tendencies would eventually develop into a more principled strong reciprocity that represents a marked qualitative shift in meaning

(Robbins & Rochat, 2011). This is the question that motivates the work presented here.

In the six conditions of Study 3 we investigate the development of strong reciprocity in children between three to seven-years. In Conditions 1-4, children participated in various versions of a first-person, multi-round, triadic sharing game in which children witnessed generous and stingy puppets distribute resources (valuable tokens) before being given an opportunity to do the same. At the conclusion of the sharing game, children were given an opportunity to engage in costly sacrifice (e.g., forfeiture of resources on the part of the child to sanction one or both of the puppets). This costly sacrifice task is our index of strong reciprocity, as engaging in such costly sacrifice requires the child to forego personal gain to enforce a norm (e.g., for fairness) that has been transgressed. This, we argue, represents the adoption of an ethical (principled) stance toward others that is qualitatively different than inequity aversion. Condition 1 reports our findings from this multi-round, triadic sharing game and associated costly sacrifice task. A series of controls (reported as Conditions 2-3) assess whether children participate in costly sacrifice in the absence of any implicit or explicit expectations for fairness (e.g., when there is a norm of either selfish or generous sharing but not both). Condition 4 extends this finding by having children interact with non-agentive puppets to determine whether strong reciprocity does indeed refer to the perceived action of the puppets, not just the sharing outcome itself. In Condition 5 we question whether such strong reciprocity predicts selective costly sacrifice in a third-party sharing game.

The ultimate goal of this suite of experiments is to capture the developmental origins of strong reciprocity, and expression of fairness that could not be reduced to mere

inequity aversion. As a general guiding intuition and based on the literature reviewed previously, we hypothesize that strong reciprocity (as indexed by costly sacrifice) emerges by five years, and not prior.

In what follows we first review the general methodology common to Conditions 1-4. The specific hypotheses, methodological details, and results from each condition are presented independently.

7.3 General methodology for Conditions 1-4

In four different conditions (described in more detail below), three- to-five-year-old children participated in a triadic (three-way), multi-round sharing game in which they were asked to split coins (poker chips of uniform size, shape, and color) between themselves and two protagonists. To provide an incentive for playing, prior to the onset of the game children visited a makeshift toy store where the experimenter explained how accumulated coins could be used to purchase various prizes (e.g., small toys and stickers < $1 USD). Children were also informed that their sharing partners could similarly spend their winnings. To ensure that children associated the coins with the ability to win prizes, at several points throughout the game children were prompted to explain how the coins worked.

7.3.1 Baseline assessment

A pre-test was used to assess children's general sense of equitable and proportional sharing. Children were asked to split nine coins between three identical dolls. We limited the number of items shared to nine to avoid an exclusive reliance on

counting, which was presumably not yet in the register of the younger (three-year-old) children.

For the pre-test trial and the four sharing rounds that followed (see description of the triadic sharing game below), an unfamiliar female Experimenter sat at a table opposite the child and arranged the resources to be split (poker chips) in a circular formation on the center of the table before instructing[17] children to "split the coins." In the pretest and the triadic sharing game that followed, children indicated ownership of the coins by placing them on the table in front of the intended recipient. After children confirmed this distribution, the experimenter deposited the winnings into banks (transparent plastic containers, each belonging to one of the sharing protagonists) for safekeeping.

7.3.2 Triadic sharing game

Following the baseline pre-test, children participated in a triadic (three-way) sharing game using nine valuable coins (poker chips). In four successive trials, children distributed the coins in turn with two puppets that acted either with marked generosity or marked stinginess (Condition 1). In a series of controls, children participated in the same triadic share task, but with slight modifications. Children interacted with either two identically generous puppets (Condition 2) or two identically stingy puppets (Condition 3). In Condition 4 children interacted with two passive puppets. In this latter control condition, children were presented with a pre-established distribution without seeing the puppets actively sharing either stingily or generously.

[17] "Split" was used in place of other instructions (e.g., "share" or "divide") which are often connotative of parsing a given object equitably, or into equal parts.

The two identical, high-quality plush hand-puppets (43 cm tall) used for all studies sat at the table to the right and left of the child and were animated by the experimenter with the same vocalizations and mannerisms throughout the experiment. In four successive rounds, the two puppets always preceded the child, one sharing *generously* (four coins to the other puppet, four coins to the child, and only one to itself), and one sharing *stingily* (keeping seven coins for itself, giving one to the other puppet and only one to the child). By sharing last, and by witnessing multiple rounds of sharing, children observed the maximum effect of the puppets' generous or stingy behaviors.

In all conditions, when it was the child's turn, we recorded and analyzed as a dependent measure the total number of coins distributed by the child to herself and to the two puppets as a function of the four sharing rounds.

Researchers counterbalanced both the position of the characters (i.e., the location of the generous and stingy puppet relative to the child) as well as which puppet shared first to avoid the potential of a side bias or order effect. Children were clearly and unambiguously informed that each protagonist would keep and could accumulate received coins to purchase attractive toys at a makeshift toy store they visited prior to testing. To re-emphasize the accumulative nature of the game, at the end of each round the Experimenter asked the child to compare her bank with the banks of the two puppets and determine which player had accumulated the most coins.

7.3.3 Selective costly sacrifice test

In Conditions 1-4, at the conclusion of the triadic sharing game children were given the opportunity to participate in a costly sacrifice task, what we construed as a

measure of strong reciprocity. After the last round of sharing, the experimenter instructed children to examine the contents of the three banks and determine which player had the most coins. Next, the Experimenter asked whether the outcome of the game was fair. It was then proposed that as the "banker" of the game, the Experimenter could take five coins away from a puppet of the child's choosing, but only if the child gave up one of her own coins. To underscore the costly nature of this decision, the Experimenter reminded children that coins sacrificed by the child or taken from the puppets could not be used in the store. The Experimenter then asked if the child would like to proceed. A child who responded "yes" had to give the Experimenter one of her own coins before identifying the puppet that should be punished.[18] The Experimenter offered a chance for the child to engage in costly sacrifice again by asking if she would like to give up another coin (i.e., "Would you like to give me another coin and I can take five coins away from one of the kings?"). This procedure repeated until the child declined to offer a coin, or until one of the banks was emptied. For the dependent measure, we recorded the number of coins sacrificed to punish each puppet.

7.3.4 General overview of the participants in Conditions 1-4

We sampled children from predominantly middle- to upper-middle class families living in metro-Atlanta, Georgia. Approximately half of participants completed the study at a university research lab; we recruited other children from small preschools less than 3 kilometers from the university campus. Table 8 provides descriptive statistics of the participants in Conditions 1-4.

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[18] The word "punishment" was not used to explain this task to participants in an effort to avoid biasing children toward participating.

Table 8. Descriptive statistics of participants in Conditions 1-4

	Males (N)	Females (N)	Mean Age ± SD (in months)
Condition 1 (First Person Triadic Sharing with Stingy and Generous Puppets), N = 66			
3-YEAR-OLDS (N=33)	18	15	42.95±4.89
5-YEAR-OLDS (N=33)	18	15	64.15±4.90
Condition 2 (First Person Triadic Sharing with Identical Generous Puppets), N = 24			
3-YEAR-OLDS (N=12)	4	8	44.25±6.03
5-YEAR-OLDS (N=12)	4	8	65.89±7.68
Condition 3 (First Person Triadic Sharing with Identical Stingy Puppets), N = 24			
3-YEAR-OLDS (N=12)	7	5	45.00±4.35
5-YEAR-OLDS (N=12)	5	7	60.92±5.90
Condition 4 (First Person Triadic Sharing with Non-Agentive Puppets), N = 18[b]			
5-YEAR-OLDS (N=18)	9	9	64.17±3.62

Note: For 3-year-olds in all conditions, participants ranged between 34-50 months and 5-year-olds ranged between 58-70 months. [a] Condition 1: two participants were omitted on the basis that they did not complete the study, yielding an attrition rate of 6%. [b] To control for the possibility that inequity aversion was driving the selective costly punishment results amongst older children, Condition 4 sampled only 5-year-olds.

7.4. Condition 1: First person triadic sharing and costly sacrifice with stingy and generous puppets

7.4.1 Method for Condition 1

Children participated in the multi-round, triadic sharing game and costly punishment task described in detail §7.3. Children interacted with puppets that were

either stingy or generous in their distribution of coins. At the conclusion of the sharing game, children could sacrifice their own coins to punish the puppet(s) of their choosing.

7.4.2 Hypotheses for Condition 1

The issue under investigation in Condition 1 was three-fold. First, we questioned whether witnessing puppets model stingy and generous behavior would influence children to share more or less equitably. Second, we asked whether children engage in costly sacrifice, and if so, whether it would be oriented toward the stingy protagonist who had violated fairness norms. Finally, we proposed to understand the origins of strong reciprocity by examining potential differences in its expression between three and five years of age.

Sensitivity to the 'moral valance' of sharing acts is expressed by age four, when children distribute resources differentially between puppets who have either helped or hindered a third party in achieving a goal (Kenward & Dahl, 2011). At four years, but not prior, children favor the helpful puppet by giving it significantly more than the hindering puppet. Coupled with the wide literature documenting the emergence of egalitarian sharing starting at five years (Fraser et al., 2007; Murninghan & Saxon, 1998; Rochat et al., 2009), we hypothesized that three- and five-year-olds would differ in their distribution of the coins, particularly with regard to the stingy and generous puppets. We reasoned that if inequity aversion guides children's sharing, children should split resources equally between themselves and both puppets. If, however, strong reciprocity guides children's sharing, we expect that children should give more coins to the generous rather than the stingy puppet that has violated an expectation of fairness.

With regard to our more explicit measure of strong reciprocity, we predicted that five-year-olds would engage in costly sacrifice to punish the stingy protagonist when offered the opportunity. Such selective, oriented punishment would hint at something (what we call an ethical stance) that is more than mere inequity aversion or direct reciprocity (i.e., replicating the previous acts of a sharing partner).

7.4.3 Results of Condition 1

Triadic Sharing Game: We analyzed the number of coins (out of 9) distributed to each player as the dependent measure in a 4 (round) x 3 (recipient) x 2 (age) x 2 (gender) mixed-design ANOVA. Neither gender ($F_{1,61} = .628$) nor children's performance on the three-way pre-test, included here as a covariate ($F_{1,61} = .446$), were found to be significant factors.

Results yielded a significant three-way interaction of round, recipient, and age, $F_{6,59} = 3.73$, $p < .01$, $\eta^2 = .531$. In a follow-up test assessing children's degree of self-maximizing and considering only what children gave to themselves, we observed a main effect of round, $F_{3,62} = 7.57$, $p < .01$, $\eta^2 = .544$. On average, both three- and five-year-olds gave more coins to themselves over the course of the game, from Round 1 (M±SD = 3.97 ± 2.11) to Round 4 (M±SD = 4.91 ± 2.26). Children were therefore equally self-maximizing at both ages.

With regard to their treatment of the two puppets, we found no significant trends for three-year-olds to favor one puppet over the other over the four rounds of sharing. These younger children did not differentiate significantly between the stingy (M±SD = 2.24 ± 1.50) and generous (M±SD = 2.20 ± 1.58) puppets at any point in the game (Fig.

8, left panel). In contrast, five-year-olds increasingly favored the generous puppet over time as indicated by a significant interaction of round and recipient ($F_{3,20} = 5.65$, $p < .01$, $\eta^2 = .361$). The mean difference in the number of coins distributed to the generous and stingy puppet was significant in Round 2 (MD±SE = .635 ± .260), Round 3 (MD±SE = .458 ± .254), and Round 4 (MD±SE = .667 ± .278), all $p < .01$ based on Bonferroni-adjusted pairwise comparisons. The disparity between puppets (particularly in Rounds 2-4, see Fig. 8, right panel) is likely a consequence of the child giving more to herself at the expense of the stingy puppet, rather than the child sacrificing her own coins to compensate the generous puppet.

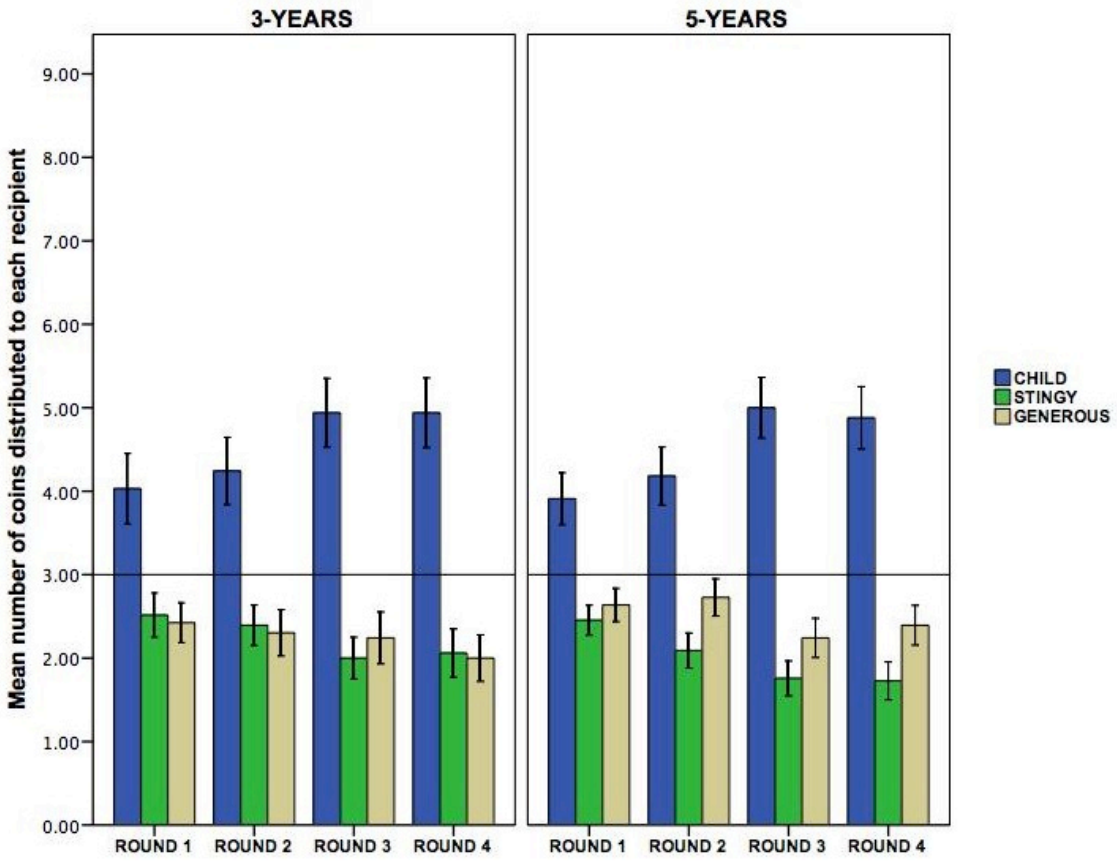

Figure 8. Children's distributions of the nine coins as a function of recipient (self, generous, stingy puppet), round (4), and age (3 and 5 years). Bars represent ±1 SEM. Note that by round 2, five year olds significantly discriminate between the two puppets by sharing preferentially with the generous puppet.

An alternative account of our findings might posit that the differing allocations by the child to the two protagonists could rest on direct reciprocity (e.g., copying identically the actions of the stingy or generous puppet). A second alternative is that children might focus exclusively on the total unequal accumulation of coins in the banks that were transparent, hence public. Because the generous puppet always received the least amount of coins prior to the child's turn, the number of coins in this bank was typically less than that of the other two protagonists. It is therefore possible that children gave more coins

to the generous puppet in order to rectify this perceptual inequity, rather than as a means of expressing approval or spite for the puppet's generous vs. stingy actions.

To test these two alternative accounts, we identified 13 potential ways for children to distribute coins during the triadic share. To probe the direct reciprocity account, we analyzed the extent to which children imitated the stingy and generous puppet in a strict "tit-for-tat" manner (i.e., giving to each of puppet the exact number of coins that the child's received from each) during any of four rounds of triadic sharing. We found that such emulation of either puppet was evident only for a small minority of children (22% of three year-olds and only 5% of five year-olds, no age difference based on chi-square calculations, p =.143). We therefore conclude that direct reciprocity account does not explain our results.

With regard to the second alternative account, we reasoned that if children share based on a perceived perceptual inequity, then the most common distribution strategies should be those in which children systematically favor the generous puppet (over the stingy puppet *and* the self) to level the number of coins in the three banks. Analysis reveals that generous-oriented sharing was uncommon, with 13% three-year-olds and only 8% of five-year -olds sharing this way. The perceptual inequity account does not seem to hold.

Costly Sacrifice Task: The inclination to engage in punishment did not differ between age groups: 76% of three-year-olds (N=25) and 91% of five-year-olds (N=30) opted to punish at least once. Because the puppets differed with regard to their stingy or generous acts, we hypothesized that fair-minded children should be less inclined to punish both puppets equally often. A two-tailed Fisher's exact test compared the

percentage of children in each age group who punished in successive attempts both puppets. Sixty-four-percent of three-year-olds did so, compared to only 17% of five-year-olds, $p < .01$.

To further investigate the selective orientation of children's costly sacrifice we used a linear regression model with the child's age (in months) to predict (out of all coins sacrificed) the percentage of coins given up to punish the stingy puppet. We observed a significant, moderate association ($R^2_{1,55} = .320$, $p < .01$) between age and punishment orientation. These data suggest that when children sacrifice coins, they are increasingly selective in orienting their punishment toward the stingy puppet, a tendency that grows stronger with age. By 60 months, fewer children punish both puppets and no children punish the generous puppet exclusively (Fig. 9, left panel). Collectively, the results of the costly sacrifice task indicate that unlike three-year-olds, five-year-olds selectively orient punishment toward the stingy character.

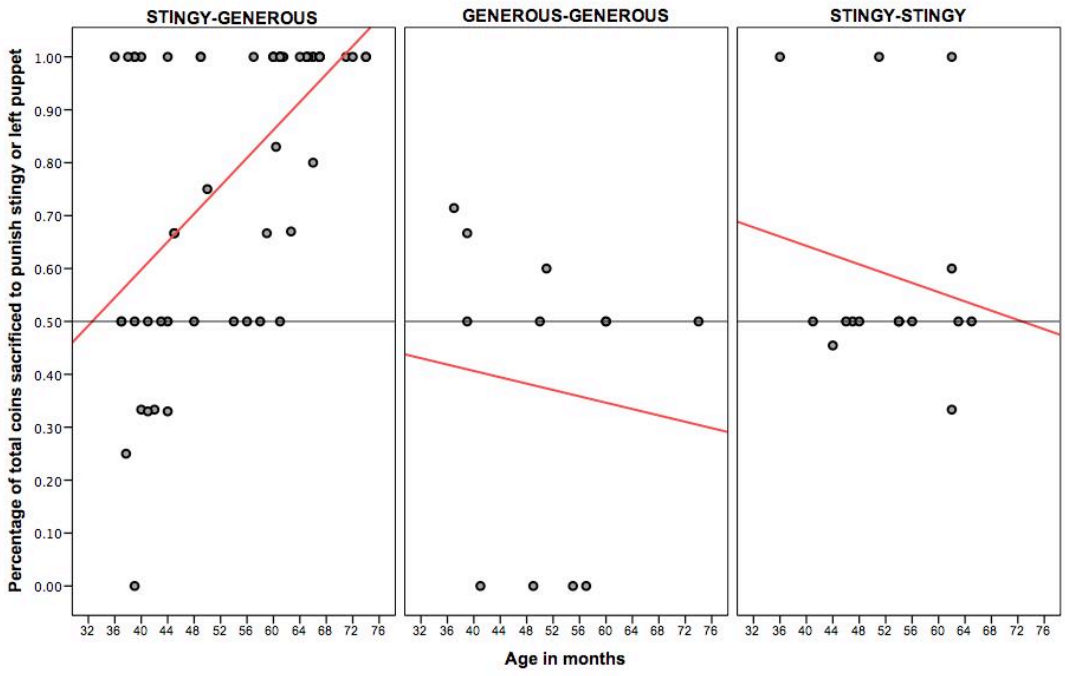

Fig. 9. Children's costly sacrifice as a function of age (in months). Vertical axis represents the percentage of coins given to selectively punish the stingy puppet in Condition 1 (first person triadic sharing with generous and stingy puppets, left panel). Center and right panels represent the costly sacrifice results of Condition 2 (Generous Control) and Condition 3 (Stingy Control).

In a final analysis we assessed whether children engaged in costly sacrifice not to punish proper, but rather to re-establish an equal distribution among the players. We calculated an index of inequity by computing for each participant the proportion of coins in each bank at the end of the four round distributions (total accumulated coins in stingy's bank/(total accumulation of coins in child's bank + total accumulated coins in generous's bank). This index of inequity could vary between a minimum value of 0.68 and a maximum value of 2.86, with greater values indicating greater levels of inequity benefiting the stingy puppet (i.e., maximum possible accumulation for the stingy puppet, which was 80 coins). If children punish to restore equity, this index of inequity should

positively correlate with the child's inclination to engage in costly sacrifice and more specifically, positively correlate with the propensity to punish the doll with the most coins (i.e., the stingy puppet). Associations between our index of inequity and whether or not the child opted toward costly punishment yielded non-significant results at both age groups, respectively rs_{31} =-.15 for three-year-olds and rs_{31} =-.25 for five-year-olds. Tests of the association between the index of inequity and the proportion of all coins sacrificed to punish the stingy puppet also yielded non-significant results at both age groups, respectively r_{31} =.018 for three-year-olds and r_{31} =.287 for five-year-olds. From these results, we conclude that children do not engage in costly sacrifice to re-establish equity amongst players. The purpose of selective costly sacrifice seems more punitive in nature.

7.4.4 Summary of Condition 1

In summary, by five years (but not before) children demonstrate signs of strong reciprocity by favoring a generous partner over a stingy partner in a multi-round triadic sharing game, and by engaging in costly sacrifice that selectively punishes the stingy protagonist. These effects remain even after accounting for alternative explanations, including percpetually-based inequity aversion or tit-for-tat direct reciprocity.

To assert that children are indeed more or less sensitive to the stingy or generous character of the puppets, we performed three control experiments that are presented next. Specifically, we repeated the triadic share and costly punishment task with three new cohorts of children sharing in turn with either a) two identical generous puppets (Condition 2), b) two identical stingy puppets (Condition 3), or c) puppets that were non-agentive in the splitting of coins (Condition 4).

7.5 Condition 2: First person triadic sharing and costly sacrifice with identical generous puppets (Generous Control)

7.5.1 Method for Condition 2

To determine whether children are sensitive to the generous character of the puppet, we this control condition sampled 24 children (12 three-year-olds and 12 five-year-olds, see Table 8). Children in the Generous Control played the Triadic Sharing game and Costly Sacrifice task described previously but with two identically generous puppets.

7.5.2 Hypotheses for Condition 2

In developmental studies of third party sharing that remove self-interest as a motivation to be egalitarian, results routinely suggest that children engage in equitable distribution of resources as early as three years (Rochat et al., 2009). However the description provided about these third parties can greatly influence sharing. Children split resources more equitably between dolls described as friends than between dolls described as strangers (Olson & Spelke, 2008). By five years children engage in proportional equity in third party contexts, distributing more resources to the party described as more needy (Fraser et al., 2007).

Evidence also suggests that as early as four years, children engage in third party punishment. Children listened to a story depicting an unprovoked attack on a victim, after which an authority figure punished either the perpetrator or the victim. When asked

to retell the story and decide how it should end, four-year-olds opted to punish the perpetrator who had transgressed a moral rule, regardless of the outcome that had been modeled by the authority figure (Kenward & Östh, 2012). This suggests that by four years (and not prior) the desire to sanction unfair others overrides the tendency to conform to established patterns of behavior.

With regard to the Generous Control condition, we hypothesized that at five years, children would demonstrate signs of strong reciprocity in the triadic sharing game by *decreasing* their self-maximization of the coins relative to three-year-olds who we assumed would persist in their self-maximization regardless of the generosity shown by both puppets. In relation to costly sacrifice, because both puppets act with marked generosity (hence negating any need to adopt a principled, 'ethical stance') we anticipated a lesser level of selective punishment relative to Condition 1. Furthermore, any such punishment should not be oriented toward one puppet over the other.

7.5.3 Results of Condition 2

Data were analyzed using the same 4 (round) x 3 (recipient) x 2 (age) x 2 (gender) mixed-design ANOVA described previously. Because children distributed coins between themselves and identical generous protagonists, the potential recipients for this study included the child, the left-side puppet, and the right-side puppet. Gender and children's performance on the three-way pre-test (included as a covariate) were both non-significant, $F_{1,19}$ = .479 and .373, respectively.

Analysis yielded a significant interaction of recipient and age, $F_{2,18}$ = 4.83, p = .021, η^2 = .349, such that three-year-olds gave more coins to themselves (M±SD = 4.17 ±

2.02) than did five-year-olds (M±SD = 2.27 ± 1.27), $F_{1,19} = 5.24$, $p = .034$, $\eta^2 = .216$. Three-year-olds also tended to give more coins to themselves than to either the left (M±SD = 2.18 ± 1.97) or right (M±SD = 2.76 ± 1.67) puppets, both $p < .05$ based on Bonferroni adjusted pair-wise comparisons. Five-year-olds shared with almost absolute equity, giving roughly the same of coins to the left (M±SD = 3.40 ± 1.79) and right puppet (M±SD = 3.34 ± 1.56) and slightly less to themselves (M±SD = 2.27 ± 1.28). Neither three- nor five-year-olds exhibited signs of a side bias by preferentially giving significantly more coins to the right versus the left-side puppet (see Fig. 10, left and right panels, respectively).

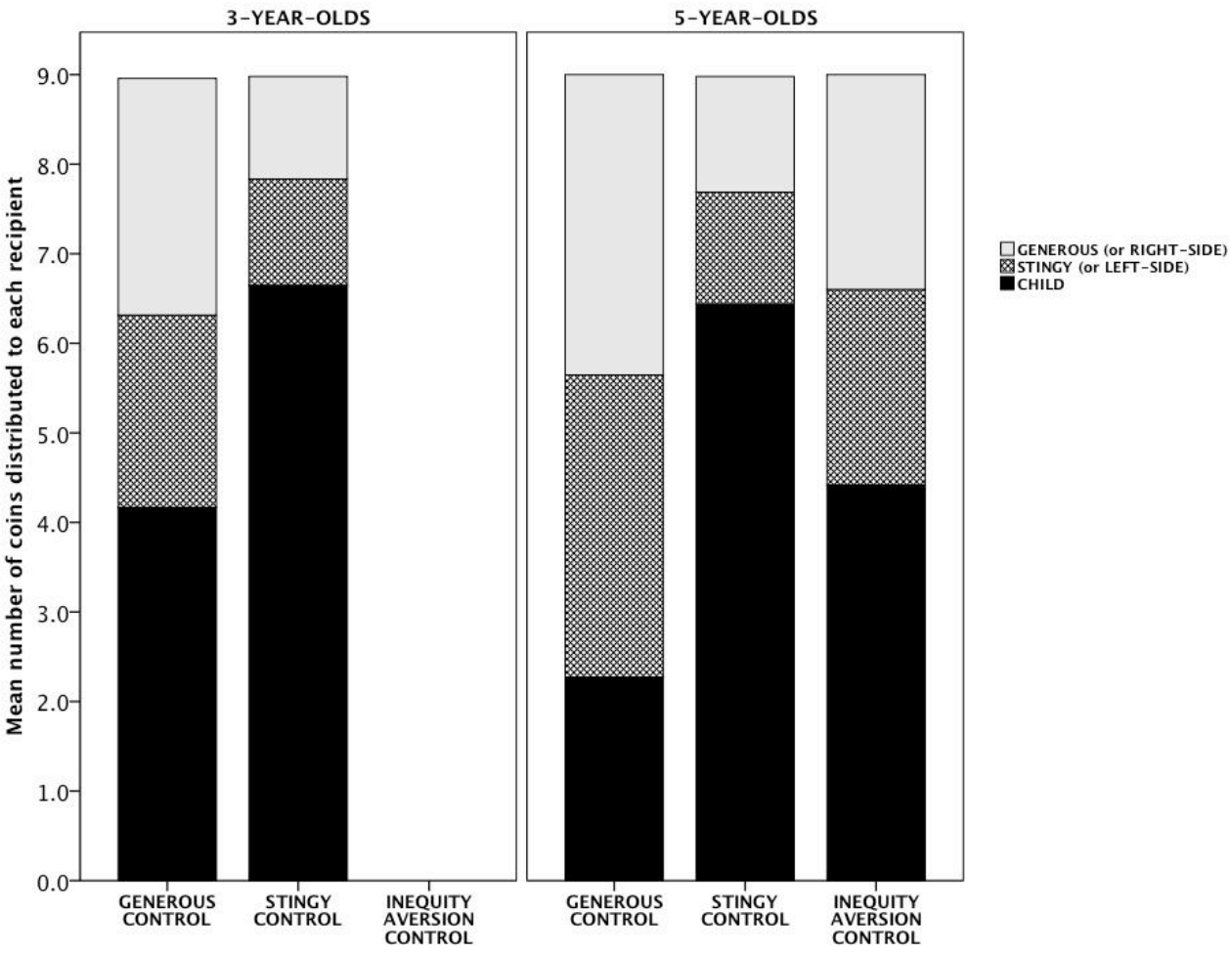

Figure 10: Mean number of coins distributed to each protagonist as a function of age in Condition 2 (Generous Control), Condition 3 (Stingy Control), and Condition 4 (Inequity Aversion Control). Note that only five-year-olds were tested in Condition 4.

Note that despite these developmental differences, three- and five-year-olds in this condition were, on average, less self-maximizing than their counterparts in Condition 1. We computed a "self-maximizing" score by averaging the number of coins given to the child across the four sharing rounds and used this score as the dependent measure in an independent samples t-test to compare self-maximizing across the two studies.

Overall, children in the Generous Control condition of gave significantly fewer coins (M±SD = 3.21 ± 1.92) to themselves than did children in Condition 1, where participants shared with both stingy and generous dolls (M±SD = 4.53 ± 1.86), $t_{88} = 2.95$, $p < .01$ (one-tail).

With regard to costly sacrifice, in the absence of any overtly unfair sharing on the part of the two generous puppets, we did not expect children to engage in costly punishment at either age. Owing to the identical character of the puppets, if costly sacrifice occurred, we anticipated that the orientation toward the right or left puppet would be at chance. A series of Fisher's exact tests supported these predictions. Approximately half of three- (58%, N=7) and five-year-olds (42%, N= 5) engaged in costly punishment, significantly less frequently than did children in Condition 1 (Fisher's exact test: $p < .01$, one-tail). Furthermore, when children punished it was not oriented toward one puppet. Seventy-one percent of three-year-olds and sixy-percent of five-year-olds punished both puppets. Linear regression demonstrated that the association between children's age (in months) and the percentage of coins (out of all coins sacrificed) given to punish the left puppet was non-significant, $R^2_{1,10} = .02$ (Fig. 9, center panel). That five-year-olds show no signs of selective costly sacrifice contrasts sharply with the findings reported in Condition 1. We speculate that when children punish in this Generous Control, they do so to prolong the playful exchange with the experimenter.

In summary, three-year-old children persist in their maximization of personal gains even when sharing with identically generous puppets. Their sharing in this control condition was akin to the self-maximizing observed in three-year-olds in Condition 1. In confirmation of our hypotheses, five-year-olds showed signs of reciprocity by aligning

themselves with the generous puppets in acts of generosity and self-maximizing significantly *less* compared to Condition 1. For a further control, we replicated this experimental design using identical stingy dolls instead.

7.5.4 Summary of Condition 2

The results of Condition 2 (Generous Control) confirm that between three and five years, children become more sensitive to the 'moral valance' (Kenward & Dahl, 2011) of their sharing partners. This sensitivity does not translate to conformity: children split equitably between generous identical dolls but still kept some portion of the coins for themselves (i.e., more than the one coin kept by the generous protagonist). Furthermore, in the absence of any overt violations of fairness norms on the part of the identically generous dolls, children were not motivated to selectively orient their punishment (if costly sacrificed happened at all).

7.6 Condition 3: First person triadic sharing and costly sacrifice with identical stingy puppets (Stingy Control)

7.6.1 Method for Condition 3

To determine whether children are sensitive to the stingy character of the puppets, we ran another control conditions sampling 24 children (12 three-year-olds and 12 five-year-olds, see Table 8). Children in the Stingy Control played the Triadic Sharing game and Costly Sacrifice task described previously but with two identically stingy puppets.

7.6.2 Hypotheses for Condition 3

Following the rationale detailed in §7.5, in the Stingy Control condition we expected that if five-year-olds engage in strong reciprocity during the triadic sharing game, then they should *increase* their tendency to self-maximize above and beyond the levels noted Condition 1, as doing so would penalize the puppets. Consequently, five-year-olds in this study would more closely resemble the sharing behavior of three-year-olds. For the costly sacrifice task we hypothesized that children at both ages would show no signs of selective punishment owing to their identical nature.

7.6.3 Results of Condition 3

Triadic share data were analyzed using a 4 (round) x 3 (recipient) x 2 (age) x 2 (gender) mixed-design ANOVA. Gender and performance on the three-way pre-test (included as a covariate) were non-significant, $F_{1,18} = 2.82$ and .565, respectively.

A main effect of recipient ($F_{2,17} = 55.8$, $p < .01$, $\eta^2 = .112$) demonstrates that three- and five-year-olds similarly distributed coins amongst the three protagonists (Fig. 10, left and right panels, respectively). At both ages children maximized their gains, giving themselves on average roughly 72% of the nine coins. Children gave significantly more coins to themselves than to either the left (MD±SE = 5.45 ± .402) or right (MD±SE = 5.42 ± .452) puppet, both $p < .01$ based on Bonferroni-adjusted pairwise comparisons. Neither three- nor five-year-olds exhibited signs of a side bias by preferentially giving significantly more coins to the right versus the left-side puppet.

As predicted, children's degree of self-maximizing in this Stingy Control condition was elevated even above levels noted in Condition 1. We used the self-

maximization score described previously as the dependent measure in an independent samples t-test. Independent of age, children give significantly more coins to themselves (M±SD = 6.52 ± 1.33) when in the presence of identically stingy puppets than in situations in which they distribute resources with a stingy and a generous puppet, as in Condition 1 (M±SD = 4.53 ± 1.86), $t_{88} = 4.83$, $p < .01$ (one-tail).

With regard to costly sacrifice and consistent with the Generous Control condition, in this Stingy Control both three- and five-year-olds were at chance in their inclination to engage in costly sacrifice. Overall, children in this control condition were significantly less likely to punish than were children in Condition 1, Fisher's exact test: $p < .01$ (one-tail). Furthermore, children who punished were non-selective in their orientation of punishment: 67% of three-year-olds and 83% of five-year-olds punished both puppets equally often. A linear regression model testing the relationship between children's age (in months) and the percentage (out of total sacrificed coins) sacrificed to punish the left puppet yielded a non-significant association, $R^2_{1,15} = .05$ (see Fig. 9, right panel).

In all, results confirm our hypotheses. Three- and five-year-olds both demonstrate strong self-maximizing tendencies when when sharing with two stingy characters. As in the Generous Control (but in contrast to Condition 1) five-year-olds did not orient costly sacrifice to punish exclusively one puppet.

7.6.4 Summary of Condition 3

The Stingy Control condition confirms that between three and five years, children become more sensitive to the 'moral valance' (Kenward & Dahl, 2011) of their sharing

partners. Five year olds showed signs of strong reciprocity by *increasing* their levels of self-maximization in response to the selfish actions of their identical sharing partners. The identically stingy puppets established a convention of selfish sharing; therefore, in the absence of any overt violations of fairness norms on the part of the dolls, children were not motivated to selectively orient their punishment.

To further assess whether children factor the relatively stingy or generous character of the puppets into their distributive decisions, a final control replicated the basic triadic-sharing game and costly sacrifice task using non-agentive (passive) puppets. Because the previous studies demonstrated signs of strong reciprocity in five-year-olds, we chose to sample only children in this age group for our final control. We reasoned that if five-year-olds only considering the outcome of the sharing (i.e., the unequal coin distribution independent of the agentive character of the puppet), we should replicate the findings of Condition 1. If not, the strong reciprocity interpretation would be further substantiated.

7.7 Condition 4: First person triadic sharing and costly sacrifice with non-agentive puppets (Inequity Aversion Control)

7.7.1 Method for Condition 4

In this final control study, we assessed the possibility that children respond more to the outcome of sharing acts rather than the intentions underlying them (as predicted by a strong reciprocity account). In the context of the current study, children may have been motivated to share differentially and engage in costly sacrifice not because they were

concerned with the character and agency of the puppets, but rather because of the unequal number of coins accrued in the banks at the end of the triadic sharing game.

Condition 4 children playing the same triadic sharing game described previously were presented with a pre-established distributions of coins. Children never witnessed the puppets sharing either stingily or generously; instead, the puppets sat inanimate in front of the child. The experimenter displayed three groups of coins on a tray, one for each of the three protagonists. The coins were presented in the same ratios described in Condition 1. Thus, in one turn the "stingy" puppet received four coins while the child and "generous" puppet received only one apiece, and in another turn the "generous" puppet received one coin while the child and "stingy" puppet each received four coins. As in the previous studies, we counterbalanced the location of the two puppets relative to the child as well as the order in which the stingy and generous distributions were presented. When it was the child's turn to share, children actively distributed as in the other studies. At the conclusion of the triadic sharing game children were given an opportunity to participate in the same costly sacrifice task described previously. Finally, because selective costly sacrifice oriented toward the stingy protagonist was observed only in five-year-old children, we limited our sample to this age group for this final control (see Table 8).

7.7.2 Hypothesis for Condition 4

Following the rationale of this control (see above) and based on the strong reciprocity hypothesis demonstrated in five-year-olds (Condition 1), we expected significantly less signs of oriented costly sacrifice in this non-agentive, passive puppet condition in which there was no clear agency or intent on the part of the puppets.

7.7.3 Results of Condition 4

Once again, triadic share data were analyzed using a 4 (round) x 3 (recipient) mixed-design ANOVA. On the basis of our earlier findings, gender and the pre-test were omitted as factors in analysis. Results yielded a main effect of recipient, $F(2,14) = 5.566$, $p = .017$, $\eta^2 = .263$. On average children gave significantly more coins to themselves ($M = 4.521$, $SD = .484$) than to either the "stingy" ($M = 2.118$, $SD = .313$) or "generous" puppets ($M = 2.361$, $SD = .264$), both $p < .05$ based on Bonferroni-adjusted pairwise comparisons. Unlike the five year olds of Condition 1, same-age children in this control were less self-maximizing and did not discriminate between the two non-agentive puppets (Fig. 10, right panel).

With regard to the costly sacrifice task, significantly more children (N = 14, or 78%) opted to punish than not (binomial test: $p = .015$, one-tail). This proportion of punishers did not differ statistically from the 91% of five-year-olds who opted to punish in Condition 1 (Fisher's exact test: $p > .05$). The selectivity of punishment differed between these two studies. In this control non-agentive control, half of five year olds (N=7) punished both puppets. However, when exclusive punishment of one puppet did occur in the non-agentive control it was oriented toward the stingy protagonist. Of the children who engaged in costly sacrifice, 86% of children (N=6) in this control present control oriented this punishment toward the stingy puppet.

In contrast, recall that our sample of five-year olds in Condition 1 were more selective: 17% of children punished both puppets, whereas the majority (83%) opted to punish only one puppet exclusively, (binomial test: $p < .05$). In short and per our

hypotheses, in this non-agentive control five year olds were at chance levels in punishing puppets selectively, a finding that contrasts sharply the oriented costly sacrifice of same-age children in Condition 1 (with agentive generous and stingy puppets). However, when children opted to punish only one puppet, in both studies the majority of children punished the stingy protagonist, perhaps as a means of restoring equity between players who were not depicted as intentionally sharing with generosity or stinginess.

7.7.4 Summary of Condition 4

The results of Condition 4 substantiate the claim that children's selective costly punishment is motivated by the agentive character of the puppets. Children were more inclined to share equitably with the two passive puppets (compared to same-age children's sharing in Condition 1). When costly punishment occurred it was not oriented toward one puppet. We interpret these findings to mean that the perception of mere inequity is not enough to account for oriented punishment, what we take as a sign of strong reciprocity.

7.8 Synopsis and Synthesis of Conditions 1-4

Collectively, the findings reported in Conditions 1-4 confirm our hypothesis, that what we construe as strong reciprocity emerges by five years in human ontogeny, and not prior. Although three-year-olds modulate their tendency toward self-maximizing depending on the relative generosity or stinginess of sharing partners, this early sensitivity is not yet principled, as evidenced by their non-selective punishment in the costly sacrifice task.

The results of the triadic sharing in Condition 1 (with generous and stingy puppets) shows that although children in both age groups express self-maximizing tendencies, only five-year-olds demonstrate evidence discriminate between the puppets, opting to give more coins to the generous puppet and reducing payoffs to the stingy puppet over the four rounds of sharing. In the two follow-up control conditions, five-year-olds (but not three-year-olds) decreased their self-maximizing behavior when sharing with identical generous puppets (Condition 2, Generous Control) and increasing this self-maximization when interacting with identical stingy puppets (Condition 3, Stingy Control). When sharing with non-agentive characters (Condition 4), five-year-olds self-maximized their payoffs (though to a lesser extent than Condition 1) and did not discriminate significantly between the "stingy" and "generous" protagonists who were passive actors and recipients in the game.

The results of Condition 1 provide additional support for a strong reciprocity hypothesis. With regard to costly sacrifice, although children in both age groups engage in punishment, only five-year-olds show signs of strong reciprocity by orienting this costly sacrifice toward the stingy protagonist. Three-year-old children did not align punishment with either character. At this age, punishment was indiscriminant, potentially reflecting a desire to continue the inertia of the game rather than conveying approval or disapproval for the puppets' actions. Furthermore, we observed selective punishment only in situations in which children interacted with both a stingy and generous puppet who were depicted as agentive (and by implication, sharing with intent to be relatively fair or unfair). In situations where puppets were either identically generous (Condition 2, Generous Control) or identically stingy (Condition 3, Stingy Control), children in both

age groups punished at chance levels and without orientation a particular protagonist. In a third control sampling only five-year-olds (Condition 4), when the puppets were non-agentive and the distribution pre-established, punishment was not exclusively oriented toward one of the two puppets, whether "stingy" or "generous."

Furthermore, analysis demonstrates that simple reciprocity or a simple aversion to inequity cannot account for these findings. Children do not conform exactly to the behavior of the puppets in what would amount to direct (tit-for-tat) reciprocity. Similarly, by five years, the inclination to engage in costly sacrifice (as well as the orientation of the ensuing punishment) cannot be predicted by the unequal accumulation of coins at the end of the triadic share. If some sensitivity to inequity is necessary for the expression strong reciprocity, is not sufficient. In the expression of strong reciprocity as construed here, individuals not only detect inequity but also tend to act principally upon it by either punishing or rewarding (in the triadic sharing game), even if doing so comes at a personal material loss (costly sacrifice task). By doing so, five year olds demonstrate a sensitivity to the norms that govern exchange relationships (i.e., the expectation of fairness). This propensity to sanction unfair others, even at a personal cost, captures first signs of an ethical, morally principled stance emerging by five years of age and not earlier.

Questions remain as to what factors contribute to such development. In these first four conditions children participated in first party sharing. Such an investigation does not make it possible for us to disentangle precisely any intent to act principality (e.g., to restore equity/justice) from more spiteful desires to enact revenge toward others who have created disadvantageous inequity for the child.

At the same time, our methodology in Conditions 1-4 did not allow for a positive sense of restorative justice (e.g., compensating wronged parties even at a personal cost; Tomasello & Vaish, 2012). It is possible that children—particularly around seven years when first signs of proportional equity oriented toward rewarding individuals who have demonstrated greater need or effort than their sharing partners—would be motivated by a desire to give resources to a protagonist who has been treated unfairly.

These possibilities motivate the research presented in the second half of this chapter. In Condition 5 we present results from a third party costly sacrifice task in which children witnessed the triadic sharing of a selfish, egalitarian, and generous puppet. In a between-subjects design, children (three to seven years) were then given the opportunity to engage in costly sacrifice to either punish or reward the puppet(s) of their choosing.

7.9 Third party costly sacrifice in three- to seven-year-olds

Tomasello and Vaish (2012) distinguish between two levels of moral reasoning. Second-order morality includes personal expressions of sympathy or fairness toward others; it would encompass the kinds of principled behaviors noted in Conditions 1-4. First-order morality, however, entails a more universal perspective in which individuals adhere to (and enforce) cultural norms. Third party costly sacrifice, what we describe in more detail below, would be within the purview of first-order morality.

7.9.1 The emergence of normativity

Social norms are mutual expectations that derive from group consensus regarding the ways that individuals *ought* to behave in certain contexts (Tomasello & Vaish, 2012). This is conceptually distinct from conventionality, which describes how things are usually done; conventionality does not entail any *imperatives* regarding behavior. Also in contrast to conventionality, norms are universal and objective standards by which actions can be assessed. As such, all persons (including the self) are held equally accountable to these expectations.

Sensitivity to conventional norms emerges during the preschool years. Around two years toddlers negatively describe situations and agents who have violated normative standards as bad, dirty, or mean (Kagan, 1981). Such terminology highlights the fact that these acts are "not normal," i.e., not conventional. By three years, children verbally protest such transgressions, though this is more typical in third-party contexts in which children are not directly or personally impacted by norm violations.

Protestations of norm violations cannot be reduced to the child's personal opinion or desires. For example, in one study children collaborated with two puppets to create a drawing. One puppet exited the room, at which point the second puppet destroyed their mutual creation. Three-year-olds often appealed to conventional normative standards (e.g., "You can't do that!") when protesting the destruction (Vaish et al., 2011). Tomasello and Vaish (2012) argue that such language is characteristic of neither moral imperatives (e.g, "That's wrong!") or individual desires ("I don't want you to do that;" see Searle, 2001). Consistent with the parochialism demonstrated in third party sharing (Olson & Spelke, 2008), three-year-olds also recognize the conventional norms

surrounding social relationships. Protests are more frequent when in-group members violate a conventional norm relative to an out-group member. The same is not true for moral norms (Schmidt et al., 2011). Perhaps most relevant to the current investigation, three-year-olds also protest norm violations when they occur in the context of material exchange, such as theft of personal possessions (Rossano et al., 2011) or failure to adhere to the rules governing transfer of ownership (e.g., theft; Smetana, 1981; Vaish et al., 2010).

These propensities, though revealing of the ontogenetic origins of morality, do not yet demonstrate what constitutes a more robust 'ethical stance' toward others (Rochat, 2012). Recognition and enforcement of moral norms would be within the purview of a strong reciprocity account, which posits that individuals act with kindness or unkindness toward others who have been more or less fair, even when doing incurs a personal cost (Fehr & Fischbacher, 2005; Gintis et al., 2005). More specifically, such strong reciprocity must occur in the context of third party exchanges in which praise or rebuke does cannot be reduced to personal motives (as may be the case in first party exchanges when children can personally benefit from sanctioning an unfair partner).

7.9.2 Two ways to restore justice: punishment versus reward

Restorative justice refers broadly to acts that restore equity between partners who have a disparate amount of material wealth.[19] In the context of exchange relationships, the term "justice" is often used interchangeably with "equitably." Strong reciprocity

[19] The term is also commonly used in the context of rights, i.e., equal opportunity or impartiality before the law.

allows for the restoration of justice through either means that are either positive (e.g., compensating a victim) or negative (e.g., punishing a transgressor) in scope.

At the level of individual psychology, we might question whether these two senses of justice have equivalency of meaning, and when sensitivity to any potential distinctions emerges in development.

It is not unreasonable to assume that children transition from more punitive restoration of justice to restoration that is compensatory, beneficial, or rewarding. Between three to five years, children begin to show signs of equitable sharing, acting with strict egalitarianism toward those who have been more helpful versus hindering (Kenward & Dahl, 2011), more collaborative versus individualistic (Ng et al., 2011) more cooperative versus obstructive (Warneken & Tomasello, 2011) and more generous than selfish (at least in an absolute sense; McCrink & Bloom, 2009).

By seven years this social evaluation of others takes on a markedly different meaning in the context of first and third party sharing. At this age children begin to show signs of proportional equity, adjusting the amount of resources distributed to sharing partners as a function of their relatively greater need (Hull & Reuter, 1979; McGillicuddy-de Lisi et al., 2004; Zinser et al., 1999) or greater effort (Anderson & Butzin, 1978; Leventhal et al., 1973) or effort (Fraser et al., 2007; Lerner, 1974). The rationales provided by children at this age take on a more positive sense of justice (e.g., "I wanted to make it fair," or "I wanted to make her happy") rather than admonishment (e.g., "I wanted to teach the other guy a lesson"). Although in general these games point to a shift in meaning between two forms of justice (punitive versus compensatory), the

use of third party sharing in particular confers the benefit of divorcing personal motives (e.g., revenge) from behaviors driven primarily by an observation of moral norms.

Thus, one developmental trajectory that we might predict is that children evolve from more retaliatory acts of sharing to more compensatory ones. Extending this logic to strong reciprocity, we would therefore hypothesize that between three to seven years children move from costly sacrifice intended to punish a transgressor of moral norms to costly sacrifice intended to reward others who have adhered to the same moral norms (or who have been victimized by the transgression). The results of the Restorative Justice task reported in Study 1 (§5.4.6) would seem to confirm this prediction.

We tested these predictions in a third party sharing game modeled on the methods first described in Robbins and Rochat (2011). In brief, three to seven year olds witnessed a one-shot sharing game in which selfish, egalitarian, and generous puppets exchanged tokens. Children were not themselves beneficiaries of the exchange. At the end of the sharing game, in two different between-subjects conditions (Punishment vs. Reward) children were given an opportunity to engage in costly sacrifice oriented toward the puppet(s) of their choosing using coins from a personal endowment earned previously.

In what follows we first describe the methodology of Condition 5 before presenting the specific hypotheses drawing from the literature described here.

7.9.3 Method for Condition 5

Participants

We sampled a total of 84 children from metro-Atlanta, Georgia. The children that recruited for each age group (3, 5, and 7 years) were divided equally into two between-subjects conditions (Punishment versus Reward, both N = 42). The sample included 28 three-year-olds ranging from 36-50 months (M±SD = 42.89±4.90, 14 females), 28 five-year-olds ranging from 60-74 months (M±SD = 66.31±3.89, 14 females), and 28 seven-year-olds ranging from 82-98 months (M±SD = 89.34±4.85, 14 females). Approximately half of participants were tested at our laboratory on the Emory University campus, with the remainder tested at local preschools less than 3km from our facilities. Preliminary analyses revealed no systematic differences between these groups.

Creation of an endowment

As in the original triadic sharing study reported in Robbins & Rochat (2011) and described in detail in §7.3, children were informed that poker chips (of uniform size, shape, and color) could be used to purchase prizes at a make-shift toy store (all prizes <$1USD). To ensure that participants understood the importance of the coins, and their value in purchasing prizes, at multiple points throughout the testing session the experimenter probed children with questions about how the coins worked. The game did not progress until children answered correctly.

In the context of third party exchange, the costly nature of the sacrifice cannot derive from the child's personal accumulation of wealth during the sharing game. Instead, to ensure that any later sacrifice was indeed costly (a hallmark of what we

construe as strong reciprocity), prior to the triadic sharing game children earned an endowment of 21 coins in an arbitrary task (e.g, helping the experimenter clean a mess). This 21-coin endowment meant that in the later costly sacrifice task children could punish each protagonist up to seven times (an upper limit established in Robbins & Rochat, 2011). This number of coins also made the child's endowment equivalent to each puppets' winnings at the end of the sharing game, as discussed in more detail below. This endowment was kept in a transparent container described as the child's "bank."

Modified triadic sharing game

After earning their endowment, children witnessed a triadic sharing game between three protagonists (the same puppets described in §7.3). The three puppets who were identical in appearance were animated by the experimenter and sat at a table across from the child. The location of the puppets relative to the table (e.g., right side, center, left side) was counterbalanced across conditions.

In a one-shot interaction, these puppets split in turn nine coins (of the same variety given to the child for her endowment). An egalitarian puppet always shared first to establish a norm of equity, giving itself and the two other dolls each three coins. In a counterbalanced order the selfish and generous puppets distributed coins in successive turns. The selfish puppet acted with marked stinginess toward the other protagonists, keeping seven coins for itself and giving one coin apiece to the other puppets. In contrast the generous puppet favored the other protagonists over itself, giving the egalitarian and generous puppets each four coins and keeping one for itself. Coins were placed in

transparent containers, one for each player, that enabled easy and immediate comparison of each puppets' accumulated coins.

We limited the interaction to one round to forestall any interpretation that multiple rounds of identical sharing (as in the original triadic sharing game) was tacit approval on the part of the puppets for each other's actions.

This design also ensured that each puppet treated its partners equivalently (e.g., the egalitarian puppet giving three coins apiece to the other protagonists, the selfish puppet giving one coin apiece to the remaining protagonists, and the other puppet giving four coins apiece to the other protagonists). It also meant that generous puppet could be ranked ordered in terms of their contributions during the game: the generous puppet was indeed generous (giving more than either the egalitarian or selfish puppet, for instance) and the selfish puppet was indeed selfish (giving less than its two sharing partners).

Consequently, at the end of the triadic sharing game, the egalitarian puppet had received a total of 8 coins (three from itself, one from the selfish puppet, and four from the generous puppet); the selfish puppet had received a total of 14 coins (seven from itself, three from the egalitarian puppet, and four from the generous puppet); and the generous puppet had received a total of 5 coins (one from itself, three from the egalitarian puppet, and one from the selfish puppet). Because this unequal distribution could potentially serve as a motivation to engage in costly sacrifice (i.e., to "level out" the banks by either rewarding or punishing puppets), children were told that the puppets had previously earned coins in an unrelated task; these coins were visible in the banks at the start of the game. The differential number of coins in each puppet's bank prior to the sharing was designed to counteract the unequal accumulation of coins during triadic

exchange and to make the total winnings of each puppet at the end of the game identical to the child's endowment (21 coins). As such, the egalitarian puppet began the game with a 13 coin endowment, the selfish puppet started with a 7 coin endowment, and the generous doll started with a 16 coin endowment.

At the conclusion of the sharing game, the experimenter asked the child to compare the number of coins (which were now equivalent) in each puppet's bank. Children were asked the following questions: (1) who has the most? (2) is that fair? and (3) why or why not?

Modified costly sacrifice task

All children witnessed the triadic exchange described above. For the costly sacrifice task, in a between-subjects manipulation children were divided into one of two conditions (N=42, for both conditions, including 14 children from each of the three age groups). In the Punishment Condition, children were then informed that they could sacrifice one of their coins to take three away from a puppet (or puppets) of the child's choosing. Participants were also told that neither coins sacrificed by the child nor coins taken from the puppet(s) could be used at the store. The game did not progress until children correctly answered control prompts about this action. Following the script in Robbins & Rochat (2011) the child had to physically place the coin in the experimenter's hand before pointing to (and verbally confirming) the puppet that should be punished. Sacrificed coins were placed in a container described as "the bank" (which did not explicitly or implicitly belong to the experimenter). The experimenter then exacted three coins from this puppets bank. Children were offered additional opportunities to punish;

the game ended when the child ran out of coins or one puppet's bank was emptied, whichever came first.

The directions for the Reward Condition were identical, except that children were told that they could sacrifice one coin to give three coins to the puppet(s) of their choosing. These coins came from the non-descript bank described above and were distributed by the experimenter.

At the end of the costly sacrifice task, children in both conditions identified the protagonist they believed to be the nicest, and the puppet they would most desire to play with.

As a dependent measure we recorded the proportion of all coins sacrificed to punish or reward each protagonist (egalitarian, selfish, or generous puppet). We also recorded children's responses to the follow-up questions regarding who is the most fair, who is the nicest, and who the child would prefer to play with.

Note that the 1:3 ratio of sacrificed to taken/given coins was different than the 1:5 ratio described in Conditions 1-4. This change was made based on observations (Gintis et al., 2005; Henrich et al., 2005) that under conditions of limited resources (which would be the more case here compared to the much greater wealth of children in Conditions 1-4), individuals will not engage in costly sacrifice if the ratio is less than 20% of one's endowment.

7.9.4 Results of Condition 5

The proportion of coins sacrificed to either punish or reward each of the protagonists was analyzed in a multivariate analysis of variance (MANOVA) factoring age condition (Punishment or Reward) and age (3, 5, and 7) as independent variables.

Results yielded a significant interaction of condition and age, $F(4,108) = 8.92$, $p < .01$, $\eta = .248$. In general, children sacrificed significantly more coins to punish the selfish puppet in the Punishment Condition (M±SE = .701±.037) than they did to reward the selfish puppet in the Reward Condition (M±SE = .157±.039), $p < .01$. In contrast, children sacrificed significantly more coins to reward the egalitarian (M±SE = .449±.044) and generous (M±SE = .395±.042) puppets in the Reward Condition than they did to punish these protagonists in the Punishment Condition (M±SE = .191±.042 and .108±.040 respectively, both $p < .01$) (Fig. 11). This general tendency to punish the unfair protagonist and reward the puppets who shared with marked equity or generosity was mediated by age. Table 9 specifies the proportion of coins sacrificed to punish or reward each of the puppets as a function of age.

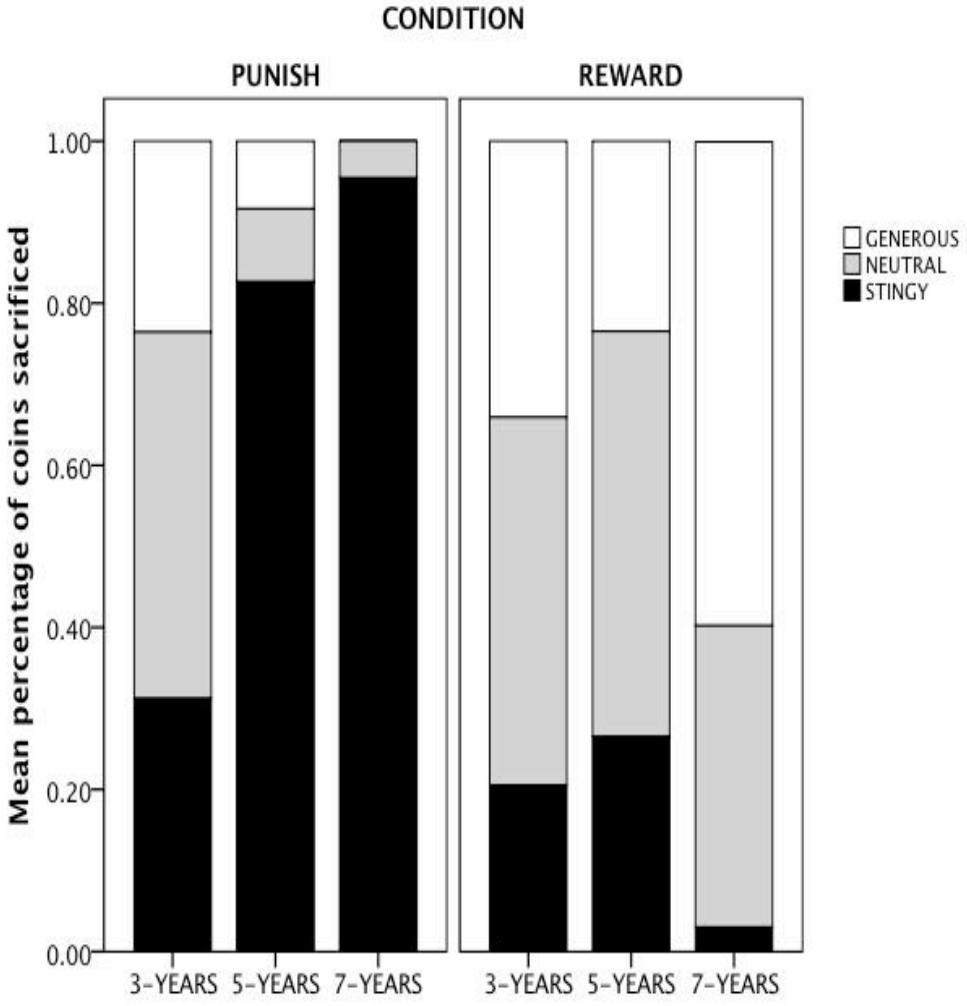

Figure 11: Mean percentage of coins sacrificed to punish the generous, neutral, or selfish puppet as a function of condition (punishment versus reward) and age (3, 5, and 7 years).

Table 9: Percentage of coins sacrificed in to Punish or Reward the Selfish, Neutral, and Generous Puppets as a function of age.

PROTAGONIST	AGE	PUNISHMENT CONDITION	REWARD CONDITION	MD±SE
% of coins	3-YEARS	.340±.069	.194±.068	n.s.
sacrificed for	5-YEARS	.825±.066	.306±.073	.519±.094 **
SELFISH	7-YEARS	.938±.067	.029±.070	.968±.096**
% of coins	3-YEARS	.397±.077	.450±.076	n.s
sacrificed for	5-YEARS	.115±.074	.511±.082	-.396±.106**
NEUTRAL	7-YEARS	.061±.075	.385±.079	-.324±.109*
% of coins	3-YEARS	.263±.073	.356±.072	n.s.
sacrificed for	5-YEARS	.060±.070	.183±.077	n.s.
GENEROUS	7-YEARS	.011±.071	.644±.074	-.643±.102**

Note: Values are M±SE. Single asterisks denote p <.05, double asterisks indicate p <.01.

The tendency to engage in costly sacrifice did not differ between conditions or age groups: three, five and seven-year-olds all tended to sacrifice coins regardless of context. However, developmental differences emerged with regard to the orientation of these costly sacrifices.

Results demonstrate with regard to the selfish puppet, three-year-olds were insensitive to condition. They did not differ in the proportion of coins sacrificed to sanction the selfish puppet in the Punishment Condition versus the proportion of coins

sacrificed to reward the selfish puppet in the Reward Condition. In contrast, both five- and seven-year olds adjusted their costly sacrificed based on condition (MD±SE = .519±.094 and .968±.096 respectively, both $p < .01$) Children in both of these age groups tended to sacrifice more coins to punish the selfish doll in the Punishment Condition than they did to reward this puppet in the Reward Condition.

With regard to the egalitarian puppet who distributed coins equally amongst all protagonists, again we observed no effect of condition amongst three-year-olds. Both five- and seven-year-olds tended to sacrifice more coins to reward the egalitarian puppet in the Reward Condition than they did to sanction in the Punishment Condition (MD±SE = .511±.082 and .385±.079 respectively, both $p < .01$).

Finally, with regard to the generous puppet, three-and five-year olds demonstrated no effect of condition, sacrificing roughly the same proportion of coins to reward the generous puppet in the Reward Condition as they did to sanction this puppet in the Punishment Condition. Seven-year-olds were more selective, opting to sacrifice a significantly greater proportion of coins to reward the generous puppet in the Reward Condition than they did to sanction this puppet in the Punishment Condition (MD±SE = .385±.079, $p < .01$).

To assess whether the magnitude of costly sacrifice in the Punishment and Reward Conditions were similar across ages, we ran another series of follow-up comparisons. With regard to the stingy puppet, sacrifices made by five-and seven-year-olds were significantly *greater* than those of three-year-olds in both the Punishment and Reward Conditions (both $p < .01$). There was no difference between the magnitude of sacrifice between five-and seven-year olds (see Table 7).

This pattern was also observed with regard to the egalitarian puppet. Again, in the Punishment Condition five-and seven-year-olds (who did not differ from one another) sacrificed significantly *fewer* of their coins to sanction the egalitarian puppet than did three year olds (both $p < .05$). However, in the Reward Condition there were no developmental differences in the propensity to sacrifice coins to reward the egalitarian puppet.

Finally, with regard to the generous puppet, five- and seven-year-olds (who did not differ from each other) sacrificed significantly *fewer* of their coins to sanction the generous protagonist than did three-year-olds (both $p < .05$) in the Punishment Condition. A different pattern emerged in the Reward Condition, where seven-year-olds sacrificed significantly *more* coins to reward the generous puppet relative to both five- and three-year olds (both $p < .01$).

Taken together, these results confirm our hypotheses that by five years children tend to selectively sanction norm violators and selectively reward those who have acted with equity or generosity. Furthermore, seven-year-olds tend to favor reward as a restorative mechanism. They sacrifice significantly more coins to reward egalitarian and generous protagonists than they do to punish selfish protagonists. By comparison, five-year-olds tend to restore justice primarily through punitive measures.

We also questioned the extent to which children construed the sharing situation in terms of moral normativity. The expectation was three-year-olds (who demonstrate an understanding of conventional but not moral norms; Tomasello & Vaish, 2012) would not construe the action of the stingy puppet as unfair in either condition. In contrast, we anticipated that five- and seven-year olds would construe the situation with regard to

moral norms and consequently judge the action of the stingy puppet to be unfair. Analyses confirm this prediction for both the Punishment Condition ($\chi^2_{(2)} = 8.14$, $p = .017$, Cramer's V = .440) and the Reward Conditions ($\chi^2_{(2)} = 13.28$, $p < .01$, Cramer's V = .562). Interestingly, three-year-olds (but not older children) judged the selfish puppet as having the most coins at the end of the sharing game, despite the fact that the end distributions were uniform across puppets. Thus, although three-year-olds believed the selfish puppet to have more than its partners, this understanding did not translate to a judgment about unfairness as it did for five- and seven-year-olds.

At the end of the costly sacrifice task, we asked children to identify the puppet they believed was nicest (Figure 12), and which they would prefer to play with (Figure 13). These questions were included as controls to determine whether children encoded the character of the protagonists. Collapsed across age (for which we found no effect), the majority of children (roughly 55%, well above chance levels) judged as nicest the generous puppet, with compared to 32% of children who deemed the egalitarian puppet nicest and 13% who deemed the selfish puppet nicest ($\chi^2_{(2)} = 20.68$, $p < .01$).

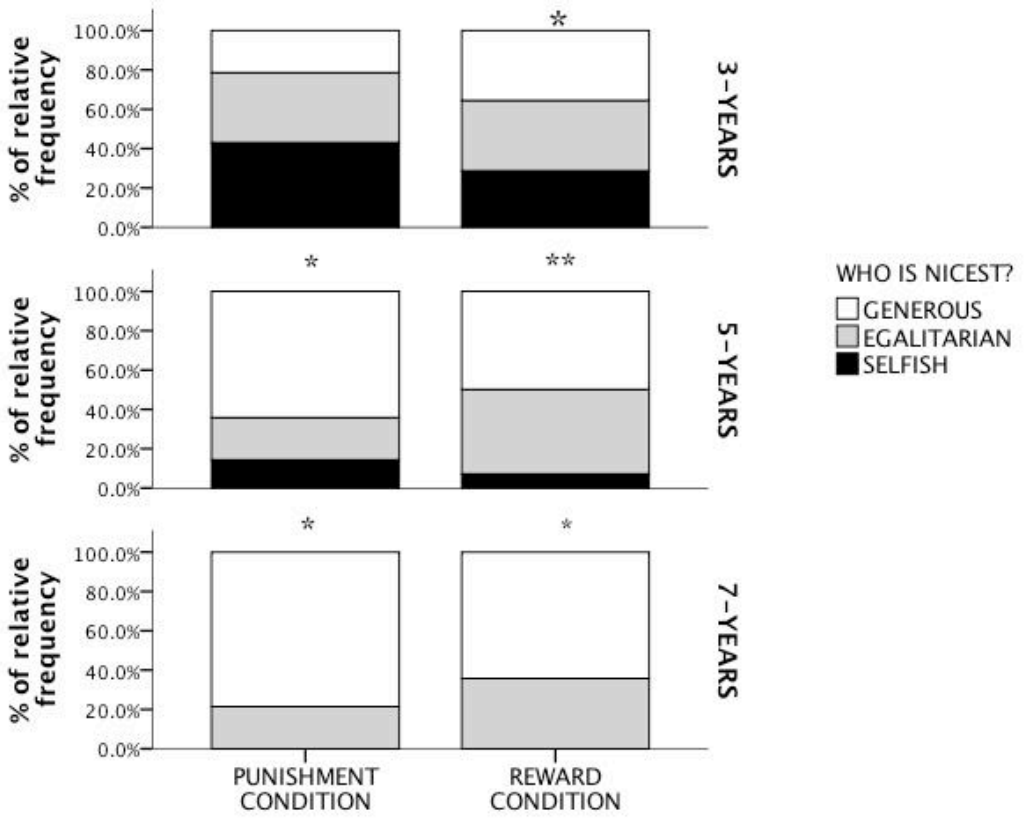

Figure 12. Percentage of relative frequency for children's responses to the question "who is nicest?" as a function of age and condition (punishment versus reward). Single asterisks indicate above chance levels, $p < .05$, and double asterisks indicate above chance levels at $p<.01$.

This may raise the question of why anyone would judge the selfish puppet as the nicest. Two possibilities come to mind. First, as this effect seems to be driven primarily by three-year-olds (although again these age trends are non-significant) it is possible that it again reflects a construal of the game in terms of conventional rather than moral norms. In this view, the stingy puppet may have been seen as nicest because it maps onto young children's own experiences of sharing, which at this age are marked by selfish tendencies (Rochat et al., 2009). Second, if children construed the task in terms of intentions, then it is possible that children liked the selfish puppet best because it was the most capable at accomplishing its goals (e.g., to win the most). The preference for this puppet may

therefore represent a conflation of "competence" and "nicest" with a more general sense of "good."

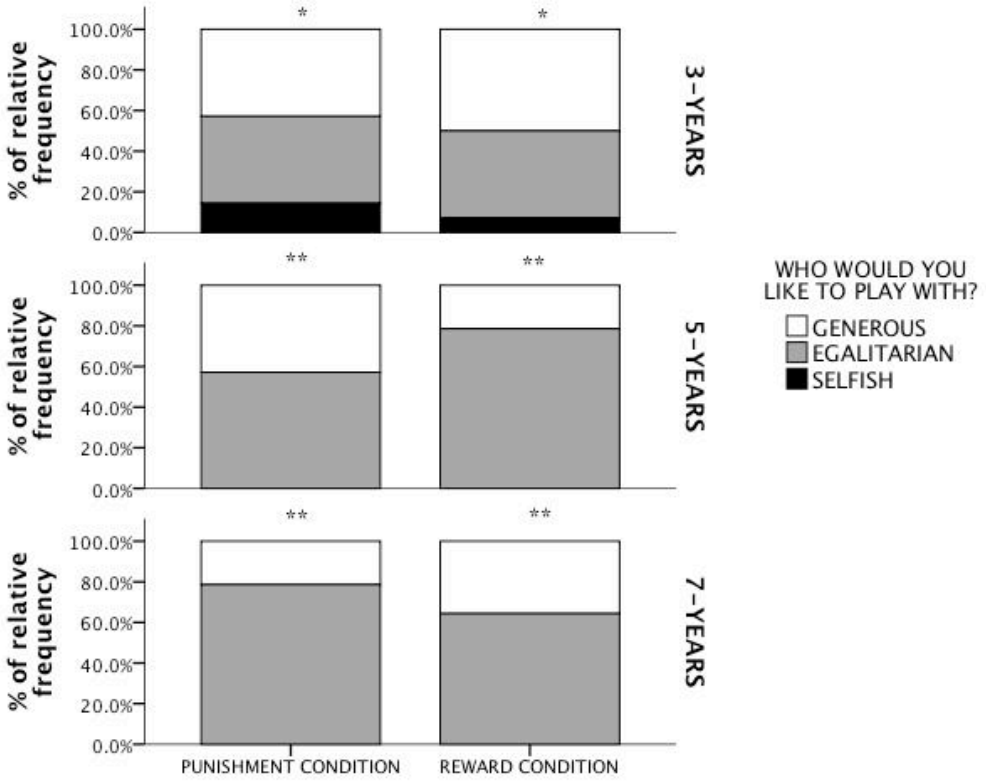

Figure 13. Percentage of relative frequency for children's responses to the question "who would you like to play with?" as a function of age and condition (punishment versus reward). Single asterisks indicate above chance levels, $p < .05$, and double asterisks indicate above chance levels at $p<.01$.

In general, these results may suggest that children tended equated generosity to "niceness," independent of age. However, this judgment of niceness did not map onto the puppet with whom children would most like to play (Figure 13). Here the majority of children at all ages (roughly 67%) picked the egalitarian puppet, compared to 35% who chose the generous puppet (no children picked the selfish puppet; $\chi^2_{(2)} = 7.02$, $p < 01$). One potential explanation for this finding is that while generosity is generally perceived

more favorably, in the context of actual sharing it engenders a "social debt" in a way that egalitarian sharing does not.

7.9.5 Discussion of Condition 5

The results reported here would seem to suggest that by five years (but not prior) children discriminate between the two forms of restorative justice described here (punishment versus reward). Punishment is more appropriate in contexts where norms of fairness have been violated, whereas reward is more appropriate when norms of fairness have been upheld. Furthermore, whereas five year olds seem to apply this "positive" sense of restorative justice to both egalitarian and generous acts, seven-year-olds are more inclined to view generosity as more deserving of reward, a finding that is consistent with the literature on children's emerging sensitivity to proportional equity. At the same time, there were few developmental differences with regard to how children construe the sharing situation. At all ages children tended to believe that the selfish puppet who violated fairness norms had profited the most (even when presented with evidence to the contrary). The puppets who acted in congruence with fairness norms were typically described as the nicest and most deserving of future interactions.

However, the crux of the matter is whether children construed the sharing situation as fair. Three-year-olds appeared to think sharing in terms of normative conventions ("that's just the way it's done"), a fact that is further reflected in their unsystematic costly sacrifice. Five and seven-year-olds, on the other hand, explicitly considered the situation as unfair and were motivated to correct this injustice, a finding that confirms our strong reciprocity hypothesis. Indeed, that older children enacted

systematic costly sacrifice is consistent with previous studies documenting the emergence of an ethical stance by age five (Robbins & Rochat, 2011; Rochat et al., 2009).

7.10 Summary and integration of first and third person costly punishment experiments (Conditions 1-5)

The experiments in Study 3 of this thesis collectively address the question of how and why children rectify inequity. If inequity aversion is the necessary condition appraisals of fairness, it is certainly not sufficient to explain the morally-valenced acts that children enact starting at five years of age. Instead, we would argue that strong reciprocity based on inequity aversion captures the psychological experience of what it means to be fair.

Inequity aversion may drive the propensity to be egalitarian, splitting resources equitably with others, but it takes on a qualitatively different meaning once children move beyond an understanding of *conventional* norms (as is the case with three-year-olds) to an understanding of *moral* norms (as seen in children five years and older). At three years and prior, egalitarian sharing may reflect sensitivity to how things are normally done. Indeed, because a sizeable proportion of adults describe 50/50 distributions as the most fair (not factoring, of course, the contextual factors that might make proportional equity more important; Bolton, 1997), young children may equate egalitarianism with a general feature of social exchanges (Tomasello & Vaish, 2012).

At five years, however, this understanding of how things are normally done transforms into an expectation about how things *ought* to be done. This in turn raises the question of what *should be done* when norms of fairness and expectations for equity are

violated. A general sense of reciprocity (replicating exactly the actions of a partner in an effort to maintain cooperative exchanges; Gintis et al, 2005) cannot account for the wide variety of principled acts in which individuals engage to restore equity or justice, and not just in the domain of material exchanges. Strong reciprocity better captures the psychological experience of recognizing and rectifying transgressions. It captures, for instance, the tendency to rebuke those who have acted with hostility or malice just as it captures the tendency to praise or reward those how have acted in accordance with socially-sanctioned norms (Fehr & Fischbacher, 2005). This is a natural extension of the logic inherent to inequity aversion, that we are driven to consider both our own interests and those of others (Fehr & Schmidt, 1999). In this sense, strong reciprocity is a hypothesis about outcomes and intentions; direct reciprocity can account for the former, but not the later.

One of the most important findings in this series of experiments addresses the issue of perspective: is the adoption of an ethical, principled stance about how things should be done an artifact of the self-interest inherent to first-party sharing in which children are direct beneficiaries of exchange? Our data suggest no. Children enact costly sacrifice (our proxy measure of strong reciprocity) in first party contexts, selectively punishing protagonists who have been selfish in their distribution of resources (Conditions 1-4). However, and crucial to our hypothesis, they also reward and sanction (at a cost) the actions of third party exchanges to which the child is not party and receives no material benefit (Condition 5).

Furthermore, the ways in which children orient their costly sacrifice in third party transactions reveals a developmental shift in regard to normativity. Five and seven year

olds both recognize selfish behavior as unfair. At five years children tend toward punitive measures to restore justice between aggrieved parties. However, we would speculate that at seven years, the enactment of punishment to restore justice is, in a sense, a double harm: It rectifies an unfairness with yet another act of unfairness as punishment is inherently harmful. This is evidenced in the way that seven year olds (but not younger children) opt to restore equity in third party sharing by rewarding those parties who acted in accordance with fairness norms.

At present, our methodology cannot determine whether the inclination to reward is a function of reinforcing cooperation expressed particularly through the egalitarian puppet, or a compensatory mechanism meant to correct the injustice suffered by the egalitarian and generous puppets at the hands of a selfish protagonist. This subtlety of meaning is deserving of further empirical scrutiny and may be illuminating of the other proximate mechanisms that subtend fairness.

In sum, children express an ethical stance by five years of age, a likely consequence of inequity aversion that characterizes young children's sharing, and which may have its antecedent roots in the prosocial preferences observed in infancy (e.g. for helpful or equitable others; Hamlin et al., 2007; Kuhlmeier at al., 2003). Above and beyond an aversion to inequity, strong reciprocity explains how and why children might rectify unfairness, either by punishing transgressors of moral norms, or rewarding the persons who observe them.

CHAPTER 5:

CONCLUSIONS AND FUTURE DIRECTIONS

8. Integration, critique, and reflection on the thesis studies

One of the first studies of distributive justice in young children (Urgel-Semin, 1959) established a trend that has been replicated many times since: children become more egalitarian and inequity averse between three to seven-years. Most accounts of the inequity aversion phenomenon explain this finding in the circular, tautological terms of children's growing preference for fair outcomes that create material equivalency between individuals, leaving neither party at a material disadvantage.

To bypass this circular account, the goal of the three studies of this thesis was to explain, at the level of individual psychology, what inequity aversion means to the young child as it emerges in ontogeny. What factors influence its development and expression? We suggested several proximate mechanisms—risk and competition aversion (Study 1) as well as loss aversion (Study 2)—that might account for these developmental trends. A second goal of the thesis was to determine how inequity aversion relates to the principled stance children adopt, starting around five years, in response to perceived unfairness (Study 3).

Our studies contribute to the field an assessment of behavioral economic phenomena (Study 1) that have long been considered important to adult models of fairness, but that have been understudied in children. But these studies also attempt to capture the more affective, subjective experience of inequity. Our consideration of loss aversion as a proximate mechanism is among the first efforts to link the asymmetric

experience of losses and gains to inequity aversion (Study 2). Finally, the results of our costly sacrifice tasks (Study 3) represent an important and novel contribution to the domains of developmental and moral psychology. Above and beyond mere inequity aversion, between five and seven years children rectify perceived unfairness in acts of punishment and compensation, even when doing so carries a personal cost. Furthermore, they align their principled acts according to their appraisals of a transgression—for instance punishing transgressors but not victims, and compensating victims but not transgressors.

In all, the studies demonstrate that inequity aversion is characterized by considerable asymmetries and variability depending on context. The work presented here indicates that at least by five years, inequity aversion is influenced by social competition and assessments of risk; by the asymmetric experience of losing versus gaining; and by the relative importance placed on personal welfare compared to that of a partner. We argue that it is the resolution of these tensions that drive development toward a principled, ethical stance toward others that emerges by five years in human ontogeny.

8.1 Grand summary of results (Studies 1-3)

Across various experimental manipulations and contexts, we see several consistencies with regard to the expression of egalitarianism in three to seven-year-old children. Self-maximization characterizes three-year-olds' sharing of both discrete resources like coins (Study 1) and continuous substances like sand (Study 2). At the level of individual sharing games, risk and competition aversion do not appear to systematically predict three-year-olds proclivities towards more or less equitable sharing.

Children at this age are not yet characterized by asymmetries between negative and positive outcomes, neither in the context of estimating losses and gains (for themselves and a partner; Study 2) nor in determining how to rectify inequity through punishment or compensation (Study 3).

By five years children show more pronounced signs egalitarianism (Studies 1 and 2), though these tendencies are not as robust as in seven-year-olds, as well as tentative signs of proportional equity by sharing differentially with generous and stingy puppets (Study 3). Relative risk- and competition-aversion begin to predict five-year-olds sharing, though not in a uniform manner (Study 1). Children at this age are also selective with regards to how they choose to rectify perceived inequity: When provided with an opportunity to punish (at personal cost) either a stingy or generous puppet, they overwhelmingly orient this punishment towards the protagonist who has shared unfairly (Study 3). A general negativity bias (e.g., tendency to overestimate both personal gains and losses; Study 2) could be interpreted tentatively as consistent with their proclivities toward punishment versus compensation as a means of restoring equity (Study 3).

By seven years and in comparison to our younger cohorts, children's egalitarianism is more consistently associated with measures of relative risk and competition aversion (Study 1). Egalitarianism is also correlated with loss aversion (Study 2). At this age, children display a marked asymmetry between estimations of personal gain (which they underestimate) and personal loss (which they overestimate). Seven-year-olds are also selective in how they decide to rectify inequity (even when done at a personal cost), though unlike five-year-olds, this costly sacrifice is oriented toward

compensation of a victim of unfair sharing rather than punishment of the perpetrator of that unfairness (Study 3).

In all, inequity aversion increases between three- to seven-years (as evidenced by children's increasingly egalitarian sharing) and in ways that can be predicted by children's corresponding aversion to risk, competition, and loss. Although these propensities seem specific to the self (and not a partner), by five years children nonetheless adopt an 'ethical stance' toward others, in both first- and third-party sharing, by engaging in selective acts of punishment in response to inequity, even when such behavior is costly (what we operationalize as strong reciprocity).

8.2 Critique of Methods and Future Directions

A review of the literature points to a general consensus that egalitarian sharing (at least in first-party contexts) emerges around five years. This finding is robust and has been replicated across multiple kinds of sharing games, from forced choice tasks (Fehr et al., 2009) to dictator and distributive justice games (Rochat et al., 2009) to more behavioral economic approaches like the ultimatum game (Fraser et al., 2007).

Most games in which children freely distribute resources between themselves and a partner use rewards that are either immediately gratifying (e.g., stickers, candy) or that can be exchanged for other goods at the end of the game (e.g., tokens; see Rochat et al., 2009). There is some debate surrounding the extent to which these resources are equally rewarding: Blake et al. (2010) note "currency effects," such that three-year-olds are more egalitarian when splitting least favorite stickers than their favorite stickers, but other work (Rochat et al., in prep) suggests that goods tend to be fungible, not only in heavily

exchange-based cultures like the United States, but also in more rural, subsistence-based economies (e.g., Samoa). In general, however, results across these different reward types nonetheless suggest that inequity aversion tends to manifest between five- and seven-years. We noted the same developmental patterns of egalitarian sharing when children shared tokens (Study 1) as well as when they distributed a continuous substance like "magical" sand (Study 2). Thus, although our methods were different across studies, they were also consistent.

There is also a general consensus that in third-party contexts in which children are not the direct beneficiaries of sharing, egalitarian tendencies emerge as early as three years (Baumard et al., 2010; Olson & Spelke, 2008; Rochat et al., 2009). Vignettes told from a third-person perspective have also been useful in probing three- to four-year-olds understanding of reciprocity and proportional equity (Kenward et al., 2011). Our own findings suggest that in third-party contexts, three year olds understand and respond negatively to violations of fairness norms, though they are not yet systematic in how they choose to rectify such inequities (Studies 1 and 3).

Many studies, including our own, approach the study of children's sharing from a more cognitivist perspective. These approaches tend question how changes in cognitive capacities (e.g., for probability reasoning; for perspective taking, etc.) manifest into differences in children's more or less fair sharing. In Study 1, for example, we assessed the extent to which children's relative risk and competition aversion might account for their relative inequity aversion. Although these proposed mechanisms correlated with egalitarian sharing in seven-year-olds, we noted no consistent associations in younger children. Given that five-year-olds can weigh probabilities against the value of the

gambles associated with them (Schlotmann & Tring, 2005), this result was surprising. However, this null finding raises the possibility that younger children may not have recognized risk and competition as forces that are capable of generating inequity between players. Future studies might address this possibility by making children's relative losses and gains dependent on those of their partner. For example, our version of the Wheels of Fortune Game featured a spinner whose landing point determined the child's payoff. Such a sense of a "shared fate" between self and other could be elicited by using a double-ended spinner that would indicate the child's losses or gains, but also simultaneously those of their partner. This sense of shared risk might better capture the child's experiences of uncertainty and competition in daily life. It could map more cleanly onto the "shared fate" children must confront in sharing tasks (like the Social Preferences Game) with limited resources.

Cognitivist approaches also tend to focus less on the affective and socio-moral evaluations that surround children's appraisal of sharing situations (though see LoBue et al., 2009 for an excellent counterexample). In Study 2, for example, we operationalized loss aversion as an asymmetry between *estimations* of losses and gains as one scoop of valuable, "magical" sand was added to or removed from a tube. We used children's estimations on these tasks as a proxy for affectivity; it was inferred from these estimations that children experience losses more negatively than gains are positive. Additional measures (e.g., of children's happiness or certainty regarding their guesses) might be more effective in substantiating this position.

A secondary question of interest in our investigation was how children construe the experience of inequity. In our third party investigation of costly sacrifice (Study 3,

Condition 5), children observed selfish, egalitarian, and generous puppets sharing before they were given a chance to punish or compensate (at personal cost) the puppet(s) of their choice. As in previous experiments (Robbins & Rochat, 2011), three year olds were unsystematic in the orientation of their punishment. Five-year-olds selectively punished the selfish puppet, and seven-year-olds selectively rewarded the generous puppet. However, this cross-sectional design does not allow us to comment on the relative consistency of punishing/compensatory tendencies *within* individuals. We cannot tell, for instance, whether seven-year-olds would choose to compensate at the *exclusion* of any punishment. A within-subjects design (similar to the Restorative Justice task described in Study 1) would better address this question. Given the marked individual differences that manifest in simple sharing studies (e.g., the Social Preferences Game of Study 1), we argue that capturing individual differences in socio-moral reasoning might be illuminating of underlying proximate mechanisms.

8.3 What inequity is and is not

Inequity aversion is description about how children and adults distribute resources: They eschew unfair outcomes in favor of those that leave neither party at a material advantage. Beyond the speculation that individuals inherently find unequal outcomes aversive, inequity aversion not comment on the origins of such preferences.

Much of the research surrounding this phenomenon has been descriptive in nature, documenting age-related changes in children's relatively egalitarian behavior, but not explaining how and why these changes occur in when they do in ontogeny. We have proposed three proximate mechanisms—risk aversion, competition aversion, and loss

aversion—to account for developmental differences, but the question remains open and is deserving of further empirical scrutiny. Equally as important: accounting for the process by which inequity aversion develops into strong reciprocity, or the tendency to reward acts of kindness and sanction acts of unkindness, what we deem as more hallmark of fairness proper. Positions that equate inequity aversion with fairness tend to minimize the subtle but important differences with regard to how children restore justice and rectify unfair acts of sharing. We hint at several possibilities here, including children's changing understanding of conventional versus moral norms.

Inequity aversion is not a theory of purely material interests. The reliance on sharing games to study egalitarianism in children ignores what its proponents argue is a key feature of inequity aversion (and also of strong reciprocity): the consideration of *intentions* behind distributive decisions. The emphasis on material outcomes has (perhaps falsely) lead to the impression that inequity aversion is a consequentialist account of behavior. In their own words, Gintis et al. (2005) argue that strong reciprocity (and antecedent inequity aversion) "unambiguously favor intentions over outcomes" (p.18). Individuals tend to punish inequitable behavior less frequently if they know they outcome was determined by chance (e.g., the roll of a die), and they are also less inclined to reward if a generous offer was randomly determined (Gintis et al., ibid). Intentions matter, and accounts of egalitarianism and the development of social preferences in children would benefit from further consideration of this possibility.

Inequity aversion is also not a theory about the causes inequity (e.g., what others have called procedural justice; Rawls, 1958). It does not hypothesize about what children (or adults) consider are things that can be "inequitable." It remains to be seen whether

children apply rules of equity to more abstract concepts, like time (e.g., proportion of time spent doing one task versus another, or the amount of time one has with a toy compared to someone else); access of opportunity (e.g., to friends); or consequences (e.g., accepting *equal* blame or *sharing* a punishment).

8.4 What is the developmental story?

A challenge for developmental psychologists interested in inequity aversion (and in fairness more generally) is how to account for changes that occur prior to the developmental period investigated here. Infants prefer prosocial acts over antisocial acts (Hamlin et al., 2007; Sloane et al., 2012), and toddlers engage in acts of spontaneous helping. Why suddenly at three are these tendencies minimized (or masked) by self-regarding behavior?

It is not falsely the case that just because three-year-olds who are marked by more self-maximizing tendencies do not also have prosocial preferences. The two are not mutually exclusive. Rather the tension lies between what children at this age *prefer in others* (e.g., third party contexts), and what they themselves do in equivalent situations.

We posit that inequity aversion is encompassing of several such tensions that children must resolve repeatedly over the course of development. Aversion to inequity may start as a detection of "not-sameness" that is then re-described and reinterpreted in light of other tensions that arise as children navigate the social world. Here we briefly review some of these possible conflicts.

One important consideration is that between three- and seven-years children's experiences with possession and ownership become more explicit (Rossano et al., 2011;

Vaish et al., 2011). The selfish behavior of three-year-olds may reflect their burgeoning understanding of exclusivity rather than a shift away from pro-sociality. Inequity aversion is arguably only relevant once I understand that something is "yours" and "mine," and that there are rules for establishing how that relationship changes. That children have no claim to exclusive rights to an object in third-party sharing may help to explain further why children at three years are selfish in first-party contexts, but not when distributing objects between third parties (Baumard et al., 2010; Rochat et al., 2009).

The shift from conventional to normative understanding of social relationships and object exchange (Tomasello & Vaish, 2012) may also explicate the seeming discrepancy between pro-social inclinations expressed between infancy and two years, and the more self-regarding behavior observed in later childhood. Once children begin to engage in the negotiation of attention and objects (per Faigenbaum, 2005) conventions come into conflict with each other. To resolve this contradiction, children may appeal to social norms about how things *ought* to be done. This not only accounts for the emergence of a principled stance toward others (as observed in Study 3) but may also explain why risk and competition were not uniformly predictive of egalitarian behavior in Study 1. If young children care more about the observance of rules (e.g., that things are done correctly, that the same rules apply to you and me), but not necessarily the consequences of those rules, then the associated risk of losses and gains may be of only secondary importance.

The context in which children make distributive decisions also changes over the course of development. The influence of institutions (Faigenbaum, 2005) is not a trivial one. Determination of what acts are "unfair" during the toddler years are typically

determined by adults. Caregivers initially provide the standards by which acts are judged as "permissible" (Gralinski & Kopp, 1996), and these conventions are repeated and reinforced in the co-construction of narratives between parents and their children (Fivush, 1991). However, entering the school environment requires children to become more self-regulatory (Bandura, 1990). Thus, at the same time that children negotiate the use of and access to objects, they are also learning to negotiate their subjective appraisals of those exchanges. It is within the resolution of these co-emerging capacities that conscientiousness may arise (Donald, 2001), eventually transforming into normative understandings of how things *should be done* within a given framework.

Changes observed between infancy and toddlerhood, and then again between three-to seven-years may also represent the struggle for internal coherency and a "moral identity" (Frimer & Walker, 2008). Conflicts between competing norms or conventions can result in cognitive dissonance; the developmental story may therefore be one in which children become more adept at resolving these conflicts in a way that is internally consistent (Eisenberg, 2000). For example, three-year-olds who discriminate between social conventions and moral norms are *more* likely to report feelings of guilt and remorse in day-to-day experiences. Perhaps as a consequence, they are also *less* likely to transgress such expectations for behavior (Kochanska et al., 1994). From this perspective, the behavioral profiles captured in Study 1 may be less revealing of egalitarian tendencies and more of the general means by which children relate to others and resolve cognitive dissonance (e.g., by prioritizing their own goals or emotions over those of another or vice versa).

Our work hints at another tension: the extent to which judgments about inequity are more deliberative versus intuitive. Work on framing effects (including loss aversion) suggest the later. For example, recent research demonstrates that offers in the ultimatum and dictator games are more generous under time pressures than when participants have more time to consider and deliberate over their offers (Rand et al., 2012). Haidt and Joseph (2004) and Greene et al. (2001) have also argued that many moral judgments (including those about fairness) are guided by intuitions that are only later justified using more deliberative logic. Evidence for this comes from studies of moral dumbfounding, in which participants assess the permissibility of a behavior, but are later unable explain their judgment.

An analogy in children is the "happy victimizer" phenomenon, in which children are asked to explain how a child would feel after victimizing another, or how they themselves would feel in the same situation (Keller et al., 2004). Five-to-six year olds frequently respond that they would feel "bad," thought they are initially unable to explain why. It is only later that they can provide post-hoc rationales for this judgment (e.g., the victimizer feels bad because he could be caught; he feels bad because he has harmed another). The phenomenon derived its name from the behavior of younger (less than 5 years old) children who report that the transgressor would feel happy, although they too are unable to explain why. In post-hoc explanations provided at a later time, they often rationalize their decision through pragmatic appeals (e.g., he was happy because he got something he wanted from the other boy; Eisenberg-Berg & Neal, 1979). These findings support the idea that moral judgments, whether positive or negative, are often characterized by intuitions and "gut reactions" that are only later formalized into

rationales (that, to underscore the point above, may be driven by a need for internal rather than logical consistency).

Finally, that children share differentially based on the social proximity of their partners (e.g., parochialism; Fehr et al., 2008; Moore, 2009) calls into question the approach that many behavioral economic approaches (including our own) adopt when they ask children to make decisions under conditions of anonymity. The first contention is whether children find this manipulation convincing. In pilot testing for these studies we were surprised to find that we could not replicate one well-established result in the literature: the influence of parochialism on children's sharing. In their sample of Swiss children and using the Social Preferences game, Fehr et al. (2008) demonstrated that by manipulating the social proximity of children's sharing partners they could elicit more or less egalitarian behavior. Fehr et al. informed children that their partner (whose exact identity was kept anonymous) was either a peer from their school or from a different school. A picture of a group of children reminded children that they were playing for a peer. In our pilot testing, however, this manipulation seemed unconvincing to children: they did not seem to buy into the conceit that their partner was actually from their school, or they tended to pick a person from the photograph and focus on that individual exclusively (instead of using them to hold an anonymous other in mind).[20]

As discussed in the introduction, conditions of anonymity were originally intended to test claims first poised by Rawls (1958) in his theory of justice, which posited that decisions of fairness must be made under conditions of impartially. The contention

[20] We were also unable to replicate this finding in a sample of roughly 50 children from small villages in Samoa and Vanuatu, though this may be attributed to the fact that small community living makes the possibility of a truly "anonymous" partner unlikely.

was that it would be difficult to determine how individuals are able to make decisions impartially if they are too swayed by information about their partners. However, anonymity (and also one-shot interactions) are not representative of the contexts in which most decisions about sharing occur (see Baumard et al., 2012 for a comprehensive critique regarding this point). Such approaches tend to minimize the influence that reputation (Robbins & Rochat, in prep; Shaw et al., 2012) and parochialism (Moore, 2009; Olson & Spelke, 2008) play in children's relatively egalitarian sharing, Children tend to be more inequity averse if they know they are being observed, or if they feel close to their sharing partners. Behavioral economic approaches may be stacking the deck toward self-maximizing behavior when they utilize one-shot, anonymous interactions. To ignore or marginalize these pressures is to confine decisions to a vacuum. These "confounds" may not mask social preferences, but may be the phenomenon itself.

8.5 Concluding Thoughts

To conclude, from the perspective of developmental psychology, inequity aversion is a description of *how* children share, but not *why* they do so. A more robust articulation of the inequity aversion hypothesis needs to account for why egalitarianism increases between three- to seven-years. Our work suggests that three proximate mechanisms – risk aversion, competition aversion, and loss aversion—may be important determinants of egalitarian sharing. Coupled with the rich literature on pro-social behavior in early life, our work points to the importance of making distinctions of levels of description when discussion inequity aversion and fairness more generally. Inequity may not be a concept (or quality) whose meaning remains stable through developmental

time or across different contexts. The detection of "not-sameness" that might drive infants' early social preferences likely takes on a different meaning as children move from conventional to normative reasoning about relationships between people and objects. Inequity aversion is also agnostic with regard to how individuals choose to *rectify* perceived unfairness, as our work on strong reciprocity and costly sacrifice suggests. Inequity aversion may therefore highlight tensions that children must resolve but it is the actual resolution of these tensions that is within the purview of what it means to be fair.

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