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Winners, Losers, Bullies and Leaders. How infants and children think and feel about social hierarchy.

DISSERTATION

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DOCTOR OF PHILOSOPHY

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by

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DEDICATION

To
my husband, who encouraged me to apply to graduate school when I thought I wouldn't get in, encouraged me to continue when I thought I couldn't finish, and makes me laugh and feel loved even when the stresses of academia feel overwhelming. (And who is willing to move across country for my career)

A group of blind men heard that a strange animal, called an elephant, had been brought to the town, but none of them were aware of its shape and form. Out of curiosity, they said: "We must inspect and know it by touch, of which we are capable". So, they sought it out, and when they found it they groped about it. In the case of the first person, whose hand landed on the trunk, said "This being is like a thick snake". For another one whose hand reached its ear, it seemed like a kind of fan. As for another person, whose hand was upon its leg, said, the elephant is a pillar like a tree-trunk. The blind man who placed his hand upon its side said, "elephant is a wall". Another who felt its tail, described it as a rope. The last felt its tusk, stating the elephant is that which is hard, smooth and like a spear.

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ABSTRACT OF THE DISSERTATION

Winners, Losers, Bullies and Leaders. How infants and children think and feel about social hierarchy.

By

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Doctor of Philosophy in Psychology

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The social relationships that we create and maintain are essential to our wellbeing. These include hierarchical relationships which occur when people are ranked along some dimension such as authority, prestige, dominance, or wealth. This dissertation is about how infants and children think and feel about these relationships. First, I discuss how infants and toddlers evaluate novel individuals they see in zero-sum conflicts: while infants, ages 10 to 16-months, prefer those who yield in a conflict, toddlers, ages 21 to 31 months, prefer those who 'win'. I consider whether this shift is due to a conceptual change or a change in priorities. Next, I provide evidence that children, ages 6 to 8 years old, can differentiate between hierarchical and egalitarian groups, and that 7 and 8 year-old children prefer egalitarian ones. Finally, I discuss children's expectations of high and low ranking individuals. Contrary to accounts of dominance hierarchies found in other species, children, ages 4 to 8 years old, do not expect leaders to be more aggressive or antisocial than subordinates. In fact, they expect them to provide benefits such as protection. Thus, children seem to be attuned to the unique characteristics of human social hierarchy. Taken

together, these studies show that social hierarchy is an important aspect of social cognition starting in infancy and throughout childhood. Children not only pay attention to 'who is in charge' they also use social rank to evaluate others, to evaluate groups, and to predict the behavior of others.

Introduction

Humans are a deeply social species and our ability to create and maintain social relationships is key to our wellbeing (Cacioppo & Hawkley, 2003; A. P. Fiske, 1991; Silk, 2007). One very common type of social relationship occurs when people are ranked along some dimension such as citizenship, age, gender, wealth, knowledge etc. These hierarchical relationships are found across societies, but vary greatly in their details. For example, in the United States people who are wealthier have more political power (Gilens & Page, 2014; Kalla & Broockman, 2016; Pratto, Sidanius, & Levin, 2006), while in small-scale societies those who are more physically dominant, trustworthy, and knowledgeable have more political power. In fact, in these small scale societies, in order to maintain their positions, high-ranking people must give away their wealth in order to maintain their position (von Rueden, 2011; von Rueden, Gurven, Kaplan, & Stieglitz, 2014). Hierarchical relationships also occur at different scales and in different social settings. For example, you can find them in domestic settings (e.g. 'head of the household'), recreational settings (e.g. 'team captain'), and professional settings (e.g. 'chief executive officer') (Boehm, 1999; A. P. Fiske, 1992; Henrich & Gil-White, 2001; Magee & Galinsky, 2008a; van Vugt & Tybur, 2014; von Rueden, 2011). One thing that is true across these settings is that being higher ranked means having better access to resources and more social influence (Cummins, 2005; van Vugt & Tybur, 2014), and thus people tend to 'strive' to improve their social rank (Anderson & Kilduff, 2009; Ellis, 1995).

Dominance Hierarchies

For non-human animals, rank is based on dominance, meaning it is derived from the ability to inflict harm on others. When two individuals have a conflict, the weaker, smaller, less aggressive individual or the individual with fewer allies yields in order to avoid physical harm (Cummins, 2005; van Vugt & Tybur, 2014). Over time, these relationships stabilize, such that some individuals routinely 'win' contested resources including food, territory or mates and others routinely defer. This is true for a variety of non-human animals including chimpanzees, lizards, salmon, orangutans, some types of fish, and some types of birds (Brown & Maurer, 1986; Harrison & Chivers, 2007; F A Huntingford, Metcalfe, Thorpe, Graham, & Adams, 1990; Oliveira, McGregor, & Latruffe, 1998; Valderr Ibano-Ibarra, Brumon, & Drummond, 2007; Wilson & Wrangham, 2003). With the exception of a hyenas and some primates, whose social rank is actually determined by the rank of one's mother (Holekamp & Strauss, 2016), for the majority of social animals rank is attained through the ability to inflict harm on others. Those who are stronger or are part of a larger group are yielded to in conflicts.

Modeling Dominance Hierarchies

Using evolutionary game theory, scholars have modeled plausible ways that dominance hierarchies can form. In these models, decisions about whether to defer or 'fight' in status interactions are akin to the game called 'chicken', in which two cars speed toward each other on a collision course. As in the real life game, interactions in the game theory model have three possible endings—(1) both parties defer which is slightly costly for both parties because they both lose the resource (2) one defers and one 'wins' which is slightly costly to the deferrer and very beneficial to the winner, (3) neither individual

defers, which is very costly to both parties (van Vugt & Tybur, 2014). In the evolutionary game theory model, this game is formalized—values are assigned to these outcomes, and then these interactions are repeated several times with many 'players'. When the game is allowed to run its course, a few patterns emerge: first, when there are mostly 'yielders' in the game, the likelihood that 'fighters' will win increases, thus the number of individuals who 'fight' increases. This causes the number of 'fighters' to increase so much that it becomes too risky to fight. Then, there are fluctuations in there being a large number of fighters, to very few, until the game reaches an equilibrium, such that it is not 'rational' for any 'player' to deviate from a given strategy. For this game, this equilibrium occurs when most players always yield and a few players never do—thus mirroring the hierarchal structures found in many non-human animals. For example, in groups of orangutans, some males routinely yield the best food, mates, and territory to dominant peers, which allows them to avoid costly conflict with them (Harrison & Chivers, 2007).

Thus, dominance hierarchies can be beneficial to both high-ranking and low-ranking individuals, at least as long as there are limited resources and others are willing to use aggression to fight over them. The individuals at the top of the hierarchy benefit the most—they have better access to resources and don't have to fight in order to get them, but the lower-ranked individuals, who lose out on those resources, also benefit because they avoid costly interactions that they are likely to lose anyway (Holekamp & Strauss, 2016). These models have important implications for social cognition in species with this type of hierarchy: it means that individuals would do very badly without being able to recognize relative social rank.

Indeed, many non-human animals recognize dominance rank. Piñon jays, apes, and fish can infer dominance rank through observing interactions between novel others (Grosenick, Clement, & Fernald, 2007; Felicity A Huntingford, 2013; Oliveira et al., 1998; Paz-Y-Miño C, Bond, Kamil, & Balda, 2004; Sapolsky, 2004). For example, in one study, Grosenick and colleagues showed fish several dominance interactions between other pairs of fish. The experimenters created an artificial dominance hierarchy such that fish 'A' always won against fish 'B', who always won against fish 'C', who always won against fish 'D' (they did this by taking the fish they wanted to lose out of water right before its interaction). When the bystander fish were put in a tank with a high or low-ranking fish, they spent more time near the low-ranking one than the high-ranking one. Thus, even fish can infer relative social rank and use this information to inform their own decisions about whom to approach.

Social Hierarchy in Humans

But does this logic of dominance apply to human relationships? One clear point of connection is the relation between size and social rank (Brown & Maurer, 1986; Ellis, 1995; Schubert, Waldzus, & Seibt, 2008; van Vugt & Tybur, 2014). Just as larger orangutans (Harrison & Chivers, 2007) and larger crayfish (Pavey & Fielder, 1996) enjoy more access to mates and resources, larger men and women are perceived as more competent, successful, and leader-like (Blaker et al., 2013; Chu & Geary, 2005; Jackson & Ervin, 1992; Lester & Sheehan, 1980; Lindeman & Sundvik, 1994; Lukaszewski, Simmons, Anderson, & Roney, 2016; Roth & Eisenberg, 1983; van Vugt & Tybur, 2014; Young & French, 1996). Moreover, even when high-ranking people are not physically larger, they often make

themselves appear larger. For example royalty often sit on large thrones, just as judges sit above courtrooms. Political leaders of the Cheyenne Indians wear large headdresses and the pope wears a large mitre (A. P. Fiske, 1992). Likewise, a very common, if not universal, show of deference is lowering oneself or making oneself appear smaller by bowing (Brey & Shutts, 2015; A. P. Fiske, 2004; Hall, Coats, & LeBeau, 2005; Schubert et al., 2008).

However, physical size is clearly not the only thing that determines a person's social rank. Sometimes people are high ranking because they provide benefits such as knowledge, protection, or guidance. For example, Martin Luther Leader Jr. or Dolores Huerta are considered leaders, not because they were physically larger or more aggressive, but because they were respected and admired.

This view of high-ranking individuals is echoed in Alan Fiske's 'Relationship Regulation' theory, which includes hierarchical relationships (which he calls Authority Ranking Relationships) among four basic models on which all human relationships are organized (see also Baillargeon et al., 2015; Cesario, Plaks, & Higgins, 2006; Fiske, 1992; Graham, Haidt, & Nosek, 2009; Henrich & Gil-White, 2001; Lind & Tyler, 1992; van Vugt & Tybur, 2014; von Rueden et al., 2014). Using a large amount of ethnographic data, Fiske has found that hierarchical relationships impose obligations on both superiors and subordinates. Unlike other views of social hierarchy, Fiske "...does not take the position that hierarchies are inherently immoral, exploitative or even undesirable. Nor do legitimate hierarchies emerge out of pure force or coercion. In many cultures, people perceive hierarchy as natural, inevitable, necessary and legitimate. . . .Subordinates are motivated to respect, obey, and pay deference to the will of superiors . . . Superiors, in turn, feel a sense of pastoral responsibility toward subordinates and are motivated to lead, guide, direct and

protect them" (Fiske & Rai, 2014, pg. 19). For example, in many small-scale societies, higher-ranked people routinely share most (if not all) of their meat with lower-status individuals (von Rueden et al., 2014). In other words, they attain rank through having skills and maintain rank by using those skills to provide benefits for others.

This way of thinking about social status is also discussed in the prestige-dominance model of human social hierarchy, which argues that prestige and dominance are distinct pathways by which people can acquire and maintain social rank (Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; Henrich & Gil-White, 2001). The model argues that those who achieve rank through dominance maintain control through aggression and fear, while those who achieve rank through prestige maintian control by providing benefits and respect.

This view is supported by an experiment in which Cheng and collegues (2013) looked at how leadership arises in randomly assigned groups. Participants were given a list of items that may be useful for a crash landing on the moon and asked to rank them in order of usefulness. First, the participants ranked the items on their own, then, the particpants worked in groups to rank the items. After the group task, the participants were asked to rate members of their group on (1) perceived social influence (i.e. "*was paid attention*," "*had high status*," and "*led the task*.") ; (2) dominance (e.g. '*I am afraid of him/her?');* (3) 'prestige' (*I respect/admire them)*; and (4) liking (e.g. '*I like this person').* Social influence was measured by comparing the private responses to the group response—the more someone's private responses matched the group's response, the higher score they recieved.

They also showed videos of the session to people who had not been involved in the task, who answered the same questions about dominance, prestige and liking about each

individual in the group. As the authors hypothesized, the people who were either feared (scored high on the dominance measures) or respected (scored high on the prestige measures) had more influence on the group task. The authors aruged that dominance (being feared) and prestige (being respected) were distinct pathways by which people attained group influence.

However, there are a few reasons to think that this study may oversimplify the distinction between dominance and prestige in human social interaction. First, dominance in this study may not directly map onto the dominance hierarchies found in other species—the stakes for an animal in a conflict over food, territory mates, are greater than the stakes for the participants in this study. Surely, college undergraduates in a school-sanctioned study, did not *actually* fear for their physical safety nor any meaningful loss of resources. Thus, an alternative explanation for this studies' findings it that the participants wanted to avoid being around an unpleasant person, not a scary one. That is, even though the researchers incentivized the participants ($5 a piece if their group answer closely matched the 'correct' answers), the participants may have agreed with the dominant individual so they could stop interacting with them, who were indeed rated as unlikeable. This is not to say that dominance does not play into the relationships of humans—its that this experiment does not necessarily provide evidence that these two factors (being respected and being feared) are distinct.

Another thing to consider about the dominance-prestige account of social hierarchy is how dominance and prestige play out in lasting relationships. In lasting relationships dominance and prestige may be harder to disentangle—a person can attain social status through prestige and then accumulate power which enables them to inflict material costs

on others (see van Vugt & Tybur, 2014 for discussion). For example consider the relationship between graduate students and their advisers. If the graduate student and adviser wanted the same office, we would expect the graduate student to step aside (i.e. to yield the resource). Not because they fear violent retaliation, but because we expect students to defer to their advisers in return for the guidance they receive. But of course, the graduate student might also defer to avoid costs. She might want to avoid a situation in which her adviser withholds resources such as grant money, letters of recommendation etc., each of which would have material consequences to the graduate student. Of course we don't *expect* advisers to act this way—we expect them to be mentors. But the point is that they could and certainly in some circumstances do, thus, in this sense, it seems that human hierarchies often contain elements of both dominance and prestige (see von Rueden, 2011 for longer discussion).

Given the disagreement about how social hierarchy works, it seems worth asking how people *represent* hierarchical relationships, and whether they match any of these accounts. Specifically, we can look at how infants and children represent hierarchical relationships, which can give us clues about what mental representations of social hierarchy are the result of evolution, and what representations are the result of cultural input. Of course, understanding how people represent hierarchical relationships cannot tell us how social hierarchy works directly (this is better left to sociologists and political scientists). However, it can tell us how people think it *ought* to work and thus may give us hints into how it actually does.

Previous work on children's ideas about social hierarchy

Infants expect 'The Mighty' to be deferred to

Several studies have found that humans represent social dominance very early on. For example, infants see a connection between an individual's strength and whether they will yield in a conflict. For example, Thomsen and colleagues, 2011, showed infants an animation in which two characters of unequal size have conflicting goals: one character wants to move from right to left and the other wants to move from left to right across a platform. After colliding several times in the middle, one character bows down and moves out of the way, allowing the other character to reach its goal. Infants were either shown a scene in which a larger character yields to a smaller one (bowed down and moved aside) or a scene in which a smaller character defers to a larger one. Infants as young as 10-months-old looked longer at the scene where the larger character defers to the smaller one, presumably indicating that they expect smaller individuals to defer to larger ones (Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011).

Similarly, Pun and colleagues showed 6-month-olds a similar scene, but this time both characters were equally sized (Pun, Birch, & Baron, 2016). Here, one character had more allies (i.e. more same colored characters on their side of the screen). Again, the infants used a cue of strength, to predict who would be deferred to, expecting the one with fewer allies to defer.

Infants also expect formidability to be transitive. In one study, 10-months-olds were shown a series of scenes in which two puppets struggled over a toy. If they saw puppet A win against puppet B, and B win against C, they looked longer when C won against A than

when A won against C. Thus, the infants (like fish) can use transitive logic when predicting the outcomes of conflicts (Gazes, Hampton, & Lourenco, 2015).

Fifteen-month old infants, have expectations about the stability of hierarchical relationships. If two characters are involved in a conflict over an object, and then over an area, they expect the same character to win in both situations (Mascaro & Csibra, 2012). Seventeen-month-olds also have expectations about social rank and resources (Enright, Gweon, & Sommerville, 2017). In one study, infants were shown two puppets with conflicting goals—both wanted to sit on the same chair. Then, one puppet yielded the chair to the other and sat instead on a cardboard box. Next, treats were distributed to the two puppets. Some infants saw a scene where the puppets got equal treats, and others saw a scene where the 'winner' got more treats. Infants looked longer at scenes where the treats were distributed equally than at scenes where the 'winner' got more. Thus, it seems that 17-month-olds expect 'winners' to get more.

Thus infants have expectations about many aspects of dominance—they expect more formidable individuals to win, they expect rank to be transitive, they expect rank to be stable and they expect high-ranking people to have more resources.

Children's Explicit Ideas about Social Hierarchy

Older children explicitly express ideas about both dominance and prestige. In one study, children, ages 5 and 6 years old used physical cues associated with dominance rank to infer 'who is in charge'—saying that a person who has their hand on their hips and chest out, was 'in charge', as opposed to a person who had their shoulders rolled forward and their hands in front of them. They also used eye gaze—saying a person who looked straight ahead was 'in charge' as opposed to someone who looked down. And finally they use a

person's head position –saying a person who had their chin up was 'in charge' as opposed to someone who had their head down (Brey & Shutts, 2015).

Children also use a variety of non-physical cues associated with both dominance and prestige to say '*Who is in charge?*'. Charefeddine and colleagues (2014) found that children, aged three to five years old, consider those who get their way, and are older to be "the boss". They also found that 4 and 5-year-olds (but not 3-year-olds) consider those who win play fights or have more resources to be "the boss". Similarly, Gülgöz and Gelman (2016) found that 3 to 9-year-olds think that characters who control resources, who achieve their goals over someone else, or who give permission are 'in charge'. They also found that 7 to 9-year-olds (but not 3 to 6 year-olds) think that individuals who set norms are in charge (See Chapter 5 for more discussion).

Children also have opinions about how resources should be allocated between high and low-status individuals (Charafeddine, Mercier, Clément, Kaufmann, Reboul, Charafeddine, et al., 2016). In one study, children were shown two puppets who argued about what game to play. In two situations, the same puppet 'got its way'. When given a larger and smaller cookie to distribute between two characters, 3 and 4-year-old children gave the larger cookie to the puppet who had gotten his way, 5 year-old children were at chance, and 8-year-old children gave the larger cookie to the puppet who had *not* gotten his way. Thus, three and four-year-olds seem to distribute resources in a way that agrees with the social rank of the individuals, while 8-year-olds seem to want to make things more equal.

Children not only think that 'the boss' should get more, they also seem to trust that 'the boss is right'. In one study, three to five-year-old children were told a story where two

girls fought over a toy and one of the girls won. Then, the two girls found a novel object but disagreed about what it was called. When children were asked what they thought the object was called, they tended to agree with the girl who had 'won' the contested toy (Bernard et al., 2016).

Thus, humans seem to represent various aspects of hierarchical relationships early on. Infants use cues about formidability to guess who will win conflicts, and older children use cues about dominance to say who is in charge. Older children also use cues about prestige and authority to say who is in charge—thinking that those who make decisions for people, or enforce norms are in charge.

In the following chapters, I discuss four projects that build on these findings. First, I discuss whether infants and toddlers prefer individuals who win or lose zero-sum conflicts. First I describe work showing that toddlers prefer those who are yielded to, while infants prefer those who yield. Then, I discuss why there might be a change. I then discuss how older children feel about social hierarchy itself—would they rather be in a group that is organized with one person making decisions or a group where they take turns making decisions? Finally I discuss how children expect those in hierarchical relationships to act toward one another, asking whether children's expectations of leaders match with the accounts of social hierarchy discussed above.

CHAPTER 1

Toddlers Prefer Those Who Win, But Not When They Win By Force

Ashley J. Thomas, Lotte Thomsen, Meline Abramyan, Angela Lukowski, Barbara W. Sarnecka

Abstract

Social hierarchies occur across human societies, and all humans must navigate these relationships. Infants can detect when one individual outranks another. However, it is unknown whether they can evaluate others based on social status. The current studies investigate whether they prefer or avoid high-ranking individuals. In Exp. 1.0, toddlers ages 21 to 31 months watched a right-of-way conflict between two puppets in which one puppet 'won' because the other yielded. Eighteen out of twenty-one toddlers reached for the puppet that won. Exp. 2.0 started with the same type of standoff, but one puppet knocked the other puppet down in order to 'win'. In this case, 18/22 toddlers reached for the puppet that got knocked over and 'lost.' These results suggest that humans, from a very early age, not only recognize relative status but also incorporate it into their decisions about whether to approach or avoid others in a nuanced way that differs from our nearest primate relatives.

Toddlers prefer those who win, but not when they win by force

Humans are born into a complex social world that they must learn to navigate. This world includes hierarchical relationships, where people are ranked along some dimension such as size, strength, age, wealth, prestige, or authority (A. P. Fiske, 1992; Hawley, 1999; Pratto et al., 2006; van Vugt & Tybur, 2014). Such hierarchies are found across human societies and across social settings (e.g. domestic, recreational and professional) (Magee & Galinsky, 2008b; van Vugt & Tybur, 2014). Hierarchies are also found in non-human species as varied as orangutans, ants, wolves, bees, and cuttlefish, where individuals are ranked according to size and strength (Grosenick et al., 2007; Hunt & Simmons, 2001; Felicity A Huntingford, 2013; Sapolsky, 2004; Smith & Price, 1973). Across these contexts, an individual's status has consequences: having higher status means having more access to resources, territory and mates (Cummins, 2005; van Vugt & Tybur, 2014; von Rueden & Jaeggi, 2016). Thus, in order to thrive in social hierarchies, individuals must be able to navigate them, including recognizing cues to status and behaving accordingly.

One reliable cue to status occurs in situations where two individuals have a conflict and only one can win (i.e. *zero-sum conflicts*), and the conflict is resolved because one individual defers (i.e. voluntarily yields) (Holekamp & Smale, 1991; van Vugt & Tybur, 2014). This is true in both dominance-based hierarchies and prestige-based hierarchies.

In dominance-based hierarchies, found in many non-human primates and across a range of other species, status comes from one's ability to inflict physical harm on others. This can be achieved through individual formidability (e.g. being larger or more powerful) or through being allied with a more formidable group (i.e. having allies who are more numerous, larger, or more powerful (Cummins, 2005; Holekamp & Strauss, 2016; J. H.

Kaufmann, 1983). Deference is a signal of rank in dominance-based hierarchies, because when individuals find themselves in zero-sum conflicts, the less formidable one (or group) will forfeit the contest to avoid getting hurt. Over many such interactions, relative status stabilizes: Some individuals routinely claim contested food, territory, and mates, and other individuals routinely yield in order to avoid costly conflicts (Schjelderup-Ebbe, 1935; Smith & Price, 1973; van Vugt & Tybur, 2014). Thus, yielding in a conflict signals lower social status (Ellis, 1995; Harrison & Chivers, 2007; Hunt & Simmons, 2001).

In human social hierarchies, status can also be derived from one's ability to provide benefits such as cultural know-how, protection, or guidance (A. P. Fiske, 1992; Henrich & Gil-White, 2001). But deference still signals relative status, because lower-status individuals will defer or yield to those with more authority, competence, or knowledge (A. P. Fiske, 1992; Henrich & Gil-White, 2001; van Vugt & Tybur, 2014; von Rueden et al., 2014). For example, if a graduate student and their adviser wanted the same office, we would expect the graduate student to step aside (i.e. to yield the resource). Not because they would fear costly retaliation in the physical sense, but because we expect students to defer to their advisers in return for the guidance they receive.

Of course, humans also sometimes act to avoid material costs as well. In the previous example, the graduate student might yield the office to avoid a situation in which their adviser withholds resources such as grant money, letters of recommendation etc. Thus, human hierarchies often contain elements of both dominance and prestige (Henrich & Gil-White, 2001; van Vugt & Tybur, 2014; von Rueden, 2011). And indeed, in laboratory experiments, dominance and prestige are shown to be two ways that humans can attain social status (Cheng et al., 2013).

Thus, for a human who is dealing with hierarchical situations, the way that people act in conflicts is a reliable cue to social status: when one individual voluntarily yields in a conflict, it signals that the relationship is hierarchical, and that the one yielding is lower ranked.

In fact, even infants infer a connection between yielding and social status. They use several formidability cues to predict who will yield in zero-sum conflicts. Infants 9 to 13 months of age expect smaller individuals to yield: When they watch two animated characters try to cross a platform in opposite directions, each blocking the other's path, they look longer at the display (presumably indicating surprise) when the larger character yields to the smaller one (Thomsen et al., 2011). In a similar setup, 6-to 9-month-old infants expect a character with fewer allies (i.e. fewer same-colored characters on its side) to yield to a character with more allies (Pun et al., 2016). Moreover, older infants seem to expect that individuals who lose one zero-sum conflict will lose another one: After 15-month-olds watch a scene where one individual pushes another out of a territory, they expect that in a subsequent scene, the individual who was pushed out will now yield over a contested resource (Mascaro & Csibra, 2012). Finally, 17-month-old infants expect that an individual who wins a zero-sum conflict will be given more resources (Enright et al., 2017).

Congruent with finding that 17-month-olds expect high-ranking individuals to receive more resources, other research has found that three- to five-year-olds give a larger cookie to a higher-status individual (i.e. a person who has made a decision for a pair) (Charafeddine, Mercier, Clément, Kaufmann, Reboul, & Van der Henst, 2016). Preschoolers also endorse the testimony of someone who wins a zero-sum conflict over one who defers (Bernard et al., 2016).

Taken together, these studies suggest that infants and preschool-aged children can infer the relative social status of two individuals. Infants think that more formidable individuals will 'win', and three- to five-year-olds adhere to the logic of social rank when they interact with novel individuals—they give more resources to dominant individuals and accept that 'the boss is right'. But it is one thing to be aware of status, and another thing evaluate others based on status. In the current studies we asked whether toddlers, having watched one novel individual yield to another, show a preference either for the individual who forfeited the contest, or for the individual who won it.

A priori, either preference is plausible. It is reasonable that toddlers might fear dominant individuals and wish to avoid them. For example, in many animal species, including non-human primates, subordinates fear dominant individuals and avoid or withdraw from them rather than risk being the victim of aggression (Goodall, 1986; Henrich & Gil-White, 2001; Oliveira et al., 1998). Indeed, in some species, being able to avoid dominant individuals is associated with lower stress levels (Sapolsky, 2004). And in fact, when preschoolers give a larger resource to a high-ranking individual or endorse the testimony of a high-ranking individual, it could be a way of avoiding aggression from that individual. For example, laboratory studies with adults have found that people will sometimes 'go along' with those who are feared (Cheng et al., 2013).

Consistent with this possibility, there are studies that suggest infants prefer 'victims' over 'bullies'. In one study, infants were shown animations of two shapes with self-generating motion (infants tend to see things with self-generating motion as 'agents'; see Carey, 2009 for review). One of the shapes repeatedly bumps against the other, even squishing it against a wall. After watching the video, infants were presented with two

shapes, and they tended to choose the shape that corresponded to the 'victim' over the one that corresponded to the 'bully' (Kanakogi, Okumura, Inoue, Kitazaki, & Itakura, 2013). Thus, one might expect that the toddlers in our studies would avoid the high-ranking puppet if they saw the yielding puppet as a victim.

Conversely, there are examples of primates preferring high-status individuals. For example, adult bonobos prefer novel dominant individuals: They prefer an animated character who pushes another one out of a contested territory (Krupenye & Hare, 2018) and they prefer a character who hinders another over one who helps another. Likewise, when macaques form alliances against opponents, they consistently choose allies who outrank themselves and their opponents (Silk, 1999). They will also pay (in fruit juice) to look at pictures of higher-ranking male macaques (Deaner, Khera, & Platt, 2005) just as adult humans prefer to look at high-ranking humans (Dalmaso, Pavan, Castelli, & Galfano, 2012).

There is also work showing that toddlers prefer competent individuals (Jara-Ettinger, Tenenbaum, & Schulz, 2015). In one experiment, toddlers were shown one puppet who struggled to make a toy play music, and another who did it easily. When asked who they wanted to play with, toddlers preferred the puppet who operated the toy easily. This could reflect a preference for high-status individuals, but it could also reflect a preference for individuals who can produce a desirable outcome for the toddler (i.e. perhaps the toddlers enjoyed hearing music, so they liked the puppet who could readily produce music).

In the present study, we asked how toddlers evaluate novel individuals based on relative social status. To do so, we tested whether toddlers prefer a novel individual who

has just won or lost a zero-sum conflict. We tested two situations: One where the 'loser' voluntarily yielded to the ‘winner,’ and another where the contest was won by force.

General Methods

Materials

The puppet stage used in all experiments was 75 cm tall, 32.5 cm deep, and 95 cm long. It sat on a folding table covered with black fabric. There were black curtains hanging at the left and right sides of the stage, and a black curtain was used to cover the stage between scenes. Another black curtain behind the stage hid the experimenter who was manipulating the puppets. In all the experiments (except Experiment 4), the puppets were 12.5cm tall and made of polymer clay. They each had one plastic craft eye (with a fixed pupil so that the puppet always seemed to be looking straight ahead) and a black rectangle for a mouth (which was black electrical tape). One puppet was a yellow oval and one was a red square. The puppets were moved by means of black wooden dowels. After the puppet show, two puppets identical to those used in the puppet show were presented to the infant. In Experiment 4, we used two plush puppets (a dinosaur and a monkey puppet) that were 25 cm tall.

Procedure

Participants were recruited at a children’s museum during regular business hours. Each experiment used a different set of toddlers. Experimenters approached parents inside the museum and asked if they would like to hear about an experiment on children’s understanding of social relationships. Parents who agreed were given the consent form to

fill out while the experimenter interacted with the child before leading the parent and child to the testing room.

The testing room was a large room off the main floor of the museum. Before entering the testing room, parents were briefed about the procedure. They were asked to remain quiet during the puppet show and to close their eyes during the choice procedure.

The participating child usually sat on the parent's lap. When this was not possible (e.g., because the parent was holding a younger sibling), the child sat in a chair next to their parent. The puppet show consisted of a familiarization phase that was shown once, an action phase that was shown three times, and a test question.

In all experiments, one experimenter stood behind the stage (hidden from view) and acted as the puppeteer. A second experimenter who was blind to the condition (i.e., could not see what the puppets were doing onstage) stood to the side of the stage and opened and closed the curtain between segments, saying "Down goes the curtain!" or "Up goes the curtain!" each time. (See supplementary materials for dimensions of stage, etc.)

In all seven experiments, one puppet at a time was visible during the familiarization phase and both puppets were visible during the entire action phase. The puppets' direction of travel (left to right or right to left across the stage) were counterbalanced with their roles in the action phase (e.g., yielding or remaining upright), as was the order in which they crossed the stage and the specific puppet (e.g., yellow oval or red square) assigned to play each role. We also counterbalanced the position of the high-status puppet (left or right) was on during the test question.

The test-question procedure was modeled after Hamlin et al, 2007. First, an experimenter who was blind to the condition asked the parent to close his or her eyes. The

experimenter then held out the board with the two puppets so that the child could see, but not reach them. The experimenter looked at the child and said, "Hi! Look!" and then looked down at the board, fixing her gaze directly in the center of the board between the two puppets. Then the experimenter said, "Which one do you like?" and moved the board toward the child so that the child could reach it.

The experimenter mentally counted off 30 seconds. If the child had not made a choice after 30 seconds, the experimenter (keeping her gaze fixed on the center of the board) encouraged the child by saying, for example, "It's OK to choose one," or "You can grab one.") If the child still made no choice, the experimenter returned the board back to its starting position and repeated the test-question procedure (See Figure 2.1). If the child reached simultaneously for both puppets (one with each hand), the trial was coded 'both.' If the procedure was done three times and the child still made no choice, then the trial was coded 'no response.' After the puppet show, each child was allowed to choose a prize (e.g., a rubber duck). Parents were invited to ask questions about the study and were given information about the lab to take home.

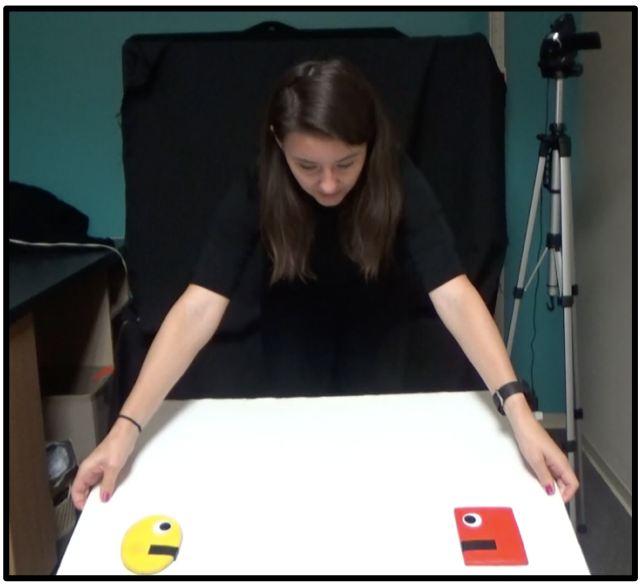

Figure 1.1 Choice Procedure for all puppet shows.

Experiment 1: One puppet Prevails, one puppet yields

In this experiment, toddlers watched a puppet show, modeled after animations used in previous studies (Pun et al., 2016; Thomsen et al., 2011), showing two puppets in a zero-sum-conflict. It began with a familiarization phase: First, one puppet, alone on stage, crossed the stage twice, both times going in the same direction. Then the first puppet exited the stage and a second puppet entered, also alone, and crossed the stage twice going the opposite direction. The purpose of this familiarization phase was to establish that the goal of each puppet was to cross the stage.

Next came the action phase: The two puppets appeared simultaneously on opposite sides of the stage and tried to cross at the same time, bumping into each other in the middle. Both puppets then backed up and tried again, meeting again in the middle. This action phase(with the puppets bumping and backing up) was repeated 5 times. Then the puppets approached one another but stopped before meeting, and one puppet 'yielded' by rotating so that its eye faced the ground, and moving aside. The other puppet passed in front of the 'yielding' puppet and continued on across the stage. (see Fig. 1). This 'zero-sum conflict' phase was repeated three times.

Finally, the test question: An experimenter who was blind to the puppets' roles in the conflict presented the two puppets to the child on a board and asked, "Which one do you like?" The dependent measure was which puppet the child reached for (Hamlin, Wynn, & Bloom, 2007) (See Fig. 2.2).

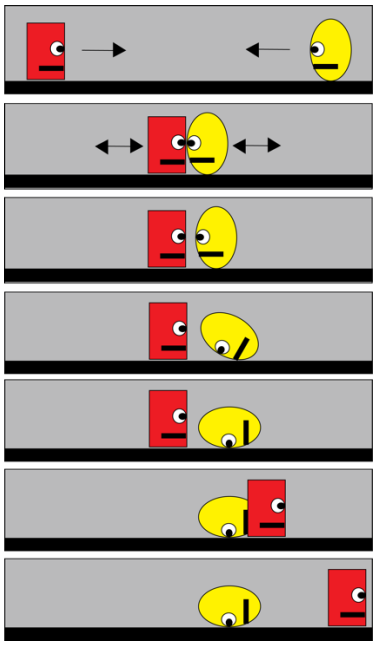

Figure 1.2 Diagram depicting puppet show in Experiment 1.0

Participants

A total of 30 toddlers participated in the experiment. Of these, 9 were excluded from the analysis for the following reasons: Refusing to choose a puppet (n=4); choosing both puppets (n=3); extreme fussiness (n=1); distraction in the testing environment—a janitor noisily entered the testing room and distracted the child (n=1). The remaining 21 toddlers (8 girls, 13 boys) contributed data to the analysis. Their ages ranged from 21 to 31 months (M=24.95 months, SD=2.92 months). Data collection was stopped when Bayesian analyses showed a sufficiently strong effect to answer the question (see analysis above). Note that although frequentist statistical analyses do not allow for preferential stopping, Bayesian analyses do (Csibra, Hernik, Mascaro, Tatone, & Lengyel, 2016).

Results

Of the 21 toddlers who contributed data to the analysis, 18 reached for the puppet that stayed upright and continued on across the stage (i.e., the 'high-status' puppet, two-tailed bin. test p=.0015). The Bayes Factor was 71.67 in favor of the alternative hypothesis, that toddlers were choosing the high-status puppet either more or less than 50% of the time. This is considered very strong evidence (Morey, Rouder, & Jamil, 2014a) that the toddlers preferred the high-status puppet (See Fig. 2.9) . All data, including pilot data are available at https://osf.io/grhf3/.

Exp. 1.1: Footrace Follow-Up

The purpose of Exp. 1.1 was to test a number of alternative explanations as to why toddlers might have liked the 'winner' in Exp. 1.0. One was that toddlers might prefer a puppet that reaches its goal over one that fails to do so, independent of any social status considerations. Another possibility was that toddlers might prefer the 'winner' in Exp. 1.0 for some nonsocial reason—because it moved farther or moved last, because it remained visible throughout the vignette (whereas the 'yielding' puppet was briefly occluded when the 'winner' passed it by), or because it moved the same way during the action phase as it did during the familiarization phase--remaining upright and traveling all the way across the stage, rather than altering its posture and path.

In this follow-up experiment, toddlers watched a scene in which the puppets moved across the stage as in Exp. 1.0, but without any social interaction. First, the familiarization phase: Each puppet crossed the stage twice, alone. But unlike in Exp. 1.0, both puppets in this experiment went in the same direction. Next came the action phase: both puppets

appeared on the same side of the stage. One puppet traveled halfway across the stage and stopped, rotated downward, and moved aside, replicating the motion of the yielding puppet in Exp. 1.0. Then the second puppet came from the same side, passed in front of the stopped puppet, and continued on to the other side of the stage. Note that this puppet show contained the same sequence of movements as Exp. 1.0; but did not depict a zero-sum conflict (see Fig. 3).

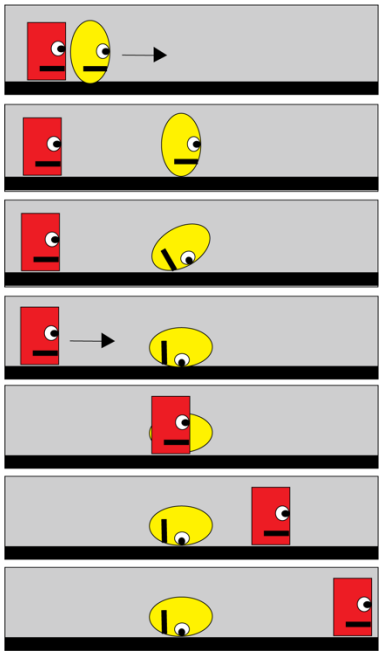

Figure 1.3 Diagram depicting puppet show in Experiment 1.1

Participants

A total of 37 toddlers participated in the experiment. Of these, 13 were excluded from the analysis for the following reasons: Choosing both puppets (n=7); refusing to choose a puppet (n=3); extreme fussiness (n=3); experimenter error (the puppets were moved backward in the puppet show, n=1). The remaining 24 toddlers (7 girls, 17 boys)

contributed data to the analysis. Their age ranged from 21 to 31 months (M=26.56 months; SD=3.25 months).

Results

Of the 24 toddlers who contributed data to this analysis, 12 chose the puppet that stayed upright and completed its journey across the stage. (p=1.0; Bayes Factor=4.02 in favor of the null, considered strong evidence in favor of a single point—in this case the hypothesis that the toddlers chose each puppet 50% of the time). Thus, when no zero-sum conflict occurred, toddlers showed no preference for the puppet that reached its goal, nor for the upright puppet even though, like the 'winner' in Exp. 1.0, it (a) remained visible the whole time; (b) remained upright the whole time; (c) traveled farther than the other puppet; (d) moved last; and (e) moved in the same way (same path and posture) in the action phase as it had during the familiarization phase. (See Fig. 9). Thus, Exp. 1.1 provides positive evidence that none of these factors explain the findings of Exp. 1.0.

Exp. 1.2: Split-Level Follow-Up

Exp. 1.2 had two purposes: To replicate the main finding of Exp. 1.0 on a split-level stage, and to use that split-level stage to test (in a different way than the footrace of Exp. 1.1) whether toddlers perhaps preferred the 'winner' in Exp. 1.0 simply because it reached its goal, and not because another puppet yielded to it. In the footrace follow-up (Exp.1.1) the puppet that stopped moving did not face any kind of obstacle. So, we reasoned, toddlers might think that it simply changed its goal and decided to stop halfway across the stage. If so, then the footrace follow-up of Exp. 1.1 wasn't a good test of the idea that toddlers

preferred the puppet who reached its goal, because toddlers might have thought that *both* puppets reached their goals, and thus showed no preference for either puppet.

For Exp. 1.2, we used a stage with two levels arranged like bookshelves, one above the other. Toddlers were assigned to one of two conditions: Condition A was a replication of Exp. 1.0, with all the action occurring on either the upper or the lower stage. In Condition B the puppets moved as they had in Exp. 1.0, but on different levels—one puppet on the upper stage, the other on the lower stage. In the Condition B familiarization phase, each puppet crossed its stage twice. In the action phase, barriers appeared on stage, and the puppets approached and retreated from the barriers, mimicking the movements in Exp. 1.0. Then the curtains closed again and re-opened to show only one barrier remaining, making it so only one puppet could complete its goal of crossing the stage (see Fig. 2.4).

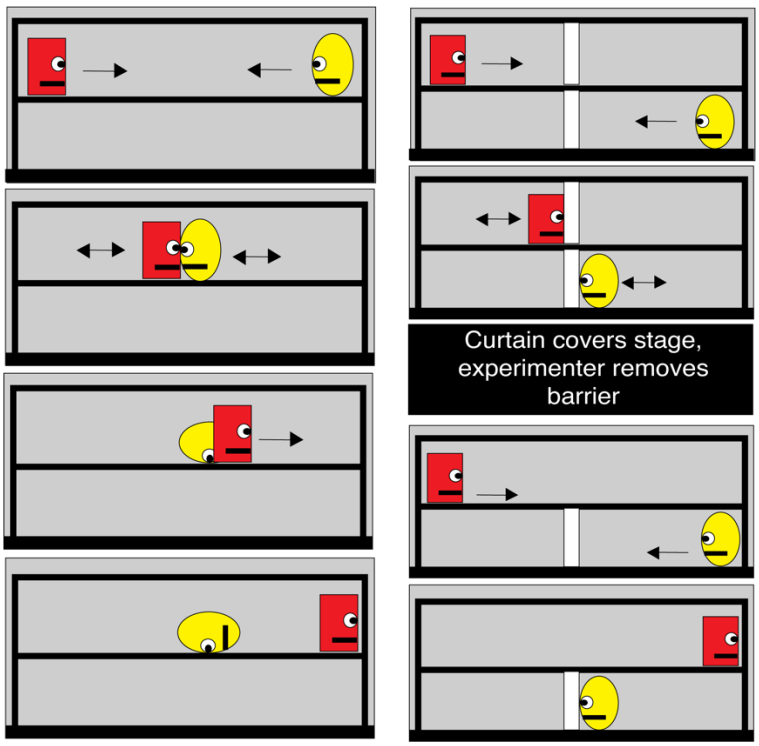

Figure 1.4 Diagram depicting puppet shows in Experiment 1.2

Participants

A total of 64 toddlers participated in the experiment. Of these, 25 were excluded from the analysis for the following reasons: Choosing both puppets (n=14); refusing to choose a puppet (n=6); experimenter error (n=3: the experimenter used her hands to present the puppet instead of the board in 1 trial; the puppet was facedown instead of upright in 1 trial; the experimenter didn't do the puppet show correctly); fussiness (n=1; the puppet show was stopped because the child started crying in one trial); interference by another sibling (n=1). The remaining 39 toddlers (22 girls, 17 boys) contributed data to the analysis. Their ages ranged from 21 to 32 months (M=26.05 months; SD=98.65 days.)

Results

Of 39 toddlers who contributed data to this analysis, 19 were assigned to Condition A (the replication) and 20 were assigned to Condition B (the barrier condition). Results from the replication matched those of Exp. 1.0, with 17 of 19 toddlers choosing the 'winner' (p<.001, BF=153 in favor of the hypothesis that toddlers chose one puppet more often than the other).

In the barrier condition, only 8 toddlers chose the puppet that crossed the stage and thus achieved its goal (p =0.823, BF=2.88 in favor of the null hypothesis, see Fig. 9). This is positive evidence that toddlers were equally likely to choose a puppet that achieved its goal of crossing the stage as they were to choose a puppet who did not. This rate of choosing the puppet that reached its goal was significantly lower than in the replication condition, (χ^2 (1)= 7.79, p=.005, BF=17.96 in favor of alternative hypothesis that the two conditions differed). Thus, toddlers' preference for the individual who prevails in a conflict (shown in

Exp. 1.0) cannot be attributed to a general preference for individuals who complete their goals over ones that do not.

Exp. 1.3: Stop-and-Face-Down Follow-Up

Exps. 1.0, 1.1 and 1.2 demonstrated that toddlers prefer an individual who prevails in a conflict over an individual who defers, and this is more than just a preference for any individual who reaches their goal. In Exp. 1.3, we asked whether the preference is elicited as soon as one of the puppets rotates downward to face the floor. For this experiment, toddlers watched a vignette identical to that in Exp. 1.0 except that it ended after one puppet rotated toward the ground. This was the first part of the 'yielding' gesture made by the puppet in Exp. 1.0. The scene ended before the puppet made the second part of that gesture, which was to move aside and allow the other puppet to cross the stage. The upright puppet never crossed the stage in this experiment, but simply stayed standing where it was until the curtain closed (See Fig. 5).

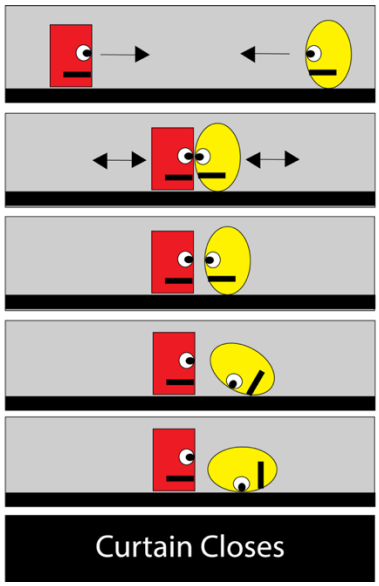

Figure 1.5 Diagram depicting puppet shows in Experiment 1.3

Participants

A total of 37 toddlers participated in the experiment. Of these, 13 were excluded from the analysis for the following reasons: Choosing both puppets (n=7); refusing to choose a puppet (n=3); experimenter error (n=2: the experimenter made the wrong puppet face downward during one trial and accidentally let the oval puppet roll onto its back in another trial); interference (n=1: the participant's sibling pointed to one of the puppets before the participant made a choice). The remaining 24 toddlers (12 girls, 12 boys) contributed data to the analysis. Their ages ranged from 21 to 32 months (M=25.25 months; SD=2.96 days).

Results

Of 24 toddlers who contributed data to this analysis, 10 chose the puppet that stayed upright (p=53, BF=2.29 favor of the null) In other words, toddlers liked both puppets equally. In other words, the preference shown in Exps. 1.0 and 1.2a is not elicited when one puppet merely rotates toward the floor and stays there (See Fig. 2.9).

Exp. 1.4: Yielding Follow-Up

Exp. 1.4 was like Exp. 1.3, but instead of stopping the scene as soon as one puppet rotated downward, we stopped it after that puppet had also moved aside, completing the 'yielding' motion shown in Exps. 1.0 and 1.2a. As in Exp. 1.3, the upright puppet did not cross the stage, but remained standing in its place. The purpose of Exps. 1.3 and 1.4 was to assess exactly when (at what point in the scene) the preference was elicited (See Fig. 2.6).

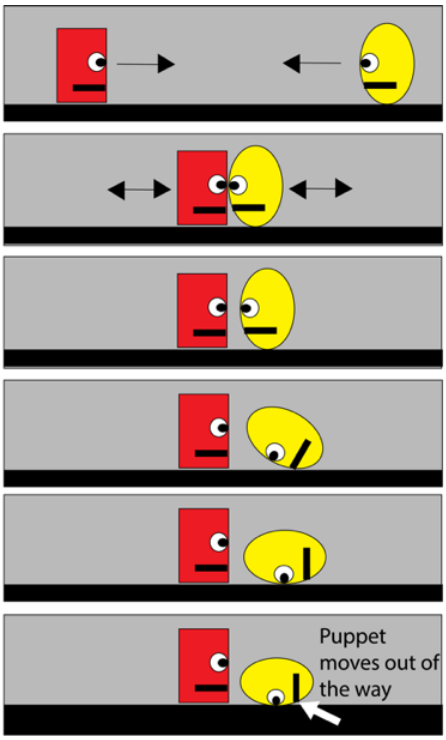

Figure 1.6 Diagram depicting puppet shows in Experiment 1.3

Participants

A total of 43 toddlers participated in the experiment. Of these, 15 were excluded for the following reasons: Choosing both puppets (n=8); refusing to choose a puppet (n=2); fussiness (n=1); interference (n=2 parent was talking to their child during the choice procedure and didn't close their eyes; in another trial the parent touched one of the puppets while the child was making their choice); developmental delays (n=1 the parent indicated that their child was on the autism spectrum on the consent form); inattention (n=1 the child was turned around, facing their parent during the action phase of the puppet show). The remaining 28 toddlers (20 girls and 8 boys) contributed data to the analysis. Their age ranged from 21 to 32 months (M=24.34; SD=2.48 months).

Results

Of the 30 toddlers who contributed to the analysis, 23 chose the upright puppet (p=.005, BF=17.23, considered strong evidencS in favor of the alternative hypothesis). In other words, toddlers liked the puppet who was 'yielded to' more than the puppet who 'yielded,' even when the upright puppet did not go on to reach its goal (See Fig. 9).

Exp. 2.0: One Puppet Wins by Antisocial Force

The results of Exps 1.0-1.4 showed that toddlers ages 21 to 31 months prefer an individual to whom another has yielded. This suggests that toddlers may have a preference for high-status individuals. In the next experiment, we tested whether toddlers prefer *any* individual who wins, or only one who wins because someone else yields to it. In other words, Exp. 2.0 explored the conditions under which toddlers prefer a winner. Specifically, we tested whether toddlers prefer a puppet who wins by using force against another puppet.

If toddlers prefer a puppet who 'wins' through the use of physical force, it would suggest a strong preference for winners, regardless of how they win. This would be consistent with findings from some nonhuman primates; for example, with recent reports that bonobos prefer novel, dominant individuals, including those who hinder others, over subordinate ones. (Krupenye & Hare, 2018). If toddlers prefer a puppet who 'loses' to one who wins by force, it would suggest that when they view conflicts, they do more than just identify a winner and a loser. This is consistent with the idea that toddlers prefer winners because they want (implicitly, of course) to affiliate with winners. An individual who uses physical force to win a conflict might be less attractive as a potential affiliate, and so might

be excluded from the general preference for winners. An individual who uses force might also be dangerous to approach, or may use force because their status is not recognized by others. In any cases, such an individual would be less likely than other 'winners' to provide benefits, and might even cause harm.

In Exp. 2.0, we showed toddlers a vignette nearly the same as in Exp. 1.0. But after the puppets reached their standoff, one puppet physically knocked the other puppet down and out of the way before crossing in front of it and continuing across the stage (See Fig. 2.7).

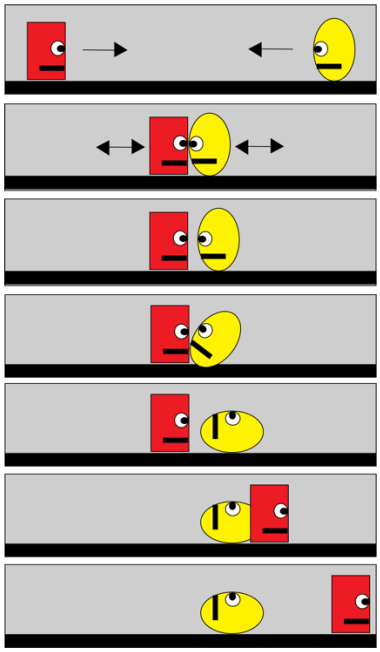

Figure 1.7 Diagram depicting puppet shows in Experiment 2.0

Participants

A total of 29 toddlers participated in the experiment. Of these, 7 were excluded from the analysis for the following reasons: Choosing both puppets (n=2); refusing to choose a puppet (n=1); extreme fussiness (n=2); parental interference (n=1); sibling interference

(n=1). The remaining 22 toddlers (10 girls, 11 boys, 1 parent did not specify) contributed data to the analysis. Their age ranged from 20 to 31 months (M=24.91 months; SD=3.13 months).

Results

Of the 22 toddlers who contributed data to this analysis, 18 reached for the puppet who was knocked down (p=.00434, BF= 24.93 in favor of the alternative hypothesis). Thus, we found strong evidence that toddlers preferred the loser (who was a victim of violence) rather than the winner (who perpetrated the violence). Thus, toddlers' preference for winners does not seem to extend to those who win by force (See Fig. 9).

Exp. 2.1: Prosocial-Force Follow-Up

In Exp. 2.0, toddlers avoided a puppet who used antisocial force to reach its goal. In Exp. 2.1, we tested whether toddlers avoid any puppet who uses force to reach a goal, or if the avoidance is specifically for puppets who use antisocial force.

In this experiment, toddlers watched a vignette in which one puppet knocks down a barrier, enabling both puppets to cross the stage to reach their common goal. The vignette begins with a familiarization stage like that of Exp. 1.1. Then in the action phase, a barrier appears at center stage. As in earlier experiments, one puppet moves across the stage until it meets the barrier, backs up and moves forward again, only to meet the barrier again. Then (unique to this experiment), the other puppet crosses in front of it and knocks the barrier down, using the same 'knocking down' motion as in Exp. 2.0, but with the force directed against the barrier instead of against the other puppet. Both puppets then hop over the collapsed barrier and continue on their way. (See Fig. 2.8)

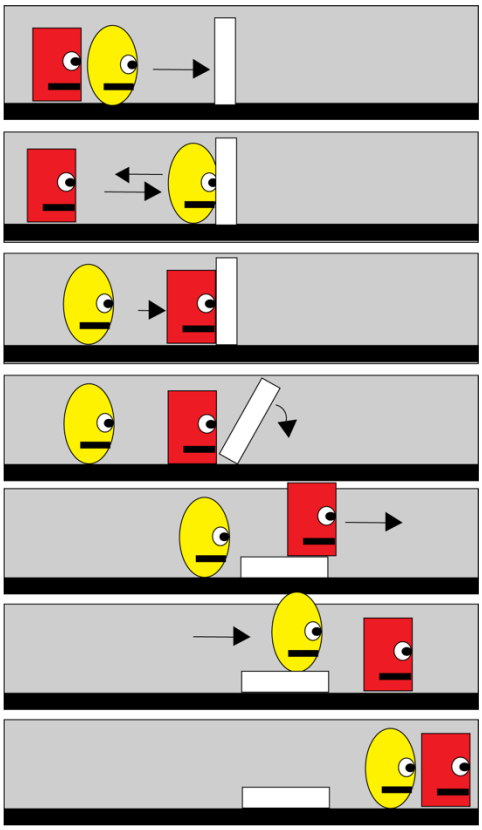

Figure 1.8 Diagram depicting puppet shows in Experiment 2.1

Participants

A total of 36 toddlers participated in the experiment. Of these, 14 were excluded from the analysis for the following reasons: Choosing both puppets (n=5); refusing to choose a puppet (n=2); extreme fussiness (n=2); parental interference (n=1); sibling interference (n=1); experimenter error (n=2: which puppet knocked the barrier over was different in two test sequnces) and one child was excluded because she had an object in one of her hands during the choice procedure (n=1). The remaining 22 toddlers (12 girls, 11 boys) contributed data to the analysis. Their age ranged from 21 to 32 months (M=26.48 months; SD=3.18 months).

Results

Of the 22 toddlers who contributed data to this analysis, 19 reached for the puppet who had knocked the barrier down (p=.0.0026 BF=39.47 in favor of the alternative hypothesis). Thus, we found strong evidence that toddlers do not automatically avoid a puppet who knocks something down. In fact, they show a strong preference for a puppet who uses force to knock over a barrier, enabling both puppets to reach their goal. (See Fig. 9).

Exp.	Description	Toddlers' Preference	Conclusions
1	One puppet wants to cross the stage from right to left, one wants to cross from left to right. They collide in the middle, until one puppet 'yields the way' (bows down and moves aside). The other puppet crosses in front of it to the other side of the stage.	Puppet who was yielded to	Children prefer those who are yielded to.
1.1	Puppets move in the same direction, one puppet goes first, stops mid way and prostrates toward stage and moves backwards, other puppet moves in front of it.	No preference	Children don't prefer the winning puppet because it (a) remained visible the whole time; (b) remained upright the whole time; (c) traveled farther than the other puppet; (d) moved last; and (e) moved in the same way (same path and posture) in the action phase as it had during the familiarization phase.
1.2A	Replication of Experiment 1.0 except the puppets were both on a top or bottom tier	Puppet who was yielded to	Replicated the finding that children prefer those who are yielded to.

1.2.B	Puppets appear on two tiers, one successfully reaches its goal, one is blocked by a barrier.	No preference	Children's preference does not depend on one puppet reaching its goal.
1.3	Puppet show stops after one puppet rotates toward the ground.	No preference	Children's preference is not elicited when one puppet rotates toward the ground.
1.4	Puppet show stops after one puppet rotates toward the ground and 'yields the way'	Puppet who was yielded to	The winning puppet does not have to go on to reach its goal.
2.0	Winning puppet knocks other puppet backwards	'Losing' puppet (victim)	Children care not only who wins but how they win
2.1	One puppet knocks over a barrier so both puppets can get across the stage	Puppet who knocks over barrier	Children do not avoid any puppet who uses force against something. (It has to be against an agent)

Table 1.1 Summary of results.

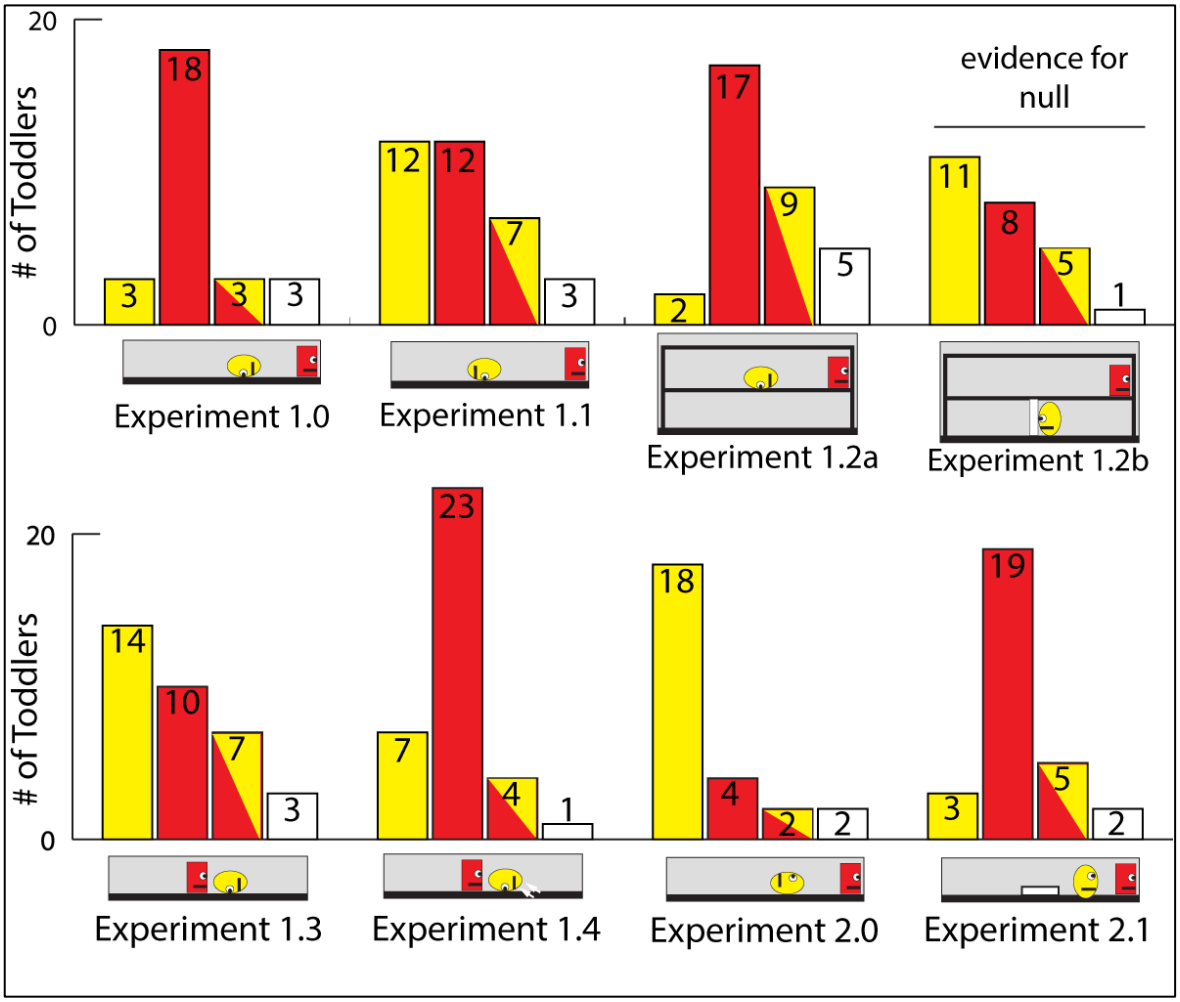

Figure 1.9. Results from all experiments. The picture under each graph depicts the ending positions of the puppets in the puppet show. The white bars represent the number of toddlers who did not reach for either puppet, the two-colored bars depict the number of toddlers who reached for both puppets at the same time.

Discussion

To recap, toddlers ages 21-31 months not only recognize relative social status, but also use that information to form social preferences. They notice and care who wins a conflict, and they care *how* the person wins. In zero-sum conflicts where one individual yields to another, toddlers like the winner (who did not yield) more than the loser who yielded (Exp. 1.0 and 1.2a). Two follow-up experiments showed that in the absence of a

social conflict, toddlers have no preference for the puppet who reaches its goal (Exps 1.1 and 1.2b).

The preference is elicited as soon as one puppet 'yields' (i.e. prostrates toward the ground and move out of the way, Exp. 1.4), although simply prostrating toward the ground without moving out of the way is *not* enough to elicit the preference (Exp. 1.3). This suggests that the act of yielding itself signals a status difference to toddlers, who prefer the higher-status individual.

We also wanted to know whether toddlers' preference for a 'winner' would hold true even when the winner behaved antisocially and used force to get its way. We found that when toddlers saw one puppet win by knocking another one down, they *avoided* the winner (Exp. 2.0). Then we showed that this avoidance was specific to situations where the force was antisocial: A puppet who used prosocial force (to knock down a barrier) was preferred (Exp. 2.1).

In short, toddlers prefer puppets who are yielded to by others, and this preference is not simply for winners over losers: They care not only about who wins, but also about *how* they win. Taken together, these studies are the first to suggest that 21- to 31-month-old toddlers have a preference for high-ranking individuals.

These findings are consistent with much research in adult social psychology. Adults pay more attention to high-status individuals, such as those who are more influential in group decision-making. Adults also like more 'prestigious' individuals (i.e., those who have group influence because they are respected, (Cheng et al., 2013), those who have higher-status jobs (e.g., a CEO versus a plumber) (Dalmaso et al., 2012; Ratcliff, Hugenberg, Shriver, & Bernstein, 2011), and those whose gaze is followed by others (Capozzi et al.,

2016). And adults like winners: The approval ratings of politicians go up right after they win an election(Cohen, 2013), adults tend to affiliate with winners rather than losers (e.g. saying *we* won' and '*they lost*') (Cialdini et al., 1976), and when adults look at novel people who were arbitrarily labeled as high-ranking (as opposed to low-ranking), by experimenters, there is greater activity in the ventral striatum, a brain area associated with monetary reward (Zink et al., 2008).

It is not surprising that adults prefer high-status people. Adults may have learned from experience that it's useful to have 'friends in high places'. They may have developed an explicit preference for high-status individuals because they have observed that affiliating with or paying attention to those individuals yields benefits. A similar explanation could apply to preschoolers who trust high-status individuals—they may already have learned that trusting the testimony of high-status individuals is beneficial, because the high-status people in their world (i.e., adults) tend to provide more accurate information than their peers.

But experience seems like a less plausible source of the preference shown by the barely-linguistic toddlers in our experiments. It is easy to see why adults would prefer high-status people in real life, after a lifetime of seeing them reap and share benefits. It's less easy to explain why toddlers who came into the world as recently as 21 months ago would prefer a puppet who wins in a stripped-down, artificial situation. The toddlers do not stand to gain any real-world benefits from affiliating with the either puppet in our experiments. It suggests that these toddlers have an implicit, intuitive and innate or early-developing preference for high-status individuals *per se.*

This brings us to Exp. 2.0, in which toddlers saw one puppet cross the stage by knocking another puppet out of the way. Here, toddlers *avoided* the 'winning' puppet, preferring the puppet that did not reach its goal because it got knocked down. This suggests that for a puppet to win a conflict and cross the stage is not enough to garner toddlers' approval—the puppet must win because another puppet yields to it.

The fact that toddlers did not like the puppet who used force to get its way may seem at odds with the idea that they prefer high-status individuals. But in fact, this finding is consistent with some of what we know about how social hierarchies function. Using force to get one's way is actually a sign that social hierarchies are unstable (A. P. Fiske & Rai, 2014; Holekamp & Strauss, 2016; Schjelderup-Ebbe, 1935; van Vugt & Tybur, 2014). This is especially true for prestige-based social hierarchies in human societies, where status is defined by the ability to provide benefits to others (A. P. Fiske & Rai, 2014; Henrich & Gil-White, 2001). An individual who uses force to get their way is not benefiting others, so by definition aggressive violence is never a demonstration of prestige-based status. Moreover, in prestige-based hierarchies, authority is freely conferred. So using force to get one's way suggests that one's status is disputed. Consistent with these points, in Exp. 1.4 toddlers preferred a puppet as soon as it was deferred to, even before it had crossed the stage to reach its goal.

A word of caution: Exps. 2.0 and 2.1 do not necessarily prove that prestige-based hierarchy is the right model to apply here. These data can also be reconciled with the dynamics of dominance-based hierarchies. In those situations, the use of force can in some cases mean that status is contested: Individuals fight each other when both think they can win. In a stable hierarchical relationship, there is no need to use violence because the

lower-status individual defers to the higher-status one (Smith & Price, 1973; van Vugt & Tybur, 2014; but see Holekamp & Strauss, 2016). Thus, even if toddlers see the world in terms of dominance-based hierarchies, they might still prefer an individual to whom another voluntarily defers.

Why might toddlers prefer high-status individuals? Our results are consistent with findings from a range of non-human species. For example, as mentioned above, male macaques pay fruit juice to look at pictures of high-status conspecifics (Deaner et al., 2005) and they prefer to ally themselves with higher-status others (Silk, 1999). Several species including dogs, rats, and prairie voles take social status into account when choosing mates (Cafazzo, Bonanni, Valsecchi, & Natoli, 2014; Carr, Kimmel, Anthony, & Schlocker, 1982; Shapiro & Dewsbury, 1986). A general preference for high-status individuals would be adaptive if affiliating with high-status others provided access to resources, support, protection and know-how (A. P. Fiske & Rai, 2014; Henrich & Gil-White, 2001). It is therefore plausible that in highly social species, where individuals can benefit from affiliating with high-status individuals, evolution could select for a preference in their favor. However, this would only make sense in situations where the high-status person was not dangerous, and indeed our results from Exp. 1.0 and 2.0 are consistent with this view.

It should also be noted that the toddlers in our study had recently become able to walk, talk (at least a little bit) and interact with similar-age peers. Status may become a salient social dimension for toddlers when their social world broadens from just caregivers to include other children with whom they might compete for attention, food, space or other resources. This is consistent with observations of daycare centers, which suggest that social hierarchies form among toddlers as young as 18 months, and that higher-ranking

toddlers are often sought-after play partners (Hawley, 1999). An important next step will be to find out whether infants younger than 21 months also show a preference for high-status individuals (see Chapter 1). It seems unlikely that these barely-linguistic toddlers have learned through experience that affiliating with high-status individuals is beneficial, but there could well be a developmental change that makes status more salient as toddlers start to interact with peers.

These proposals should be considered in light of recent studies with bonobos, an ape that is considered to be highly socially tolerant (Hare, Wobber, & Wrangham, 2012). Bonobos seem to prefer dominant individuals, even when they are aggressive: They prefer novel individuals who push others out of a territory, and they also prefer individuals who hinder others over those who help others (Krupenye & Hare, 2018). The fact that the human toddlers in our studies only preferred those who won zero-sum conflicts when they were deferred to suggests that humans might be attuned to different aspects of social hierarchy than bonobos—humans might care more about status that is freely conferred and based on providing benefits (A. P. Fiske, 1992; Henrich & Gil-White, 2001).

It is also interesting to compare these findings to research showing that infants prefer helpers over hinderers (Hamlin et al., 2007). In our Exp. 2.1, toddlers preferred the puppet who knocked down a barrier, allowing itself and another puppet to reach their common goal. This preference is consistent with the Hamlin findings, and may constitute the first independent conceptual replication of those findings. This is important, given that not all attempts to replicate the original findings have succeeded, raising questions about the robustness of the phenomenon (Salvadori et al., 2015)).

We did not set out to replicate Hamlin (2007), and indeed our experiments differed from those in several important respects: First, in our Exp. 2.1, toddlers preferred an individual who helped another reach its goal, even when the action also benefited the helper. (In Hamlin's design, the action does not benefit the helper). Similarly, in our Exp. 2.0, toddlers disliked a puppet who used physical force to 'hinder' another from reaching its goal, which is clearly consistent with Hamlin's finding that toddlers dislike hinderers (or antisocial actors in general).

Viewed from a different angle, however, these findings diverge from Hamlin's (2007). In Exps 1.0 and 1.2a, the puppet that yields could be seen as 'helping' the other puppet reach its goal. If toddlers viewed this scene in terms of helping and hindering, and if they like helpers, then they should prefer the puppet who yielded—but they didn't. This suggests that either toddlers prefer hinderers (which seems unlikely) or that they did not construe the scene in terms of helping and hindering.

To us, the simplest explanation is that that toddlers are not only sensitive to prosociality (i.e., helping or hindering), but also to social status. The degree to which they evaluate individuals by one yardstick or the other probably depends on many factors: The specifics of the scene, the age of the toddlers, etc. In our Exps 1.0 and 1.2a, toddlers liked the higher-status individual (i.e., the winner) more than the lower-status individual. Thus in those scenes, viewed by those toddlers, social status was more salient than prosociality.

Taken together, the results of the seven experiments presented here suggest that when toddlers ages 21 to 31 months witness a zero-sum conflict between two novel individuals, they not only make inferences about the social status of those individuals, but also form preferences based on that status: They like the high-status individual more than

the low-status one. We followed up with several experiments to test other explanations, showing that the preference was not just for a puppet who successfully reached its goal, crossed the stage, remained upright, remained visible, traveled farther, etc. We also found that toddlers do not like *all* winners; specifically, they do not like a puppet who wins by knocking another one down. Thus, toddlers not only care who wins, but also *how* they win. These results suggest that toddlers evaluate others based on social rank in ways that differ qualitatively from our nearest primate relatives.

CHAPTER 2

Infants Prefer Those Who Yield In A Conflict

Ashley J. Thomas & Barbara W. Sarnecka

Abstract

Humans quickly and automatically evaluate others. Two salient factors involved in these evaluations are social status (i.e. a person's position in a social hierarchy), and pro-sociality (i.e. cooperativeness or helpfulness). Infants as young as six months evaluate others based on pro-sociality, preferring helpers over hinderers. They also recognize social rank—expecting smaller individuals or individuals from smaller groups to yield in zero-sum conflicts. But whether infants evaluate others based on rank is unknown. In the present experiments, infants were shown puppet shows where two puppets had conflicting goals. In four experiments, we find that infants prefer (i.e. reach for) a puppet who yields in a conflict. Five other experiments rule out alternative explanations.

Infants prefer those who yield in a conflict

Social evaluation is an inevitable part of human life: humans are constantly and automatically evaluating others (Ambady & Rosenthal, 1992; Greenwald et al., 1998; Todorov, Mandisodza, Goren, & Hall, 2005; Winter & Uleman, 1984). These evaluations are thought to be important because our wellbeing depends on the social relationships we create and maintain. Two aspects of human social life are cooperation (Tomasello & Vaish, 2013; Tooby & Cosmides, 2005) and social hierarchy (Smith & Price, 1973; van Vugt & Tybur, 2014). Thus, it is unsurprising that two major dimensions upon which people evaluate each other are pro-sociality (i.e. the tendency to cooperate or help others) and social status (i.e. an individual's position in a social hierarchy) (e.g. S. T. Fiske, Cuddy, & Glick, 2007).

Adults value both social status and pro-sociality. For example, adults prefer individuals who have high status, as well as individuals who possess more resources (Cheng et al., 2013; Cialdini et al., 1976; S. T. Fiske et al., 2007; Horwitz & Dovidio, 2015; Todorov et al., 2005). On the other hand, adults also prefer individuals who help others to achieve their goals, over those that do not (S. T. Fiske et al., 2007; Jensen-Campbell, Graziano, & West, 1995; Trivers, 1971). However, it is unclear whether either of these motives are 'primary' or more important in people's social evaluations, especially when they are at odds (Van Berkel, Crandall, Eidelman, & Blanchar, 2015).

Infants Prefer Prosocial Others

Infants as young as 6-months prefer prosocial agents over antisocial ones. For example, Hamlin and colleagues (Hamlin, Wynn, & Bloom, 2007; Hamlin, Wynn, Bloom, & Mahajan, 2011) demonstrated that infants prefer those who help others achieve their goals

and avoid those who hinder others from achieving their goals. In this study, infants saw two scenes: in one scene, a puppet tried, but failed to reach the top of a hill, and another puppet helped the struggling puppet by pushing it up the hill. The other scene was similar except that the struggling puppet was hindered by another puppet who pushed it down the hill. When presented with the helper and hinderer, infants who were 6 months old preferred (i.e. they reached for) the helper over the hinderer (Hamlin et al., 2007). Moreover, they also preferred a neutral puppet over the hindering puppet. Thus, very young infants seem to prefer those who help and avoid those who hinder.

Infants Recognize Dominance

There is also evidence that very young infants have expectations about social rank. In dominance hierarchies, individual rank is determined by one's ability to inflict harm on others. Thus, more formidable individuals, such as those who are larger or have more allies are higher ranked. Yielding is a cue to social status, because those who are less formidable yield resources or territory to those who are more formidable to avoid potentially costly conflicts (van Vugt & Tybur, 2014). Both infants and even non-human animals such as fish, birds, and apes can infer social rank (Grosenick et al., 2007; Paz-Y-Miño C et al., 2004; Sapolsky, 2004). Infants infer rank based on formidability: when two individuals have conflicting goals, six-month-old infants expect those from larger groups to be deferred to (Pun et al., 2016) and 10-month-old infants expect physically larger individuals to be deferred to (Thomsen et al., 2011). Ten to 13-month-old infants expect relative-rank to be transitive (i.e., they expect that if A outranks B, and B outranks C, then A will outrank C) (Gazes et al., 2015; Mascaro & Csibra, 2014) and 15-month-olds expect that those who have displayed dominance in the past (e.g. by getting a desired resource) will win a new

dominance contest against the same opponent (e.g. by controlling territory) (Mascaro & Csibra, 2012).

Do infants evaluate those in zero-sum conflicts?

Here, we explore whether infants prefer the puppet who 'wins' or yields in a zero-sum conflict. As summarized above, we know from previous studies that infants evaluate individuals they see interacting with one another. We also know that they expect those with less fighting power (either because they are smaller or have fewer allies) to yield in such a conflict. Here we were interested in how infants feel about the individuals in a conflict—when the puppets are equally sized, do they prefer the one who yields or the one who prevails?

Reasonable arguments could be made in support of either prediction. On the one hand, infants may like the winners of zero-sum-conflicts. This would be in line with the preferences of some primates and human toddlers (see Chapter 1). For example, male macaques will pay juice in order to see high-ranking others (Deaner et al., 2005). Bonobos also seem to like dominant individuals—they prefer hinderers to helpers, and when shown an animation where two same-sized animations are in a zero-sum conflict, and one yields, they like the one who 'wins' the dominance contest (Krupenye & Hare, 2018). Human adults also pay more attention to and like those who have more influence in group decision making, at least when this occurs because of respect and not fear (Cheng et al., 2013). They also pay more attention to those who have higher-status jobs (a CEO versus a plumber) (Dalmaso et al., 2012; Ratcliff et al., 2011), and those whose gaze is followed by others (Capozzi et al., 2016).

On the other hand, it is also plausible that infants will prefer the yielding puppet. This would be in line with studies showing that infants prefer prosocial agents. Moreover, there is one study suggesting that infants prefer 'victims' over 'bullies'. In this study, infants were shown animations of two shapes with self-generating motion (infants tend to see things with self-generating motion as 'agents', see Carey, 2009 for review). In the animation, one of the shapes repeatedly bumps against the other, even squishing it against a wall. When the infants were presented with the two shapes from the animation, they tended to choose the shape that corresponded to the 'victim' over the one that corresponded to the 'bully' (Kanakogi et al., 2013). Thus, infants seem to avoid aggressive individuals.

Infants may also avoid the winner of a zero-sum conflict because of an inclination to avoid dominant individuals. This would agree with studies which show that for many species, subordinates avoid or withdraw from dominant individuals to avoid provoking aggression (Goodall, 1986; Henrich & Gil-White, 2001; Oliveira et al., 1998). Indeed, wolves in captivity experience high levels of stress because they are unable to avoid dominant wolves (Sapolsky, 2004). And in some circumstances, adult humans fear those who have more decision-making power (Cheng et al., 2013).

In this experiment we were interested in how infants feel about those who win or lose zero-sum conflicts (i.e. conflicts with one winner and one loser). In our first experiment infants saw a live puppet show based on the animations used by Thomsen and colleagues and Pun and colleagues, which showed that infants expect larger individuals or individuals from larger groups to win zero-sum conflicts. Here, the puppets were the same size and we ask which one (if any) the infants prefer.

General Methods

Materials

The puppet stage used in all experiments was 75 cm tall, 32.5 cm deep, and 95 cm long. It sat on a folding table covered with black fabric. There were black curtains hanging at the left and right sides of the stage, and a black curtain was used to cover the stage between scenes. Another black curtain behind the stage hid the experimenter who was manipulating the puppets. In all the experiments (except Experiment 4), the puppets were 12.5cm tall and made of polymer clay. They each had one plastic craft eye (with a fixed pupil so that the puppet always seemed to be looking straight ahead) and a black rectangle for a mouth (which was black electrical tape). One puppet was a yellow oval and one was a red square (except in Experiment 6 where one was an orange triangle and one was a green hexagon). The puppets were moved by means of black wooden dowels. After the puppet show, two puppets identical to those used in the puppet show were presented to the infant. In Experiment 4, we used two plush puppets (a dinosaur and a monkey puppet) that were 25 cm tall.

Procedure

Participants were recruited from the floor of a children's museum during regular business hours. Experimenters greeted parents and asked if they would like to hear about an experiment on infant's understanding of social relationships. Parents who agreed were given the consent form to fill out while the experimenter interacted with the infant before leading the parent and infant to the testing room. The testing room was a large room off the main floor of the museum. Before entering the testing room, parents were briefed about the

procedure. They (and any other people with them such as siblings) were asked to remain quiet during the puppet show and to close their eyes during the choice procedure.

The participating infant sat on their parent's lap. The puppet show consisted of a familiarization phase and an action phase. During the familiarization phase, infants saw one puppet alone on stage, cross in opposite directions. Infants saw the first puppet cross the stage until they looked away for at least half of the sequence. Then, the infant saw the other puppet cross the stage the same number of times. Then, the action phase was shown to the infant until they looked away for more than half of the sequence. One experimenter, standing behind the stage and occluded from view, acted as the puppeteer. A second experimenter who was blind to the condition (i.e., could not see what the puppets were doing onstage) stood to the side of the stage and opened and closed the curtain between segments, saying "Down goes the curtain!" or "Up goes the curtain!" each time.

In all experiments, one puppet at a time was visible during the familiarization phase and both puppets were visible during the entire action phase. The directions traveled by the puppets (coming from stage right or stage left) were counterbalanced, as was the order in which they crossed the stage and the specific puppet assigned to play each role. We also counterbalanced which side the puppets were presented—for example in Exp. 1 half of the time the 'winner' was on the left and half of the time it was on the right.

Experiment 1: One puppet Prevails, one puppet yields

In this experiment, infants watched a puppet show based on animations used in previous studies (Pun, Birch, & Baron, 2016; Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011). It began with a familiarization phase to establish the goals of the puppet, where each

puppet appeared alone on stage and crossed the stage twice. This was repeated until the infants looked away for at least half of the sequence (always at least 3 times and no more than 10 times). Next, the two puppets appeared on opposite sides of the stage and tried to cross at the same time. Upon colliding, both puppets backed up and tried again, meeting again in the middle. This action phase (with the puppets colliding and backing up) was repeated 5 times. Then the puppets approached one another but stopped before meeting, and one puppet 'yielded' (bowed down and moved aside). The other puppet passed in front of the bowing puppet and continued on to the other side of the stage (see Fig. 1). This action phase, with the puppets appearing together on stage, was repeated until the infant looked away for more than half of the sequence.

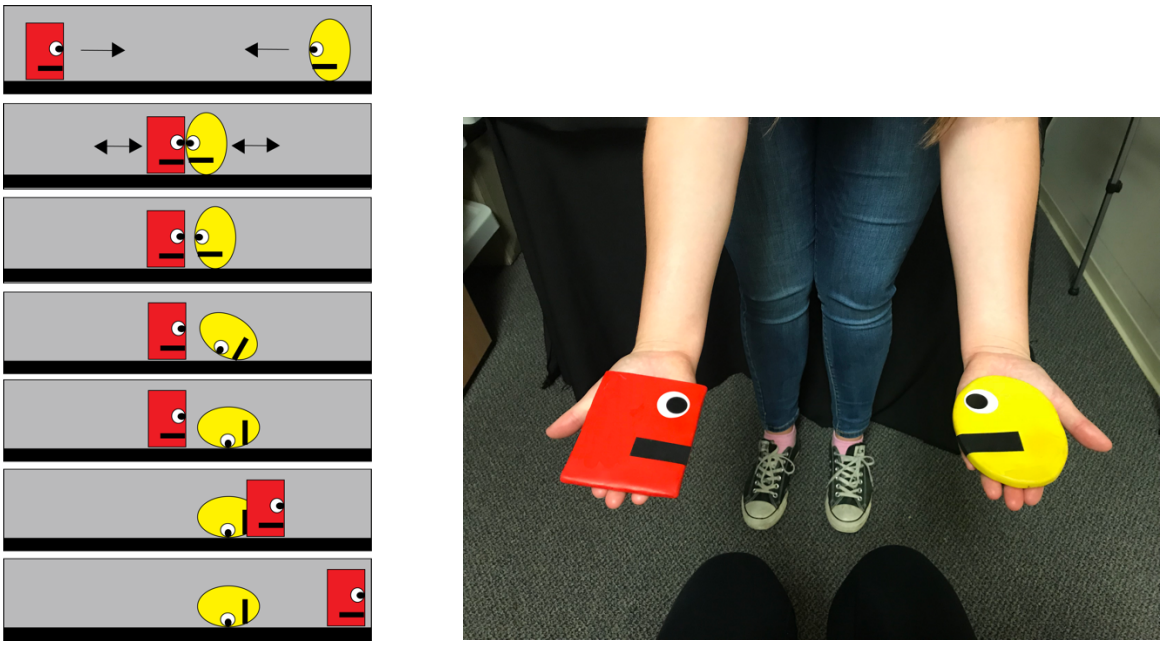

Figure 2.1 [Left Panel] Diagram showing the test phase of the puppet show in Exp. 1. [Right Panel] Photograph showing the choice procedure.

Participants

We tested 39 infants ages 10 to 16 months (*Range:* 316-516 days, *Mean*=437 days, *SD*= 61days). Fifteen parents indicated their child was a boy, 24 parents indicated their child was a girl. Sixteen of these infants were excluded from the analysis for the following reasons: 6 of the infants chose both puppets at the same time, 3 infants failed to choose either puppet, 5 were excluded because of interference (the parent or sibling touched one of the puppets, or talked excessively throughout the puppet show), and in 2 trials the infant became overly fussy so the experiment was stopped short. This exclusion criteria was decided before testing based on previous experiments with toddlers (see Chapter 2).

Results

Of the 23 infants that were included in the analysis, 20 chose the puppet who bowed down and moved out of the way for the other puppet (two-sided binomial test $p<.001$, Bayes Factor of 106 meaning that the data was 106 times more likely given the alternative hypothesis, that infants were choosing one puppet more or less than 50% of the time, than given the null hypothesis that they were choosing one puppet 50% of the time, which is considered strong evidence). (See Figure 2.9)

Experiment 2 –'Bow' Only

In the first experiment, we found that infants prefer a puppet who yields to another puppet. In this experiment we wanted to investigate whether infants simply avoided any puppet who made the 'bowing' motion that was in Experiment 1. Thus, in Experiment 2, we showed infants a puppet show in which neither puppet reaches its goal. The puppet show

was the same as the puppet show in Experiment 1, but this time it ended after one puppet bowed.

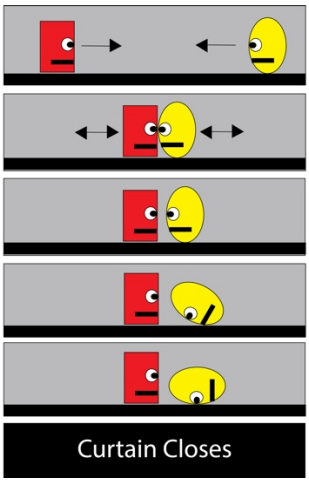

Figure 2.2 Diagram showing test phase for Experiment 2

Participants

We tested 53 infants ages 10 to 16 months (*Range:* 312-517 days, *Mean*=418 days, *SD*= 55 days). 24 parents indicated their child was a boy, 29 parents indicated their child was a girl. 19 of these infants were excluded from the analysis for the following reasons: 8 of the infants chose both puppets at the same time; 7 infants failed to choose either puppet; 1 of the experiments were stopped because of extreme fussiness; 2 child's data was excluded because of experimenter error (The upright puppet completed its goal in just one of the action phases); 1 child's data was excluded because the parent interfered in their child's choice.

Results

Of the 34 infants that were included in the analysis, 24 chose the upright puppet who did not make the bowing motion (two-sided binomial test p=.024, Bayes Factor of 4.73

in favor of the alternative hypothesis that infants were choosing one of the puppets more than 50% of the time). That is, there we found moderate amount evidence that infants preferred the puppet who remained upright (See Figure 2.9). This experiment ruled out the possibility that infants avoid any puppet who makes a 'bowing' motion toward the ground after colliding with another individual. In fact, when the puppet show is stopped after the bowing motion, infants seem to prefer puppet who ends the show in an upright position. Note, this positive finding should be taken with caution because it was not one that the experimenters anticipated.

Experiment 3: Clearing the Path (Bow-Move)

The findings from Experiment 2 suggest that infants do *not* prefer any puppet who makes a 'bowing motion'. In fact, in the absence of one puppet reaching their goal, they seem to prefer a puppet who remains upright. In Experiment 3, we wondered if the reason why infants may have chosen the upright puppet in Experiment 2 (in which the puppet show ended right after the puppet made the bowing motion) was because infants see the 'bowing' puppet as 'falling forward' instead of making a motion that denotes yielding. In the previous experiment we stopped the puppet show after the puppet bowed, but before it moved aside—thus the prevailing puppet did not reach its goal, but the yielding puppet also didn't really yield the way. We thought a better way to investigate whether the 'winning' puppet actually had to go on to achieve its goal in order for the infant to prefer the yielding puppet, was to instead stop the puppet show after one puppet 'bows' and then moves out of the way, but before the winning puppet crosses in front of the bowing puppet.

Thus, in this puppet show it ended before the upright puppet crosses in front of the 'bowing' puppet but after the 'bowing' puppet moves aside, clearing the pathway. It also tests the possibility that infants avoid the last puppet that moves (which was not ruled out by the first two experiments). It should be noted that Experiments 3 and 4 were conducted in the same session—each infant saw two puppet shows with the choice procedure following each puppet show. Half of the infants saw Experiment 3 first, half saw Experiment 4 first.

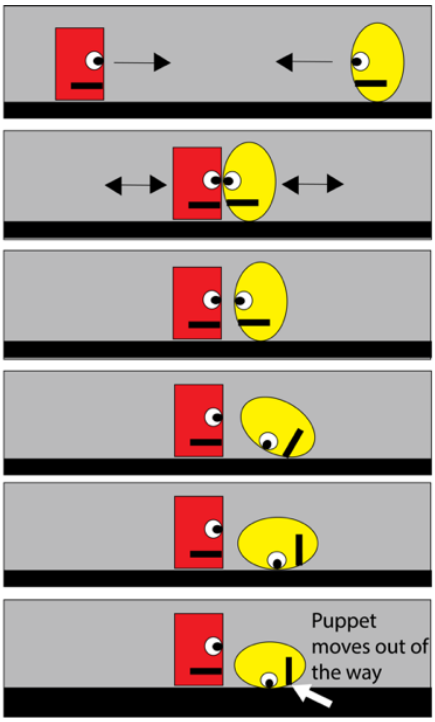

Figure 2.3 Diagram depicting test phase for Experiment 3

Participants

We tested 26 infants ages 10 to 16 months (*Range:* 312-512 days, *Mean*=391 days, *SD*= 64 days). Sixteen parents indicated their child was a boy, 10 indicated that their child

was a girl. Six infants were excluded from the analysis: 1 child grabbed both puppets, 2 fussed out, one baby did not watch the puppet show, and 2 didn't make a choice.

Results

Of the 20 infants that were included in the analysis, 17 chose the puppet who bowed down and moved out of the way (p=.003 BF=28.11 in favor of the alt. hypothesis). Thus, it seems infants prefer a puppet who 'clears the path' for the other puppet, even when the other puppet does not go on to reach its goal (See Figure 2.9).

Experiment 4: Conflict over a rattle

In experiment 4, we wanted to see whether infants would prefer a yielding puppet in a different context. Here, we used two plush hand puppets. One of the puppets was green and looked like a dinosaur, the other was brown and looked like a monkey (we chose puppets that were visually distinct to encourage infants to track their individual behavior). First came the familiarization phase—we showed infants a sequence to establish the goals of the puppets. Each puppet appeared alone on stage with a rattle sitting in the center of the stage. Then, the puppet approached the rattle, moved back to its starting position on the side of the stage, and shook the rattle up and down, which resulted in the rattle making a chiming noise. This was repeated until the baby looked away from the scene for more than half of the scene's length. Next, the other puppet appeared alone on the other side of the stage, and the sequence repeated with the new puppet (the same number of times as the first puppet).

Next, came the action phase. Both puppets appeared on stage at the same time on opposite ends. Again, the rattle rested in the center of the stage, between the two puppets.

The puppets then approached the rattle at the same time, picked up the rattle together, and swayed back and to depict a struggle over the rattle. Then, the puppets put down the rattle (at the same time) backed up and moved up and down. This was repeated three times. Next, both puppets approached at the same time, but this time did not pick the rattle up. The sequence ended when the 'yielding' puppet backed away and moved its head down slightly and the other puppet picked up the rattle, went back to the side of the stage, and shook it up and down. This entire sequence was repeated until the infant looked away from it for more than half of the sequence.

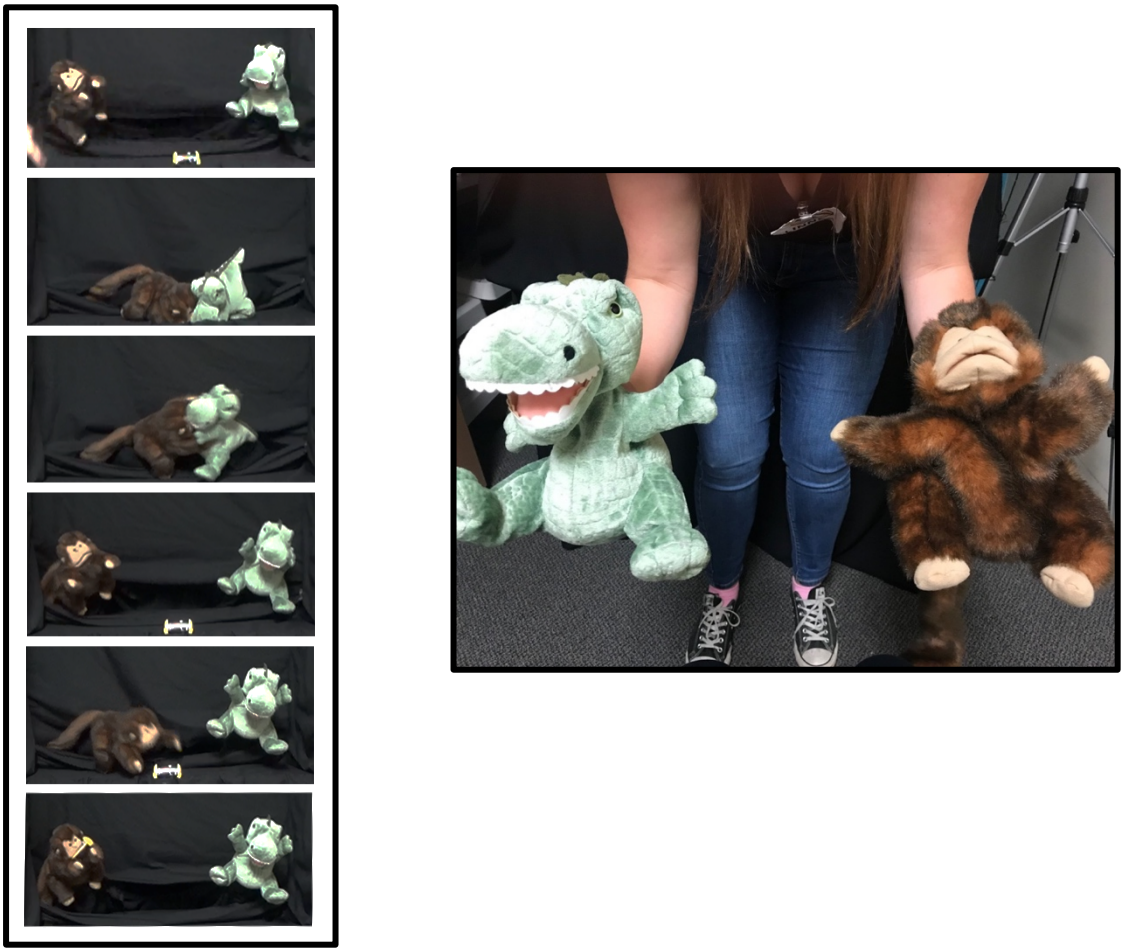

Figure 2.4 [Left Panel] Still photographs taken from a video of the test phase in Experiment 4. [Right Panel] Choice procedure.

Participants

The participants in Experiment 4 were the same infants as in Experiment 3. Of the 26 infants we tested, nine infants were excluded in this experiment--three were excluded because of experimenter error (in one case, the puppeteer moved the puppets in the wrong way such that the 'winning' puppet returned the rattle to the center of the stage, at the end of one of the action sequences, in the other case the action phase did not include one of the puppets 'winning' the rattle (the curtain went up after the struggle); and in one case the puppeteer switched which puppet 'won' in different repetitions of the action phase); 3 were excluded because they failed to make a choice, 2 were excluded because they chose both puppets at the same time, and 1 was excluded because the infant got overly fussy and the experiment was stopped early.

Results

Of the 17 remaining infants, 15 chose the 'losing' puppet. That is, they chose the puppet who yielded to the other after struggling over the rattle (p=.002 BF=28.78 in favor of the alt. hypothesis). Thus, it seems that infants prefer a yielding puppet even in a different context, when the zero-sum conflict is over a rattle (See Figure 2.9).

Experiments 5: Replication of Experiment 1

In Experiment 5, we wanted to see whether the results from Experiment 1 would replicate. Experiments 5 and 6 were conducted in the same session—each infant saw two puppet shows with the choice procedure following each puppet show. Half of the infants saw the puppet show for Experiment 5 first, half saw the puppet show for Experiment 6

first. In Experiment 5 we always used an orange triangle and a green hexagon, and in Experiment 6 we always used a red square and a yellow oval. In Experiment 5 the puppet show was identical to Experiment 1 but we used different shapes.

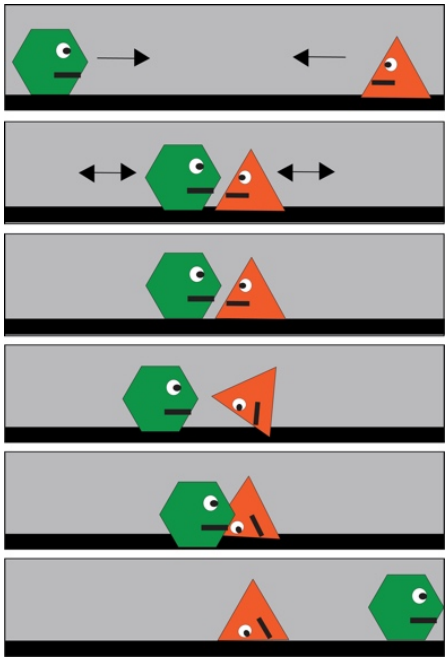

Figure 2.5 Diagram depicting the action phase used in Experiment 5

Participants

We tested 33 infants ages 10 to 16 months (Range: 306-432 days, Mean=407 days, SD= 54 days). 15 parents indicated their infant was a boy, 20 parents indicated their child was a girl.

Results

15 of these infants were excluded from the analysis (6 infants chose both, 3 chose neither, 3 were excluded because of experimenter error--in one case the puppets were presented to the child upside down, in another case the curtain went up before the puppets had been reset, and in another case one of the puppets was oriented incorrectly, and 2

were stopped early because the infant became overly fussy. Of the 18 infants that were included in the analysis, 16 chose the puppet who 'bowed' down and moved out of the way for the other puppet (two-sided binomial test p=.001; Bayes Factor of 45.23 in favor of the alternative hypothesis that infants were choosing one of the puppets more than 50%). That is, we again found strong evidence that infants preferred the puppet who yielded the way for the other puppet(See Figure 2.9).

Experiment 6: Bowing After Hitting a Barrier

In Experiment 6, we wanted to further clarify the results from Experiment 2, where infants preferred an upright puppet when the other puppet 'bowed' but did not clear the path. Here we looked at whether infants would still avoid a puppet who makes the bowing motion, and then stops, when no social interaction occurred. To do this, we showed infants a puppet show where the two puppets appeared on two different levels. First, to establish the goals of the puppets, we showed each puppet alone on stage, crossing on one of the level (the puppets appeared on different levels). Then, the puppets appeared at the same time (again on different levels) but now there were barriers blocking their pathway. The puppets approached and retreated from the barriers, making the same meet and retreat motions in the other studies. The puppet show ended when both puppets approached the barrier and one puppet prostrated and stopped in the prone position, making the same 'bowing motion' as in Experiment 2.

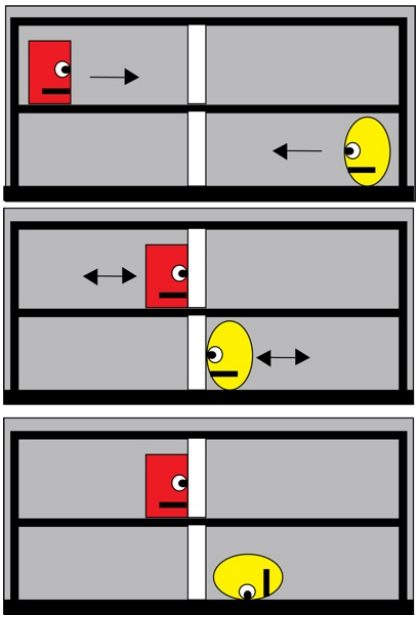

Figure 2.6 Diagram depicting action phase of Experiment 6

Results

Of the 33 infants we tested, 16 were excluded from the analysis (5 infants chose both, 2 chose neither, 3 experiments were stopped because of fussiness, and 4 were excluded because of Experimenter Error—in one case the puppets were presented to the infant upside down, in another one of the puppets was oriented incorrectly, in another the puppets were presented to the infants upside down, and in another, during the action phase the puppeteer switched the roles of the puppets; and 2 were excluded because a parent or sibling interfered with the infant's choice). Of the 17 infants that were included in the analysis, 15 chose the puppet who remained upright (two-sided binomial test p=.002; Bayes Factor of 28.78 in favor of the alternative hypothesis that infants were choosing one of the puppets more than 50%). That is, we again found evidence (this time strong

evidence) that infants preferred the puppet who remained upright when one puppet makes the prone motion and stops moving (See Figure 2.9).

Experiment 7: Yielding Puppet Reaches its goal

The findings from Experiment 3 suggest that infants prefer a puppet who 'bows' and clears a path for the 'winning' puppet, even when that puppet does not cross the stage to reach its goal. Here, in Experiment 7 we tested whether infants' preference for the 'losing' puppet depended on the losing puppet *not* reaching its goal. Here, the puppet show began the same way that Experiments 1,2,3, and 5 start—first the two puppets, alone on stage crossed, then the two appeared together on stage, blocking one another's pathway. Here one puppet 'bowed' and moved aside to let the other puppet crossed in front of it to reach the other side of the stage. However, then, the yielding puppet 'stood up' and went on to cross the stage. Thus, the yielding puppet still helped the other puppet reach its goal, but also was able to reach its own goal.

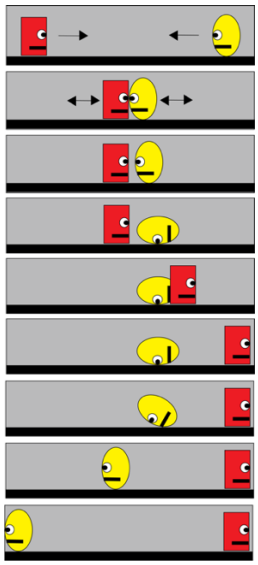

Figure 2.7 Diagram of action phase in Experiment 7.

Participants

We tested 56 infants ages 10 to 16 months (*Range:* 304-505 days, *Mean*=387 days, *SD*= 50 days). 21 parents indicated their child was a boy, 35 parents indicated their child was a girl. 27 of these infants were excluded from the analysis (N=27; 15 of the infants chose both puppets at the same time; 10 infants failed to choose either puppet, and 1 due to interference by a sibling, 1 infant was excluded because of developmental delays).

Results

Of the 29 infants that were included in the analysis, 15 chose the puppet who bowed down and moved out of the way for the other puppet (two-sided binomial test p=1.0 Bayes Factor of 2.36 in favor of the null hypothesis that infants were choosing one of the puppets 50% of the time). That is, we found positive evidence that infants did not prefer either the puppet that yielded the way or the one that did not. It should also be noted that in this experiment, infants were just as likely to choose 'both' puppets as they were to choose one puppet or another, and many infants did not choose a puppet. We think this likely reflects infants' lack of preference (See Figure 8).

Experiment 8: Controlling for Low-Level Explanations (In progress)

In this experiment we wanted to investigate several alternative explanations as to why infants seem to prefer yielding puppets including (1) they avoid any puppet who completes its goal of crossing the stage, (2) they avoid any puppet who was never occluded, (3) they avoid a puppet who remains upright during the whole puppet show (4) they like a puppet that does something different during the two sequences. During the familiarization sequence first one puppet appeared alone on stage and moved across the stage. Then, the

other puppet appeared alone on stage and moved across the stage in the same direction. During the action phase the puppets appeared on the same side of the stage. Then, one puppet moved to the center of the stage, and made the 'bow and yielding motion' that we used in experiments 1, 3, and 5. Then, the other puppet crossed in front of it to reach the other side of the stage. Thus, this experiment had many of the same elements as previous experiments: one puppet was occluded, one puppet stopped and made the 'bow and yield' motion in the center of the stage, only one puppet made it all the way across the stage etc, but it did not depict a conflict between the two puppets.

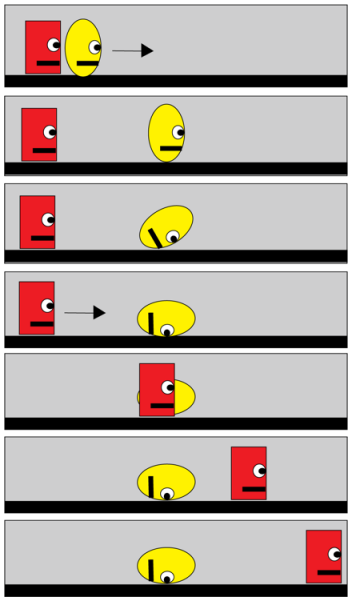

Figure 2.8 Diagram of action phase in Experiment 8.

Participants

So far, we have tested 34 infants ages 10 to 16 months (*Range:* 301-500 days, *Mean*=414 days, *SD*= 57.79 days). 17 parents indicated their child was a boy, 17 parents indicated their child was a girl. 16 of these infants were excluded from the analysis (N=16;

11 of the infants chose both puppets at the same time; 3 infants failed to choose either puppet, and 1 experiment was stopped short because the infant became overly fussy).

Results

Of the 18 infants that were included in the analysis so far, 14 chose the puppet who bowed down and moved out of the way for the other puppet (two-sided binomial test p=.038. Bayes Factor of 4.34 in favor of the alt hypothesis that infants were choosing one of the puppets more than 50% of the time, which is considered moderate evidence). That is, we found positive evidence that when there is no conflict, infants prefer the puppet who makes it all the way across the stage. It should be noted how many children chose both puppets (N=11), which may indicate that their preference is for the puppet who crosses the stage all the way, instead of an aversion for the puppet who bows in the middle of the stage. In any case, we will collect more data until we get a stronger Bayes Factor.

Experiment 9: Plush Puppet Control (In Progress)

In this experiment we wanted to investigate alternative explanations for the findings in Experiment 4, where infants preferred the puppet who yielded the rattle to the other puppet. We wanted to rule out the possibility that infants may have disliked the puppet who shook the rattle more frequently than the other puppet, infants may have preferred any puppet who makes a slight 'bowing' motion, or infants may avoid the last plush puppet that moves. To investigate these possible alternative explanations, we showed infants a puppet show that was very similar to Experiment 4, except that only one puppet had access to the rattle, thus there was no conflict. Just as in Experiment 4, during the familiarization phase we established the goals of the puppets: first, one puppet, alone

on stage approached the rattle and shook it. This was repeated until the infant looked away for more than half of the sequence. Then, the other puppet appeared alone on stage, approached the rattle and shook it. This was repeated the same number of times as the first sequence. Then, during the action phase both puppets appeared on either side of the stage, with a barrier between them and the rattle just to one side of it. Then, the puppets made the same motions as in Experiment 4. First, they both approached the front center of the stage (where the rattle was). Then, the puppet who had access to the rattle picked it up. Then the puppets moved back and forth, mimicking the motions in Experiment 4. Then the two puppets approached the front center stage and the puppet holding the rattle set it down. This was repeated three times. Then, both puppets approached the front center part of the stage one last time, but this time, one puppet backed up, put its head slightly down, and the other puppet picked up the rattle and shook it. (Again mimicking the motions made by the puppets in Experiment 4).

Participants

The participants for this study were the same as for Study 8. So far, we have tested 34 infants ages 10 to 16 months (*Range:* 301-500 days, *Mean*=414 days, *SD*= 57.79 days). 17 parents indicated their child was a boy, 17 parents indicated their child was a girl. 16 of these infants were excluded from the analysis (N=13; 4 of the infants chose both puppets at the same time; 6 infants failed to choose either puppet, 1 was excluded because the experimenter knocked over the barrier during the action phase, 1 due to interference from a sibling, and 1 due to fussiness).

Results

Of the 20 infants that were included in the analysis so far, 14 chose the puppet who ended the puppet with a rattle (two-sided binomial test p=.11. Bayes Factor of 1.64 in favor of the alt hypothesis that infants were choosing one of the puppets more than 50% of the time, which is considered moderate evidence). That is, we have inconclusive evidence about whether infants prefer one of the puppets or are choosing randomly. In any case this does rule out the possibility that children do not *avoid* a puppet that shakes a rattle, and do not seem to prefer any puppet who does not end the puppet show with its desired object, since if anything infants seem to prefer the puppet that gets the rattle in this experiment.

Exp.	Description	Infants' Preference	Conclusions
1	One puppet wants to cross the stage from right to left, one wants to cross from left to right. They collide in the middle, until one puppet 'yields the way' (bows down and moves aside). The other puppet crosses in front of it to the other side of the stage.	Yielding puppet	Infants prefer a puppet who yields in a zero-sum conflict
2	Same as Exp. 1, but the puppet show ends after one puppet makes the 'bowing' motion.	Upright puppet	Infants don't like puppets who ends the puppet show prone.
3	Same as Exp. 1, but the puppet show ends after one puppet makes the 'bow-yield' motion (i.e. bowing and then clearing the path) but before 'winner' crosses in front of it.	Yielding Puppet	Infants' preference in Exp. 1 is elicited as soon as one puppet yields the way. It does not depend on the winning puppet reaching its goal.
4	Two plush puppets struggle over a rattle, one yields	Yielding Puppet	Conceptual replication of the finding that infants prefer the puppet who yields in a zero-sum conflict
5	Replication of Exp. 1 with different shapes/colors	Yielding Puppet	Replication of the finding that infants prefer the puppet who yields in a zero-sum conflict
6	Two puppets appear on different tiers and are blocked by barriers. They make the same motions as in Exp. 1 but against a barriers instead of against each other. The puppet show	Upright Puppet	Infants don't like any puppet who ends the puppet show prone.

	ends after one makes the bowing motion.		
7	Yielding puppet 'stands up' after yielding and crosses the stage to reach its goal.	At chance	Infants' preference depends on only one puppet reaching its goal. Also shows that infants don't prefer any puppet who is obscured during the puppet show, or any puppet who makes the 'bow yield' motion during the puppet show.
8	Puppets move in the same direction. One stops and makes the 'bowing yielding' motion in the middle of the stage, the other passes in front of it.	(Preliminary) Prefer the puppet who makes it across	Shows that infants *don't* prefer any puppet who 1. Is occluded 2. Stops in the middle 3. Makes the bow-yield motion 4. Moves in a different way
9	Plush puppets move in the same way as in experiment 4, but only one has access to the rattle. Thus, everything is the same except the two puppets don't have a conflict over the rattle.	(Preliminary) Infants don't prefer the puppet that ends the show *without* the rattle.	Infants *don't* prefer any puppet who 1. Does not end the show with its desired object. 2. Does not make noise with the rattle 3. Makes a slight 'bow' motion

Table 1. Summary of results.

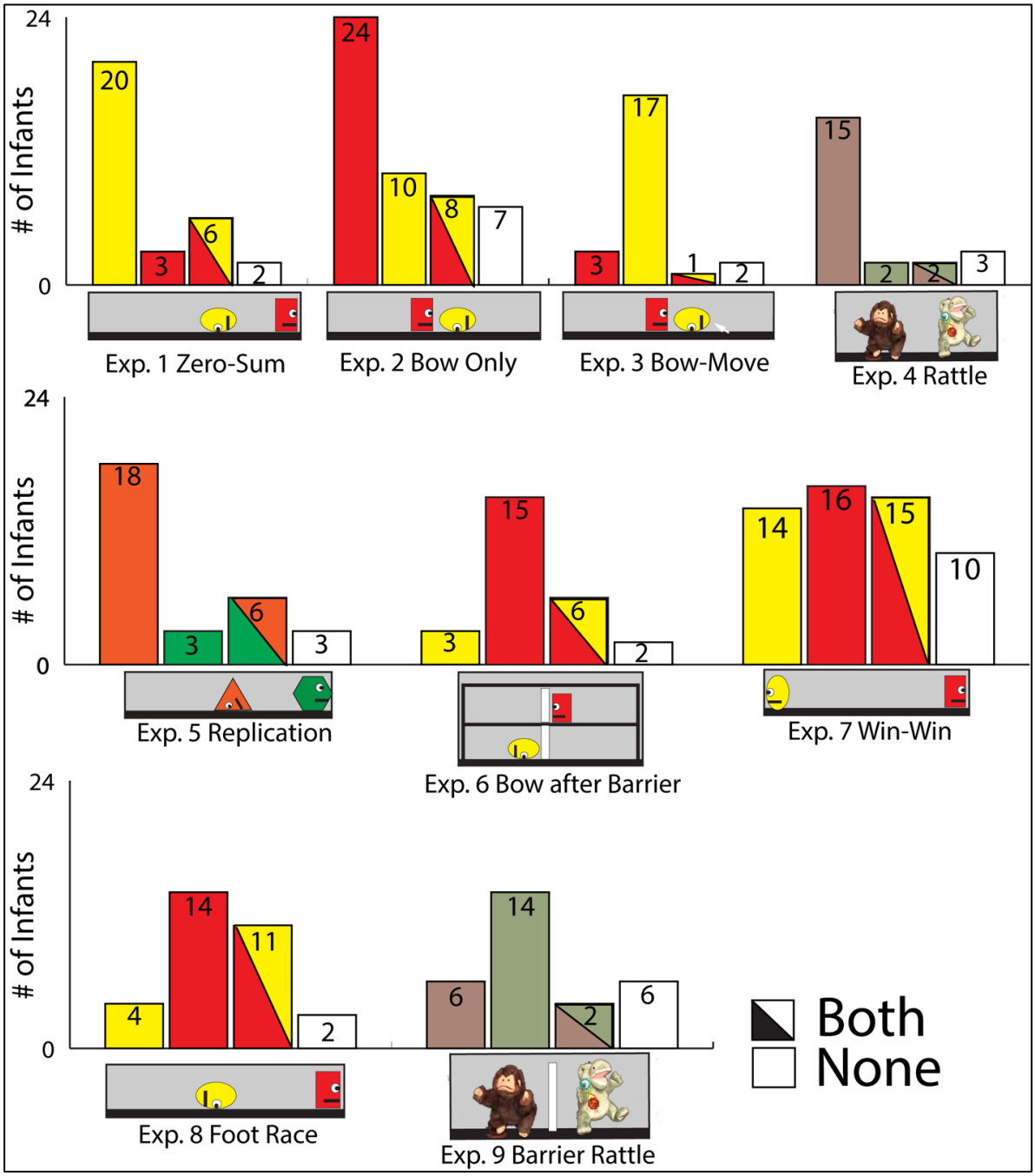

Figure 2.9 Results from all experiments. The picture under each graph depicts the ending positions of the puppets in the puppet show. The white bars represent the number of infants who did not reach for either puppet, the two-colored bars depict the number of infants who reached for both puppets at the same time.

Discussion

To sum, these experiments suggest that infants prefer puppets who yield in a zero-sum conflict. We showed this in four experiments across different contexts. In fact in one of those experiments, they even preferred a yielding puppets when the other puppet did not go on to reach its goal. In Experiment 2, infants preferred the upright puppet when the puppet show ended after one puppet 'bowed', which ruled out the possibility that infants prefer any puppet who makes the 'bowing' motion. Since this finding was unexpected, we conducted Experiment 6 to see if this preference would hold when the puppets did not interact—in this study, the puppets were blocked by barriers (instead of one another), and the puppet show ended when one made the 'bowing' motion. Here, infants again chose the upright puppet . The authors do not have a great explanation for this finding, and feel uncomfortable speculating too much since this was an unexpected finding beyond the scope of this experiment.

Next we investigated whether infants would prefer an upright if the puppet show ended after one puppet made the bowing motion and then cleared the path. Here, infants preferred the yielding puppet. Thus, it seems that infants avoid puppets who make the bowing motion and stop moving, but avoid a puppet who bows and then clears the pathway for the another puppet. For the purposes of these studies, this shows that infants do not prefer any puppet who ends the show in a prone position, rather, their preference depends on the prone puppet clearing the pathway for the other puppet. In Experiment 7, we ruled out several other possible explanations for the finding that infants prefer a yielding puppet—infants do not seem to avoid the last puppet who moved, they do not prefer a puppet who follows a different path than the familiarization trials, and they don't

like any puppet who yields the way for another puppet. In Experiment 8 we ruled out some other explanations such as infants don't seem to prefer a puppet that ends in the middle of the stage, they don't seem to prefer a puppet who ends the puppet show in a different position rather than the same position, or a puppet who is occluded.

So why might infants prefer puppets who 'yield the way'? One explanation is that infants see yielding as helpful or 'prosocial'. That is, infants might see clearing the path as a helpful action because it leads to the other puppet reaching its goal. However, this explanation seems less plausible given the results in Experiments 3 and Experiment 7. In Experiment 7, the bowing puppet yielded to the other puppet and then 'stood up' and moved across the stage. If infants' preference was based on them liking any puppet who clears a pathway, then they should have liked the puppet who moved out of the way. But, in this experiment infants chose both puppets equally often. Likewise, in Experiment 3, the yielding puppet moved out of the way for the other puppet, but the puppet show ended before the 'winning' puppet reached its goal. In this experiment, even though the action did not lead to the 'winning' puppet reaching its goal, infants chose the puppet who made the 'bow-yielding' motion. Taken together, at least as much as we define 'helping' as allowing another individual to reach their goal, it seems that infants preference could not be based solely on helping. If that were the case we would expect them to have liked the puppet who moved out of the way in Experiment 7. Likewise, we would expect them to have been at chance in Experiment 3, where the yielding action did not result in the other puppet reaching its goal. In both cases, this is not what we found.

Another possible explanation for these findings is that infants avoid 'dominant' or high-ranking individuals. Perhaps it is not that they see the yielding puppet as more

prosocial, but instead see the 'winning' puppet as dominant and potentially dangerous. These results agree somewhat with the previous work on infants preferring 'victims' to 'bullies' (Kanakogi et al., 2013). In this previous work infants prefer an agent (a shape with self-generating motion) who was repeatedly bumped into and was squished against walls over the 'aggressive' agent who did those actions. What is striking about the current study is that the infants preferred the puppet who *voluntarily* yielded the way (i.e. through self-generated motion, 'bowed' down and moved out of the way; or stepped away from a contested object). Thus, it is not just that infants avoid aggressive individuals or prefer victims of aggression, they also prefer subordinate individuals over dominant ones. These findings agree with observations of other animals in which subordinates avoid or withdraw from dominant individuals.

In any case, when infants see a conflict, it seems that they not only keep track of the puppet who wins or yields, but also use that information to evaluate the individuals involved in the conflict, preferring the yielding puppet. This suggests that infants may have an intuition to avoid novel dominant individuals.

CHAPTER 3

Why Do Toddlers Like Winners And Infants Like Yielders?

Ashley J. Thomas & Barbara W. Sarnecka

Abstract

Conflicts are a common occurrence in everyday life. Often they are resolved when one person voluntarily yields to the other. In many cases this behavior is the result of social hierarchy—low-ranking individuals yield to high-ranking individuals. Children between the ages of 10 and 31 months evaluate others based on whether they yield or prevail conflicts. However, infants (10 to 16 month-olds) prefer those who yield, while toddlers (21 to 31 month-olds) prefer those who are yielded to. This chapter explores possible explanations for this shift in preferences. First, it describes analyses using a data set which combines data from all of the studies where one puppet yielded. The analysis shows strong evidence that age indeed predicts children's choices, and moderate evidence that the data is more likely if age is treated as a categorical variable rather than a continuous variable. Next, the chapter describes a study where infants aged 16 to 20 month old (the age range that falls between the infants tested in the two previous chapters), saw the puppet show where one puppet wins and one puppet yields. In this study, caregivers answered additional questions about their children's motor skills, communicative skills, social skills and language abilities. The correlation between these factors and children's choices were inconclusive, except one—there was moderate evidence that a child's fine motor skills predicted their choices. However, the finding was counterintuitive: children in this age range who had higher scores on fine motor skills were *less* likely to choose the winning puppet than children who had lower scores on fine motor skills.

Why do toddlers like winners and infants like yielders?

The previous two chapters suggest a dramatic shift in the way that children evaluate those who win or yield in a zero sum conflict—infants around the age of 12 months prefer the puppet who yields, while toddlers around the age of two, prefer the puppet who is yielded to. Why might this shift occur? There are several reasonable explanations for this shift.

One idea is that children get more experience interacting with high-ranking individuals overtime. Toddlers may see people such as parents or teachers as high-ranking and they might also recognize that it is helpful to have their attention. Perhaps this leads children to form preferences for high-ranking individuals. It is worth pointing out however, the frequency that adults prevent children from doing things—perhaps even more often then they help them. It could also be that as children get more experience with peers, they learn the benefits of affiliating with high-ranking peers who may control desired toys or 'get their way' more often. Stable social hierarchies have been observed in daycare centers with children as young as 18-months (see Hawley & Little, 1999; Henrich & Gil-White, 2001 for review). Thus, if these children have spent time in groups that are hierarchically organized they may have learned that affiliating with high-ranking individuals is useful.

The toddlers we tested in the experiments in Chapter 2, had recently learned how to walk and talk, which could increase a child's ability to directly interact with other children. Thus, we might find that learning how to walk predicts children's choices. This idea agrees with studies that look at how learning to walk affects children's social behavior. For example, infants who are able to walk make more vocalizations and gestures directed toward people than infants who can only crawl, even when experimenters control for age.

They also spend more time playing with toys and interacting with their mother than babies who can't yet walk (Clearfield, 2011; Clearfield, Osborne, & Mullen, 2008). Thus, is possible that whether children can walk predicts their social evaluations.

On the other hand, the shift may be due to a conceptual change—in other words infants and toddlers may interpret the interaction in different ways. Preverbal infants seem to be born with the ability to represent dominance—or at least as much as it takes to predict that larger individuals or individuals from larger groups will be yielded to in zero-sum conflicts (Pun et al., 2016; Thomsen et al., 2011). Preverbal infants also seem to represent prosocial and antisocial behavior—preferring those who help over those who hinder another individual (Hamlin et al., 2007)[1]. Perhaps as children acquire the ability to put concepts together, their representation of dominance shifts to one that is closer to prestige. After all, the simplest definition of a prestigious person is a is a high-ranking person who helps—which may come about as infants are able to put the concepts of prosociality and dominance together. Two concepts that infants seem to have early on. Thus, perhaps toddlers see the 'winning' puppet not as dominant but as something akin to the adult concept of prestigious (i.e. as both high-ranking and 'not anti-social'[2]). This agrees with our finding that toddlers avoid the puppet who 'wins' in an antisocial way, by pushing the puppet out of the way.

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[1] An alternative explanation for these findings has been offered by Powell & Spelke (2017), where they suggest that infants prefer the helper, not because it helps the puppet reach its goal, but because, unlike the hinderer, it does the *same* movement as puppet who needs help. Although, its also worth pointing out that the original finding has failed to replicate at least once.

[2] I'm hesitant to say prosocial here, because as discussed in the previous two chapters if any puppet is prosocial in the zero-sum contest, it's the puppet who bows down and moves aside.

If the shift in preference is indeed due to a conceptual change, then it would make sense if the change occurred in stages, rather than a gradual development where children start to like those who are yielded to more and more. Of course, the data that we collected do not directly speak to whether the change in preference should be thought of as stage-like change or a gradual one—we did not measure single children's preferences at different points in time. However, it is possible to ask whether the data is more likely if age is treated as a continuous versus a categorical variable which begins to hint at this idea. This is what I describe below.

Analyzing Age-Related Changes Together

Here, I combined data from each experiment that depicted one puppet yielding to another puppet: this included the two "face-off" experiments, where one puppet crosses the stage and one puppet yields (Experiment 1 in Chapter 1 and Experiment 1.0 in Chapter 2, along with the data below); the two replications of this main paradigm (Experiment 5 in Chapter 1 and Experiment 1.2A in Chapter 2); the two experiments where the puppet 'yields the way' but the winning puppet does not cross the stage (Experiment 3 in Chapter 1 and Experiment 1.4 in Chapter 2), and the experiment where one plush puppet yields a rattle to the other puppet. We also included data from a study (see below) where we tested infants whose age feel between the groups in the two previous chapters (16 to 20 month-olds). We only included children who chose one of the puppets in this analysis. This analysis included 201 children—there were ninety-five (N=95) 21 to 31-month-olds, eighty-six (N=86) 10 to 16 month-olds, and nineteen (N=19) 17 to twenty-month-olds. There was 101 boys and 100 girls in the analysis.

To test whether a child's age predicted their choice, we used the generalTestBF function in the Bayes Factor package in R (Morey et al., 2014a; Team, 2015). We found very strong evidence that age (how many days old the children were) predicated children's choices across the experiments (BF=3.8x10^14 in favor of the alternative hypothesis that age predicted whether a participant chose the 'winner'). We also found anecdotal evidence that girls and boys chose the winners at different rates, such that girls were slightly more likely to choose the winners than boys (BF=2.46 in favor of the alternative that the distributions were different), 44/105 boys chose the winning puppet, while 59/106 girls chose the winning puppet. Of course, this difference is very small, the evidence is weak, and it was not hypothesized *a priori*, so it could very well be a fluke. However the finding is interesting given people's apparent intuitions about boys being more competitive than girls (e.g. see Booth & Nolen, 2012).

Exploratory Analysis of Age-Related Changes

Next, we were curious as to whether this shift should be thought of as a gradual change or a stage change. On the one hand, as children accumulate evidence that affiliating with high-status individuals is beneficial, they become more likely to choose the winners. On the other hand, this shift in preference may coincide with conceptual developments. To investigate this, we compared a model that treats age as a continuous variable (how many days old the child was at the time of testing) and a model that treats age as a categorical model (where age was separated into three categories: 10-16 month-olds, 17 to 20 month-olds, and 21 to 31 month-olds). We found moderate evidence that the data was more likely if age is treated as a categorical model than if it is treated as continuous (BF=3.70 in favor of the model that treated it as a categorical model).

We also looked at whether age predicted children's choices within the three age groups. For the 21 to 31 month-olds, we found positive evidence that the null was true (BF=3.46 in favor of the null hypothesis), meaning the data was more likely given a model where age was not included as a factor. For the infants we found inconclusive evidence (BF=1.22 in favor of the null). That is, the data is no more likely given a model that includes or excludes age as a factor.

Although these analyses are far from conclusive about whether this change should be thought of as gradual or stage-like, it does *hint* toward the idea that it is more stage like than gradual. Longitudinal data (i.e. measurements from one child over time) should be collected before any conclusions should be made. The one thing this data does show however, is that infants and toddlers preference for the two puppets changes.

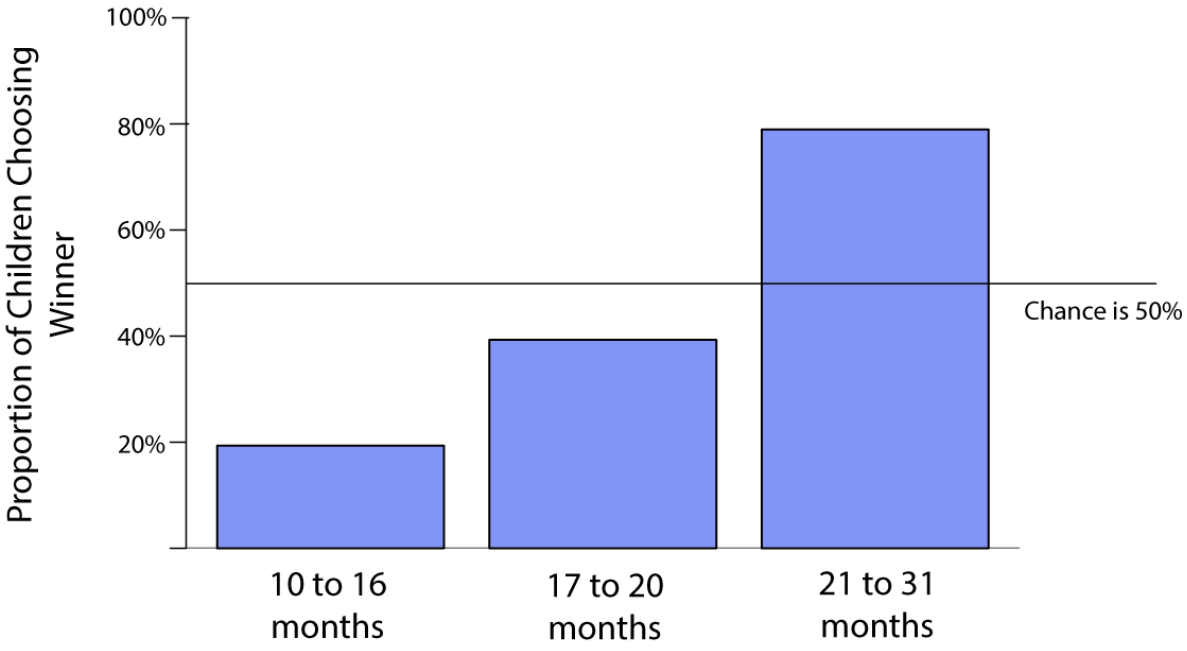


Figure 3.1 Proportion of children choosing the puppet who is 'yielded to' and age group. (75/95 21 to 31 month-olds; 16/87 10 to 16-month-olds and

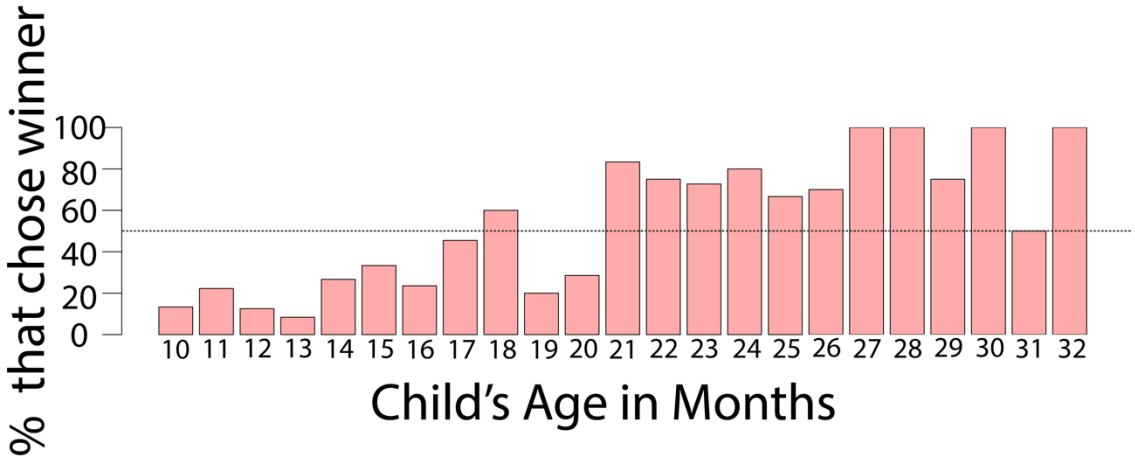


Figure 3.2 Proportion of children choosing 'winning' puppet by age in months.

Testing Children, 16 to 20 months

In this study, we were curious about how infants whose age fell between the two age groups would evaluate the puppet who yields or prevails, and whether we could find evidence that their preferences could be predicated by developments in motor skills, communication skills, other social skills, or language skills.

Procedure

As before, children were recruited from the floor of a children's museum. Parents who agreed to participate in the study were given a consent form to fill out while the experimenter interacted with the infant before leading the parent and infant to the testing room. We also asked parents to fill out two forms in addition to our basic demographic form and the consent form: a short version of the MacArthur Bates Language Communicative Development Inventory II which was designed for infants between the ages 16 to 30 months. This inventory lists 100 terms and parents check off whether their child regularly uses those terms. It also asks, "Has your child begun to combine words yet, such as 'mother cookie' or 'doggie bite'?" (Fenson et al., 2000). We also asked parents to fill out the ASQ-18 (ages and stages questionnaire) which asks parents about their children's motor skills, communication, and problem-solving. For example it asks, "Does your child throw a small ball with a forward arm motion?" and parents can answer 'yes' 'sometimes' or 'not yet'.

The puppet show and procedure was the same as Experiment 1 in chapter 1. First, infants watched a puppet show where two puppets had conflicting goals. It again began with one puppet, alone on stage crossing. This was repeated until the infant looked away for more than half of the sequence. Then, the second puppet appeared on stage, also alone,

and crossed the stage the same number of times as the first. Then, the two puppets appeared simultaneously on opposite sides of the stage and tried to cross at the same time, bumping into each other in the middle. Both puppets then backed up and tried again, meeting again in the middle. This action phase (with the puppets bumping and backing up) was repeated 5 times. Then the puppets approached one another but stopped before meeting, and one puppet 'yielded' by rotating so that its eye faced the ground, and moving aside. The other puppet passed in front of the 'yielding' puppet and continued on across the stage. This 'zero-sum conflict' sequence was repeated until the infant looked away for more than half of the sequence.

Next the test question: an experimenter who was blind to the puppets' roles in the conflict presented the two puppets to the child, holding them, one in each hand, and asked, "Which one do you like?" The dependent measure was which puppet the child reached for and touched (e.g. Hamlin et al., 2007).

Participants

A total of 44 infants participated in the experiment between the ages of 16 months and 21 months (*M*=544.58 days, *SD*=40.55 days). Of these, 17 were excluded from the analysis for the following reasons: Refusing to choose a puppet (n=7); choosing both puppets (n=7); experimenter error—the eye fell off of one of the puppets during the show (n=1); one infant was excluded because of interference from a sibling (n=1); and one experiment was stopped short because of fussiness. The remaining 27 infants contributed data to the analysis. Their ages ranged from 16 to 21 months (M=547.77 days, SD=41.21days).

Results

Of the 27 infants who contributed data to the analysis, 16 reached for the puppet that yielded the way and 11 reached for the puppet who was yielded to. The Bayes Factor was 1.6 in favor of the null hypothesis that infants were choosing the high-status puppet 50% of the time as opposed to the alternative hypothesis that infants preferred one of the puppets. In other words, this data was inconclusive—it is not clear if this age group chooses randomly or whether they (as a group) favored one of the puppets. Of course, we did include 16-month-olds in this analysis (6/7 of whom chose the yielding puppet which agrees with the previous studies with younger infants). When we excluded the 16-month-olds from the analysis the infants (ages 17 to 20 months) were evenly split—10 of the 17 to 20 month-olds chose the winning puppet and 10 chose the yielding puppet (BF=2.07 in favor of the null).

We then tested whether a child's age predicted their choice. To do this, we used, the 'generalTestBF' function in the Bayes Factor package in R (Morey et al., 2014a; Team, 2015). This compares the likelihood of the data given a model that includes or does not include a given factor. That is, it tests whether factors predict children's responses. We found positive evidence for the null (BF=2.43 in favor of the null), which suggests at least for children between the ages of 16 to 20 months a child's age does not seem to strongly predict children's choices.

Questionnaires

Next, we wanted to investigate whether any of the categories on the Ages and Stages Questionnaire, or language abilities, as measured by the MacArthur Bates Inventory predicted children's choices for the winning or yielding puppet. Two additional infants

were excluded from the analysis because their parents failed to fill out the two questionnaires. For the responses on the Ages and Stages Questionnaire, we coded “Yes”, “Sometimes” and “Not yet” numerically, such that “Yes” was coded as 3, “Sometimes: was coded as 2, and “Not yet” was coded as 1, then found an average for each category of question (as defined by the questionnaire). The categories included, Fine Motor Skills, Gross Motor Skills, Problem Solving, Communication, and Personal-Social Skills. For the MacArthur Bayes Inventory, an infant’s score was the number of words that the parent marked, which indicated the number of words on the list that their child regularly uses. We also numerically coded the question that asked if children combined words numerically: we coded "Yes” as 3, “Sometimes” as ‘2’ and “No” as ‘1’.

The only score that predicted children’s preference for either the yielding or prevailing puppet was children’s fine motor skills score (BF=4.16 in favor of the alternative hypothesis which is considered moderate evidence). However the direction of this correlation was unexpected: Children who scored better on fine motor skills were *less* likely to choose the winner. The average score of the children who chose the winning puppet was 1.71 (on a scale from 1 to 3), while the average score of the children who chose the yielding puppet was 1.91 (on a scale from 1 to 3). We also found anecdotal positive evidence that infant’s gross motor skills predicted whether they chose the winner or loser (BF=1.8 in favor of the alternative hypothesis), such that those who chose the winner had slightly lower scores on the gross motor questions than those who chose the winner.

For all other categories we found inconclusive but anecdotal evidence for the null: social and communication skills did not predict choices (BF=1.83 in favor of the null); problem solving skills did not predict children’s choices (BF=1.89 in favor of the null); and

children's ability to communicate did not predict their choices (BF=1.75 in favor of the null). In other words, other than Fine Motor Skills, this present data does not provide much evidence one way or another as to whether the other skills asked parents to predict whether children prefer the winning or yielding puppet.

We also looked at whether vocabulary predicted children's choices. To do this, we counted the number of words their parents said they used on the MacArther-Bates Communication Inventory. We again found inconclusive evidence that this score predicts children's preferences (BF=1.6 in favor of the alternative hypothesis). We also looked at parent's responses to the question '*Has your child begun to combine words yet, such as "nother cookie" or "doggie bite?*'". This time we found weak positive evidence for the null hypothesis, suggesting that this does not correlate with children's preferences (BF=2.09 in favor of the null).

Discussion

To sum, infants and toddlers have very different preferences for those who winor yield in a zero sum conflict. However, the reason why is unclear. Most of our measures were inconclusive except for children's fine motor skills, which turned out to predict children's choices in the opposite direction that I would have expected a priori. In the opinion of the author, this positive result should be interpreted with caution. Moreover, because of the many other factors that yielded *inconclusive* evidence—more data should be collected before drawing any conclusions.

Still, it is worth considering why fine motor skills would correlate with children's choices. It is unlikely that that differences in children's age could account for this, because

we found positive evidence that age was *not* a factor in the choices of the infants whose age fell between the 16 and 20 months. Moreover, the fact that having better motor skills meant that children were more likely to choose the yielder instead of the winner suggests this is not due to age—surely 10 to 16-month-olds who choose the yielding puppet have worse motor skills than 21 to 31-month-olds, who choose the winning puppet. Assuming that the finding was not a fluke, one possible explanation is that children who have not developed fine motor skills have more to gain from high-ranking individuals. That is—those children might lose out to other individuals more often. However, as mentioned above, more data should be collected before too much is made of this finding.

Although we did not find conclusive evidence for any of the hypotheses introduced above, it is worth considering how this data sheds light on them. If it is true that the change in preference is indeed more stage-like than gradual, one possibility is that infants and toddlers understand the interaction in a different way. Perhaps infants see those who are yielded to as more dominant individuals who may be dangerous and should be avoided. This agrees somewhat with the work showing that infants expect more formidable individuals to win zero-sum conflicts (i.e. individuals who are larger or from a larger group). Toddlers, on the other hand may see those who are yielded to as high-ranking but more along the lines of prestigious individuals or legitimate authorities. In other words, perhaps toddlers see those who are yielded to as potentially helpful, while infants see them as potentially dangerous.

Another possibility is that infants and toddlers have different priorities. Perhaps infants see yielding the way as a helpful action and prioritize helpfulness above all else. Toddlers seem to care somewhat about pro-sociality as well—they avoid a puppet who

knocks the other puppet backwards (see chapter 2). But perhaps toddlers prioritize social rank above helpfulness—looking for individuals who can resources such as cultural knowledge, resources or protection. One reason why this seems less likely is the fact that infants preferred a yielding puppet even when the action did not lead to the other puppet reaching its goal. Moreover, when the yielding puppet *also* reached its own goal, they didn't prefer either puppet. Thus, a preference for a helpful puppet does not seem likely as a full explanation for the infant's preferences.

Another factor that might explain the change in children's social preferences, is that toddlers presumably have more direct experience with social hierarchies. Several scholars have observed that have stable hierarchies exist in daycare centers with infants as young as 16-months, such that some children will routinely have better access to contested toys and are often preferred playmates (Hawley, 1999). Thus, status may become more important in how toddlers feel about others after they have experienced hierarchy themselves.

Another factor to consider is that toddlers seem to understand their own body size more than infants. For example, in one study, experimenters encouraged toddlers to pass through a slit that was clearly too small for their bodies. 18-month-olds were much more likely to try to fit through the slit than 22-month-olds or 26-month-olds, suggesting that children learn the size of their own body between the age of 18-months and 22-months (Brownell, Zerwas, & Ramani, 2007). It is unknown whether toddlers would also fail to compare their own body size to other animate agents, but if they do, it could explain the difference between the two age groups. Perhaps as toddlers get more experience with moving around, they are better at understanding how the size of another individual affects

a social interaction. That is, perhaps toddlers and infants see the interaction in the same way but see the *consequences* of interacting with the puppets in different ways. Toddlers understand that the dominant puppet is smaller than themselves, and thus will not pose any threat if approached, while infants just know that one puppet is dominant and one puppet is subordinate and so infer that its best to avoid the dominant puppet.

Although we did not find evidence that language influenced children's preferences, more research could be done to investigate whether language abilities indeed predict this change in preference. There are other examples of language influencing conceptual development. For example children's ability to remember the relative location of an object 'e.g. to the left of the green wall' is thought to develop with the ability to express it in language (Spelke, 2016). It does seem that humans have abilities that allow us to keep track of relative social rank. The fact that prelinguistic infants expect more formidable individuals to win in conflicts, and animals can represent these relationships suggests it is something that may be the result of evolution. It also seems that humans begin life with a concept of 'helpfulness' (or something akin to pro-sociality). This agrees with the work showing that infants prefer helpers to hinderers—although as far as I know this has not been shown in other animals. In fact, bonobos, one of our nearest primate relative prefer hinderers to helpers. In any case, if we do begin life with a concept that has something to do with helpfulness or social cohesion, then it might very well be unique to humans and might very well be something we are born with.

If these things are true, then it is interesting to think of ways those two concepts could be combined. Some scholars speculate that learning language allows humans to combine 'core concepts' in order to make new concepts (see Spelke, 2016 for review).

Thus, as children learn language they may be able to put 'helpfulness' and 'dominance' together to form a new concept which is akin to 'prestige'. In other words, the toddlers who are able to talk a little, see the puppet show in a very different way than the infants. They see the individual who is yielded to as high-status, but not dominant per se. The one who is yielded to is 'high-status' and perhaps also *not* 'anti-social'. That is, they may have developed a new concept that is akin to prestige—which is some mixture of helpfulness and dominance.

CHAPTER 4

Do Children Prefer Egalitarian Or Hierarchical Groups?

Ashley J. Thomas, Vivian Mitchelle, Brandon Terrizzi, Paul Piff, Barbara W. Sarnecka

Abstract

In order to coordinate actions and make decisions, humans often form social groups. These groups vary greatly in how they are organized. Two common types of social groups are hierarchical groups—where one person makes decisions for the group, and egalitarian groups—where decision making is shared. In the current study we investigated whether children ages 4 to 8 years old can differentiate between these two social structures. Children heard about two novel groups who went camping. In the hierarchical group, one character made each decision, in the egalitarian group, the characters took turns making decisions. Then, we asked children which group had someone in charge, and which group they'd rather join. We found that 6 to 8 year-olds could say which group had someone in charge, and 7 and 8-year-olds preferred the egalitarian group.

Do children prefer egalitarian or hierarchical groups?

Pretend you are a child who just started at a new school. During recess you notice two groups of children. In the first group, one person makes all the decisions for the group, she decides where the groups sits for lunch, what snack they should share, and what game they play. In the second group a different person makes each decision—one person decides where to sit, another person decides snack to share, and still another person decides what game to play. To any adult it would be obvious how the two groups differ—the first group has a leader while the second group does not. But can children tell the difference between the two groups? And if so, how might they use this to decide which group to approach? The current studies are about whether children can tell the difference between these two types of groups, and if they can, whether they prefer the hierarchical or egalitarian group.

Being able to tell the difference between the two groups requires "naïve sociology" (L. Kaufmann & Clément, 2014). Distinct from "naïve psychology" which allows us to infer an individual's beliefs, preferences, or goals, "naïve sociology" allows us to make inferences about the relationships between people. For example you might see two people and infer they are friends, or see two people and infer they are enemies. In the example above you would infer that one group was more hierarchical and one group was more egalitarian. As it turns out, these two ways of organizing groups are very common in human society.

Children's understanding of social hierarchy

Social hierarchies are found across human societies, and across social settings (A. P. Fiske, 1992). Thus, recognizing them is important for an individual's wellbeing. For example, imagine a jury member standing up in the middle of a trial to overrule a judge's sentencing—they would be reprimanded and might even be arrested. Or, imagine an intern

who walks into their CEO's office and takes a bite out of their CEO's lunch—the intern would likely be fired. Thus, being able to recognize social rank and act accordingly is important to the wellbeing of any person who finds themselves in situations where social rank is a factor.

Indeed, humans can do this from a very early age. Six-month-old human infants expect individuals who are larger or from larger groups to be deferred to (Pun et al., 2016; Thomsen et al., 2011). Ten to 13-month-old infants expect relative-rank to be transitive (i.e., they expect that if A outranks B, and B outranks C, then A will outrank C) (Gazes et al., 2015; Mascaro & Csibra, 2014) and 15-month-olds expect that those who have displayed dominance in the past (e.g. by getting a desired resource) will win a new dominance contest against the same opponent (e.g. by controlling territory) (Mascaro & Csibra, 2012).

Older children can say 'who is in charge'. For example, in a story where two people have a conflict and one person gets their way, children as young as 3 years old say that the person who gets their way is 'in charge' (Charafeddine et al., 2015). Children also distribute resources based on decision making power. In one study, three to five-year-old children saw a puppet show in which puppets first argued about which game to play, and one of the puppets go their way—this happened on two occasions suggesting that one pupper was higher ranked. Then, they were asked to distribute a small and large chocolate to the two puppets. Three and four-year-old children gave the larger chocolate to the puppet who had gotten its way, five year-olds were at chance and 8-year-olds gave the larger chocolate to the puppet who had *not* gotten its way (Charafeddine, Mercier, Clément, Kaufmann, Reboul, Charafeddine, et al., 2016). Thus, it seems that three and four-year-olds act in ways to preserve hierarchy, while eight-year-olds act in ways to compensate for asymmetry. To

sum, humans have early developing intuitions about social hierarchy and that children feel about social hierarchy may change throughout development.

Children's understanding of turn-taking

Another very common way to organize groups occurs when people share in decision making or take turns (A. P. Fiske, 1992). Thus, just as it is important for a person to understand social hierarchy, it is also important for a person to understand turn-taking. For example, imagine a person who cut in front of a long line at the DM—they would be considered rude and might be refused service. Likewise, a person who tries to 'take-over' a group that has decided to share decision-making power might be viewed as anti-social. Indeed, turn-taking is prevalent in many cultures, and humans have very strong intuitions about fairness (Boehm, 1999; Graham et al., 2013; Henrich et al., 2010). In fact, even 12 and 13-month old infants expect that individuals will be given equal amounts as opposed to unequal amounts, and 18-month-olds prefer those who allocate resources equally (Sloane, Baillargeon, & Premack, 2012; Sommerville, Schmidt, Yun, & Burns, 2013). When older children are given a chance to allocate rewards—children between the ages of 3 ½ and 5 prefer to allocate rewards equally (Baumard et al., 2012; Thomas & Sarnecka, in review) and 6 and 7-year-olds will discard a resource to avoid giving an extra resource to someone (Shaw & Olson, 2012). Humans also seem to understand turn-taking as a cooperative strategy around the age of five (Melis, Grocke, Kalbitz, & Tomasello, 2016). Melis and colleagues had children work in pairs where they played a game such that children had to take turns pulling a lever, which in turn delivered a reward one at a time but only to one of the children at a time. This meant, that children had to 'take turns' in order to distribute rewards equally. Melis and collogues found that 5-year-olds were able to develop this

strategy, but 3-year-olds and chimps failed in doing so. Thus, it seems that turn-taking may be both a uniquely human way to organize social interactions, and one that is later developing.

To sum, humans seem to have early developing intuitions about two common types of social organization. However, it is unknown whether children can directly compare these two types of social groups, which is the first question we were interested in answering in this study. Next, we were also interested in children's feelings about either hierarchical or egalitarian groups. Do they have a preference for one type of organization over another?

Preferences for Hierarchical versus Egalitarian Groups

There are reasons to believe that people prefer more egalitarian structures— adults often claim that they prefer egalitarian social structures (Tiedens, Unzueta, & Young, 2007) and often encourage children to share, 'take turns' or 'wait your turn'. Indeed, in many small scale societies there are norms in place that actively curtail any individual member from getting too much power (Boehm, 1999). On the other hand, hierarchies readily form. They form in a wide range of situations including societies that have norms to actively curtail hierarchy (von Rueden, 2011). At least one study has found that social hierarchies spontaneously form in groups of unfamiliar undergraduates who are asked to cooperate on a simple task (Cheng et al., 2013) and they have also been observed in daycare centers with infants as young as 18-months-old (Hawley, 1999; Sluckin & Smith, 1977). Moreover, adults are better at remembering hierarchical social structures than egalitarian social ones (Zitek & Tiedens, 2012),

However, the fact that social hierarchies form, does not mean that people prefer them. Especially when it comes to dominance hierarchies – the structure itself can be seen

as a byproduct of interactions. That is, people do not necessarily decide on a hierarchical structure, they naturally arise when people have different abilities, different access to resources, and others are willing to defer either out of respect, out of fear, or out of some combination of the two. Thus it is unclear how children will feel about social hierarchy versus other forms of social organization.

There are several studies, especially in natural settings, that look at how young children feel about individuals based on their social rank. For example in one study those who observed preschoolers found they pay more attention to children who win contested toys through physical force or aggressive behavior, but also tend to avoid them. However, in other studies, toddlers who behave in socially dominant ways (i.e., by taking contested toys or thwarting other children) are preferred playmates (Hawley, 1999, 2015; Sluckin & Smith, 1977). Toddlers also seem to prefer novel individuals who are high stats: 21 to 31-month-olds prefer the winner of zero-sum conflicts, but only when they win because they are deferred to, not when they win by force (See Chapter 2) (Thomas, Abramyan, Lukowski, Thomsen, & Sarnecka, 2016). But these studies do not tell us how children feel about hierarchy itself. For example, you could imagine wanting to affiliate with a high-ranking person even if you found hierarchy itself unappealing.

In these experiments, we were interested in two questions. First can children differentiate between hierarchical and egalitarian social groups? Second, do children prefer one type of organization over another?

General Methods

Children were recruited from the floor of a children's museum. Parents were approached and asked if they wanted to participate in a study about children's understanding of social relationships. If they agreed, the experimenter led the child and parent to a room off the main floor of the museum. The parents filled out the demographic form, usually outside of a room with glass walls, while the child participated in the study. In the experiment, children heard stories that were accompanied by pictures. The stories in each experiment were presented in a random order.

Experiment 1

Participants

A total of 176 children, ages 4 to 8 years old participated in the experiment. Six children were excluded because of interference from other siblings, or the experimenter going off script (e.g. the experimenter said, "The Wugs make great music"). Of the 170 children remaining, 42 were 4 years old, 37 were 5 years old, 34 were 6 years old, 30 were 7 years old, and 26 were 8 years old. When asked about gender, 82 parents indicated their child was a boy, 84 indicated their child was a girl, and 4 didn't answer the question. When asked to indicate racial background, 83 parents answered 'White', 31 did not answer the question, 23 answered 'Asian', 9 answered 'African American', 6 answered, 'Asian and White', 4 answered 'American Indian/Alaska Native and White', 4 answered 'Asian and Native Hawaiian'; 9 indicated they were multiracial.

Procedure

Children were told two stories about novel groups who were going camping—"The Wugs" and "The Flurps". Each story described three decisions that were made and who made the decision (e.g. "*First, they have to decide where to put the tent. Grug the Wug says, put it under the tree. Look! All the Wugs are setting up the tent under the tree, just like Grug the Wug said."*). In the hierarchy story, the same character made each decision and in the egalitarian story, a different character made each decision. There were pictures that accompanied the stories, which were laid out on the table in chronological order. Next, children were asked three questions. First we asked, "*Would you rather be a Wug or a Flurp?"; "Who would you rather go camping with?"* and "*Who do you think shares more with each other?"*. Then, to check whether children could differentiate between the two groups we asked, "*Which ones had someone who is in charge?* and *'Which ones had a boss*?". We used both forms of this question because during piloting, some children seemed to understand 'boss' better, while others understood 'in charge' better. Then we asked*, "Who is the boss? Who is in charge?"* Finally we asked,, *"Which ones took turns?*"

The group that was hierarchical or egalitarian was counterbalanced, as was the leader of the hierarchical group. Half of the children heard the hierarchical story first and half heard the egalitarian story first.

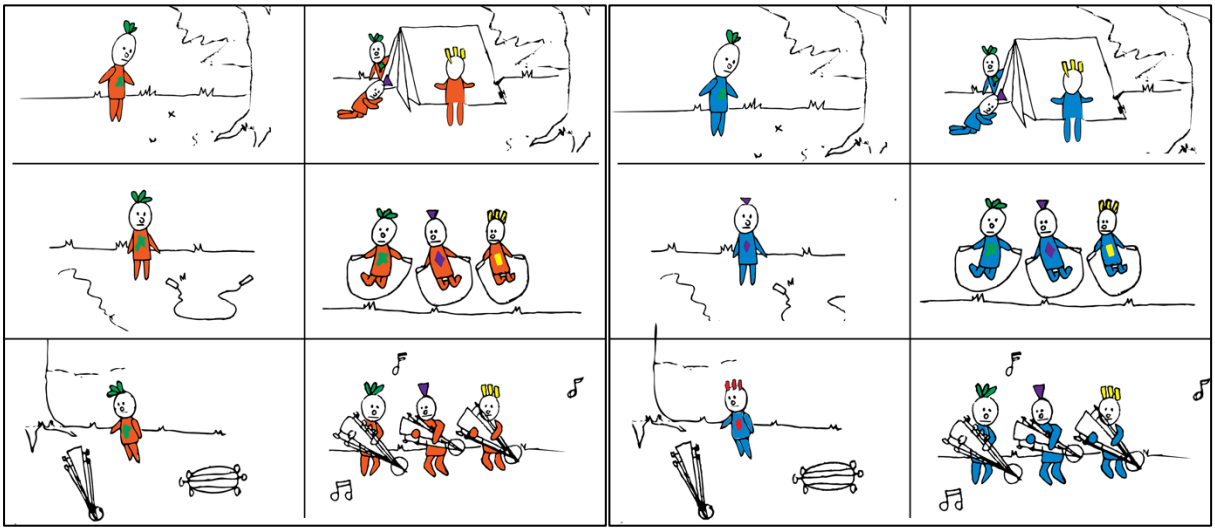


Figure 4.1 [Left Panel] illustrations that went with the hierarchical group. [Right Panel] illustrations that went with the egalitarian group.

Data Analysis

For each of the questions, we wanted to investigate whether age predicted children's choices. To do this we used a general linear model (the 'glm' function in R) and we calculated a Bayes Factors using the 'generalTestBF' function in the Bayes Factor package in R. In this case we calculated a Bayes Factor that compared the likelihood of the data given a model that includes age versus a model that does not include age (Morey et al., 2014a; Team, 2015).

Then, we ran a two-sided binomial test for each age group and calculated a Bayes Factor which compares the likelihood of the data given the null hypothesis (that the children chose both groups 50% of the time) compared to the alternative hypothesis (that children were choosing one group or the other more than 50% of the time).

Results

Can children tell the difference between the two groups?

When asked 'which group has someone in charge', older children were more likely than younger children to choose the hierarchical group (Bayes Factor of 371 in favor of the alternative hypothesis that age predicted children's answers; z=3.19; p=.00157).

A marginally significant proportion of 4-year-olds answered correctly: 26/42 of the 4-year-olds (p=.1641, the Bayes Factor was 1.0 meaning that neither the null or the alternative is more likely), 5 year-olds said both groups equally often: 17/37 of the 5-year-olds said that the group with one person making decisions had 'someone in charge' (p=.748, BF=2.39 in favor of the null hypotheses that they were choosing one group half of the time).

In contrast, six, seven and eight year-olds were well above chance for this question (27/34 of the six-year-olds said that the group where one person made all the decisions had someone in charge (p<.001, BF=75.65 in favor of the alt. hyp.); 25/30 of the 7-year-olds answered this way (p<.001; BF=160.3 in favor of the alt. hypothesis) and 23/26 of the 8-year-olds answered this way (p<.001; BF=440.95 in favor of the alt. hypothesis).

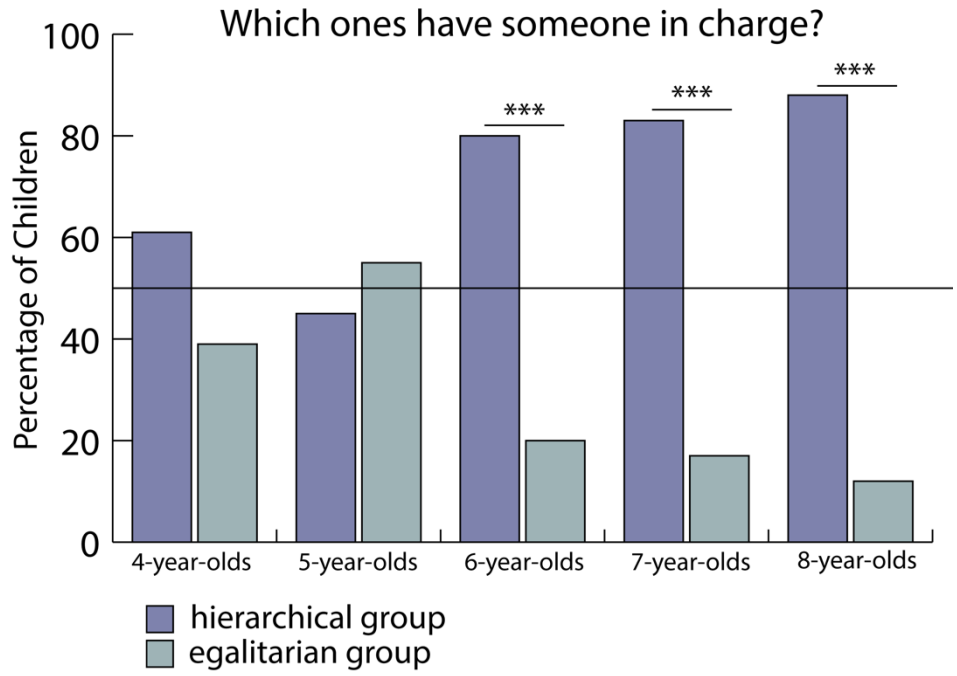


Figure 4.2 Percentage of children who chose the hierarchical group when asked, *which ones have someone in charge?* (Chance is ½)

Which character was in charge?

We also asked children which character was in charge. Again, there was strong evidence that older children were more likely to choose the character who made the decisions than younger children (BF= 1331063; z=4.930; p<.001).

Here, 4 and 5 year-olds seemed to be guessing (15/42 4-year-olds got this question correct, p=.7451; BF=2.58 in favor of the null; 15/37 5-year-olds got this correct p=.3842; BF=1.84 in favor of the null). Six to 8-year-olds answered this question correctly (26/34 of the 6-year-olds got this question correct, p<.001;BF>1,000; 25/30 of the 7-year-olds got this correct, p<.001;BF>1,000; and 22/26 of the 8-year-olds got this correct p<.001;BF>1,000). Thus 6 to 8 year-olds could tell the difference between the two groups, and could remember who was in charge, while 4 and 5 year-olds could do neither.

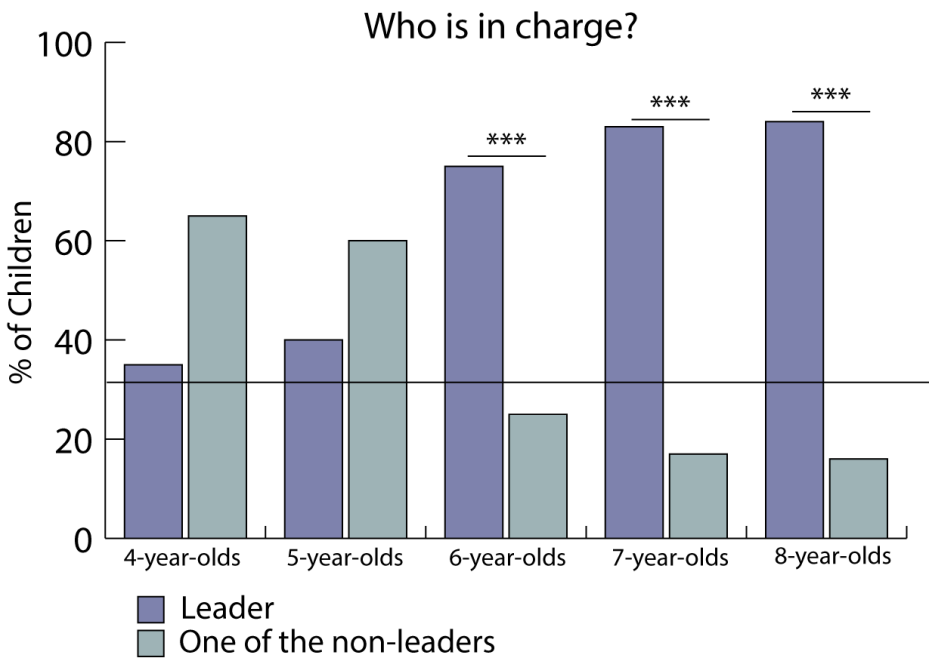


Figure 4.3 Percentage of children in each age group choosing the 'leader' when asked, "Who was in charge?" (Chance is 1/3)

Which group takes turns?

When asked, which group takes turns, older children were more likely to say the egalitarian group than the hierarchical group (BF= 1147.896 in favor of the alt. hypothesis; z=3.882; p<.001). Four and 5-year-olds were at chance when asked which group took turns (24/42 of the 4 year-olds said that the correct group took turns, p=.441; BF=1.93 in favor of the null; and 23/37 of the 5-year-olds said the egalitarian group took turns, which was marginally significant, p=.0895, BF=1.04 which does not support either the alternative or null hypothesis). In contrast the 6, 7 and 8-year-olds said that egalitarian group took turns (29/34 of the 6-year-olds chose the egalitarian group, BF=987.21, p<.001; 28/30 7-year-

olds said the egalitarian group, $p<.001$; BF=21252 in favor of alternative; and 23/26 8-year-olds said the egalitarian group, $p<.001$, BF=440).

Which group shares more?

When asked, "*Who shares more?"* older children were more likely to say the egalitarian group than younger children (BF= 43.94 in favor of the alt. hypothesis; $z=3.089$ $p=.002$). Four and 5-year-olds seemed to be guessing when asked this question, while 6 to 8 year-olds said that the nonhierarchical group shares more (22/42 of the 4 year-olds said that the egalitarian group shared more, BF=2.69 in favor of the null; $p=.8776$; 18/37 of the 5-year-olds thought that the egalitarian group shared more, $p=1.0$; BF=2.623 in favor of the null; 24/34 6-year-olds chose the egalitarian group, $p=.0243$, BF=7.726 in favor of the alt. hyp,; 20/30 7-year-olds chose the egalitarian group, $p=.0987$, BF=1.66 in favor of alternative; 21/26 of the 8-year-olds chose the egalitarian group, $p=.0025$, BF=29.96 in favor of alt. hyp).

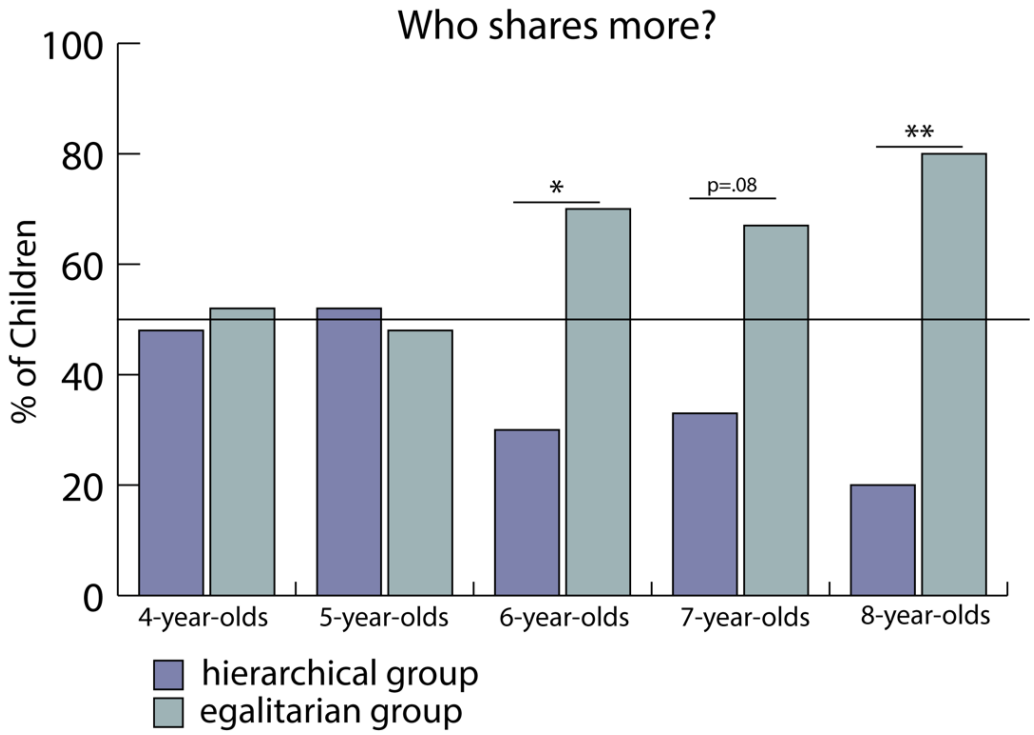


Figure 4.4 Percentage of children in each age group choosing the hierarchical group when asked, Who shares more? (Chance is ½)

Thus it seems that 6 to 8-year-old children were able to compare the two groups and see that one group had someone 'in charge'. They also seemed to infer at least one other thing about the egalitarian group which is that they share more than the hierarchical group.

Who would you rather be? A Wug or a Flurp?

When asked, "Would you Rather be a Wug or a Flurp?" older children were more likely to choose the egalitarian group while younger children seemed to be at chance (BF=5.28 which is considered moderate evidence in favor of the alt. hypothesis; z=2.83 p=.005;). We also found an interaction between age and whether children got the question

'Which group has someone in charge' in predicting children's answers to their preference (BF=8.45 in favor of a model that includes the interaction over one that does not; z=2.83 p=.005). Because of this interaction we analyzed the data including all children tested and we analyzed the data excluding the children who answered this question incorrectly.

First, we analyzed the data including all the children. Four and 5 year-olds did not show a preference for either group: 20/42 4-year-olds chose the hierarchical group (BF=2.688 in favor of null; p=.8776); 23/37 5-year-olds chose the hierarchical group (p=.1877, BF=1.042 again no evidence for null or alt.). Interestingly, even though 6-year-olds could differentiate between the groups, they chose the two groups equally often (17/34 6-year-olds chose the hierarchical group (p=1.0, BF=2.56 in favor of the null hypothesis). In contrast, 7 and 8 year-olds did have a preference, they preferred the egalitarian group: 7-year-olds were marginally more likely to choose the egalitarian group 19/28 chose the egalitarian group (p=.087, BF=1.865 in favor of alt); and 19/26 8-year-olds chose egalitarian group (p=.0289, BF=4.37 in favor of alt. hyp.)(See Figure 3.4). We also investigated if a model that grouped the children into two age groups 4 to 6 year-olds and 7 & 8 year-olds was more likely than one that grouped the children by age. We found moderate evidence that the two groups was more likely (BF=2.92 in favor of the alt. hypothesis). Thus we also looked at the data when we combined the data of the 3 to 6 year-olds and 7 and 8 year-olds. We found moderate evidence for the null, that 4 to 6 year-olds did not prefer one group over the other (BF=3.56) and strong evidence that the 7 and 8 year-olds preferred the group that took turns making decisions (BF=19.56).

Then, we analyzed the data excluding the children who got the question, "*Which ones have someone in charge?*" incorrect. The four year-olds seemed to be at chance: of the

27 remaining children, 16 4-year-olds chose the hierarchical group (BF=1.60 in favor of the null hypothesis). In contrast, the five-year-olds who answered the question correctly, seemed to prefer the hierarchical group: 13/16 of the five year-olds chose the hierarchical group (BF=5.67 in favor of the alt hypothesis, p=.021). The six-year-olds chose both groups equally often: 14/26 of the 6-year-olds chose the hierarchical group (BF=2.16 in favor of the null). In contrast, the 7 and 8 year-olds seem to prefer the egalitarian group 8/26 of the 7-year-olds chose the hierarchical group (p=.075; BF=2.12 in favor of the alt hypothesis); and 7/26 of the 8-year-olds chose the hierarchical group (p=.0289, BF=4.37 in favor of alt. hyp).

We again were interested in what made the most sense in terms of splitting up the data by age. We compared the likelihood of data given different models which separated children into groups by age in different ways. Splitting the age groups into two groups which 4 to 6-year-olds and 7 and 8-year-olds meant that the data is 2.8 time more likely than if we split it up into age into five groups (4 year-olds, 5 year-olds, 6 year-olds, 7 year-olds and 8 year-olds), and 4.5 times more likely than if we split up the data into two groups with the split being between 5 and 6-year-olds (4 and 5-year-olds and 6 to 8-year-olds). Thus, we thought it made sense to combine the 7 and 8-year olds—and when we did this, we found strong evidence supporting the idea that they prefer the egalitarian group (p<.001; BF=9.38 in favor of the alt. hypothesis).

Thus, at least for children who understood the difference between the two groups, 5-year-olds seemed to prefer the hierarchical group, while 7 and 8-year-olds preferred the egalitarian group. One note of caution is that we had few 5-year-olds who got this question

correct, and based on the data above, it seems as though they were guessing as to which group had someone in charge.

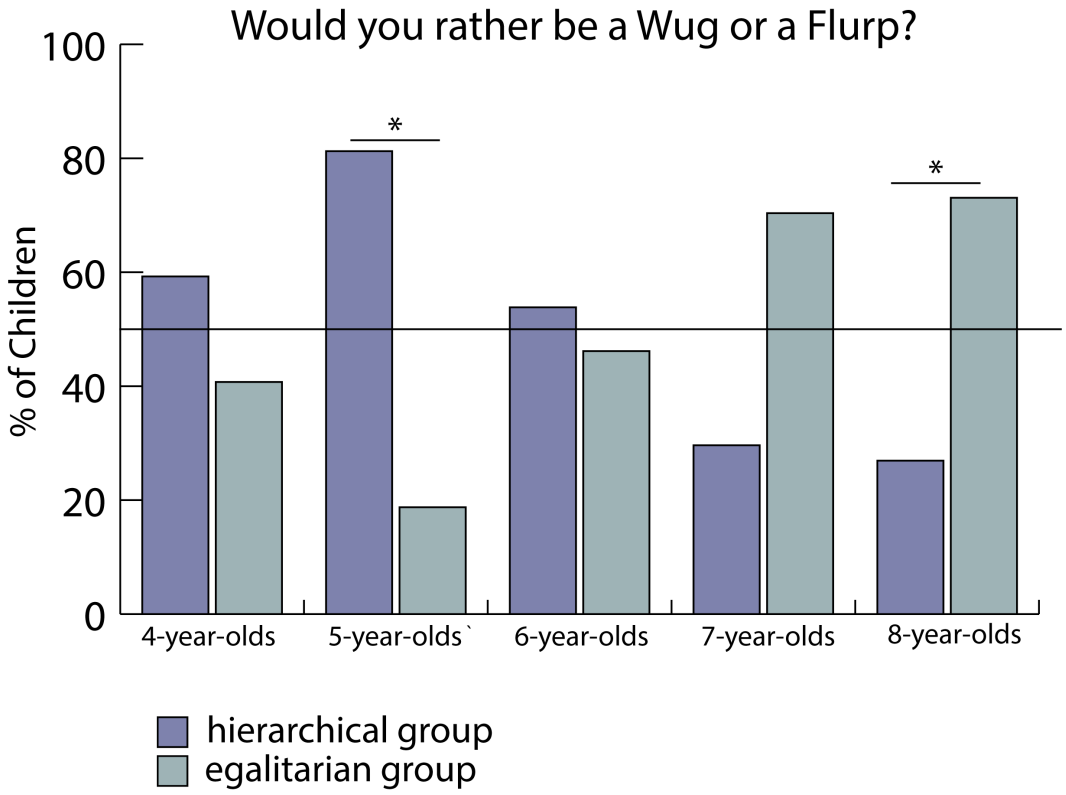


Figure 4.5 Percentage of children who chose the hierarchical group when asked, *Would you rather be a Wug or a Flurp?* (Chance is 1/2). Excluding children who answers, 'Which ones have someone in charge?' incorrectly.

Who would you rather go camping with?

When asked, 'who would you rather go camping with' There was strong evidence age affected children's answers (BF=13.26 in favor of the alt. hypothesis; z=2.85 p=.004).

When we analyzed the children's responses by age group, 8-year-olds seemed to be the only group that favored the egalitarian group (20/26 of the 8-year-olds chose the egalitarian group; p=.009; BF=10.512 in favor of alt. hypothesis;). Five to seven-year-olds seemed to pick both groups equally as often --18/31 of the seven-year-olds chose

hierarchical group (BF=1.76 in favor of null; *p*=.437); 18/35 six-year-olds chose hierarchical group (BF=2.56 in favor of null *p*=1.0) and 22/36 of the 5-year-olds chose hierarchical group (BF=1.187 in favor of alt; *p*=.1686). Interestingly, the 4-year-olds preferred the hierarchical group: 28/42 4-year-olds chose hierarchical group (BF=2.79 in favor of the alternative hypothesis, *p*=.04).

For this question the data was most likely given a model that separated the ages by year (BF=14.46 in favor of a model that separated it by year than a model that separated age into two grops-4 & 5 year-olds and 6 to 8 year-olds, and BF=5.87 in favor of the model that separated it by year over a model that separated age into two other groups 4 to 6-year-olds and 7 and 8-year-olds. This further suggests that 8-year-olds were the only group that had a preference and that 4-year-olds may have preferred the hierarchical group.

We also analyzed this question excluding all the children who got the answer to 'Who has someone in charge?' incorrect. The only age group that we had at least moderate evidence for were the 8-year-olds who preferred the egalitarian group—of the 26 remaining 8-year-olds, only 5 chose the hierarchical group (BF=29.96 in favor of the alternative). There was positive evidence for 4-year-olds preferring the hierarchical group--Of the 27 remaining 4-year-olds 19 chose the hierarchical group (BF=2.76, *p*=.052), but the rest of the age groups were close to inconclusive with slightly more evidence for the null, that children were choosing the two groups 50% of the time: 7\16 of the 5-year-olds said the hierarchical group (BF=1.79 in favor of the null); 13/26 of the 6 year-olds said the hierarchical group (BF=2.30 in favor of the null); 11/26 of the 7-year-olds said the hierarchical group (BF=1.75 in favor of the null).

Finally, we also looked at whether children's answer to '*Would you rather be a Wug or a Flurp'* predicted who they chose for the camping question. We did not find any relationship between these two variables – such that children were not more likely to give the same answer and were not more likely to give a different answer (Bayes Factor of 3.9 in favor of the null hypothesis).

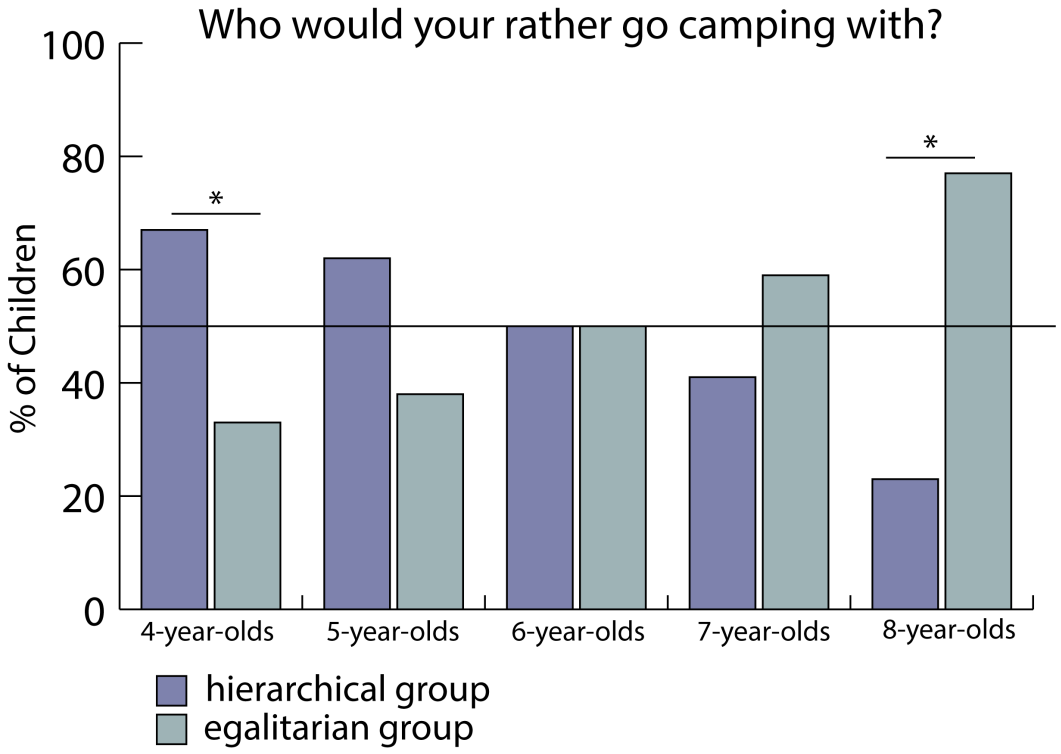


Figure 4.6 Percentage of children who chose the hierarchical group when asked, *Who would you rather go camping with?* (Chance is 1/2). This includes all children.

Exploratory Analysis

We also investigated if children preferred the group that they thought shared more. Indeed, their answer to who shares more did predict their answer to the question—'*Who would you rather be a Wug or a Flurp*' even when for controlling for age and controlling for whether they correctly identified the group that had someone in charge (z=3.56; p*<.001;*

BF=176 in favor of the alternative hypothesis). We also looked at whether their answer to who they thought shared more predicated who they would rather go camping with. It did not (z=.015; p=.987; BF=3.78 in favor of the null). Of course, the question about who they thought shared more always came after the questions about camping and who they would rather be—so it is possible that their preference affected their answer to the sharing question and not the other way around. However, given the fact that the camping question also came before the sharing question – it seems unlikely that this is the case.

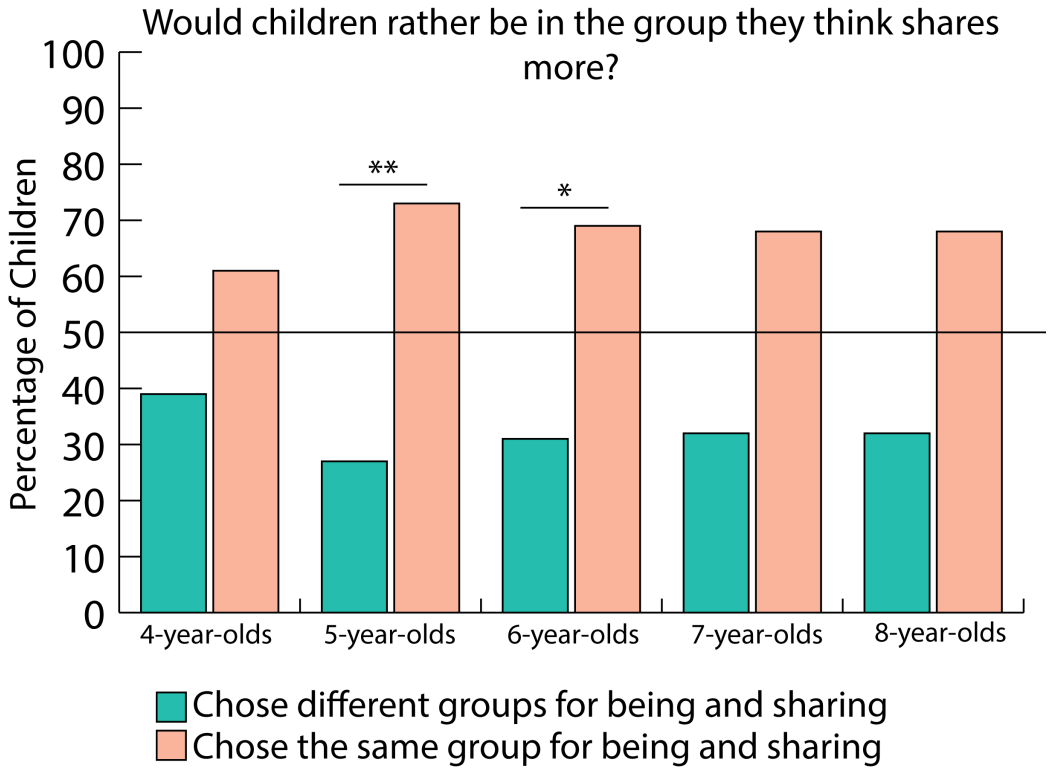


Figure 4. 7 Percentage of children that chose the same group when asked "Would you Rather be a Wug or a Flurp" and "Who do you think shares more?"

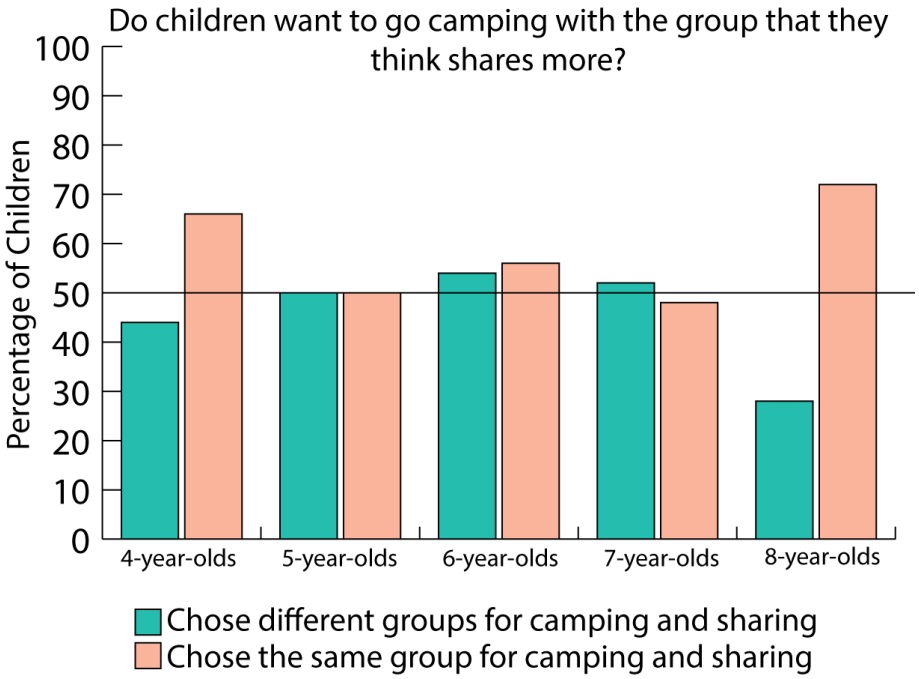


Figure 4.8 Percentage of children that chose the same group when asked "Who would you rather go camping with?" and "Who do you think shares more?"

Discussion

The results of this first study suggest that children, at least as young as six years old can differentiate between decision-making structures. This somewhat agrees with the work by Gulgoz & Gelman, 2016, who found that seven to nine year-olds, but not younger children, thought that a person who made decisions for a pair was 'in charge'. Our study built on this finding in two ways. First, we asked whether children can compare two different ways of organizing decision making in social groups, and indeed, we found that children as young as 6 years old were able to do this. Moreover, children also inferred that the group who shared in decision making generally, 'shared more'.

We also asked whether children have a preference based on the decision-making structure of the groups. We found that 6-year-olds did not have a preference, but that 7 and

8 year-olds preferred the egalitarian group. One interesting question is why 6-year-olds could differentiate between the two groups, but did not prefer one group to another. It seems unlikely that this result was due to 6-year-olds forgetting which group had someone in charge, because we always asked, "Which group had someone in charge" *after* we asked about their preference. One possibility is 6-year-olds could tell the difference but didn't factor it into their preference. The other explanation is that 6-year-old children were indeed using the structures of the groups, but were split in their preferences. This would agree with other studies that have found a shift between 4-year-olds and 8-year-olds in how they treat high and low-ranking individuals: 4-year-olds will give a larger cookie to a puppet who 'gets their way' while 8-year-olds give a larger cookie to a puppet who does not.

Moreover, the fact that 4 and 5-year-olds feel differently about social hierarchy is hinted at in our data: the 4-year-olds who could infer the difference between the two groups and preferred the hierarchical group when asked who they would rather go camping with. Likewise the 5-year-olds who that correctly inferred which group was which said they'd rather be part of the hierarchical group. Of course this could reflect individual differences—perhaps children for whom hierarchy is salient also tend to prefer it. Or it could be that children may start out liking hierarchical structures better and then are taught that turn-taking is good—thus they go from preferring hierarchical groups to groups where people take turns.

Study 2

In Study 2 we investigated whether younger children would show a preference if they didn't have to infer that one group was hierarchical. This study was very similar to the first study, but we told them which group had someone in charge. (i.e. we said, '*These are the Wugs they have someone who is in charge*.') The purpose was to take out the need for the children to make inferences about which group had someone in charge.

Methods

The methods were the same as in Study 1 but the script was slightly changed such that when we introduced the two groups we said, 'These are the Wugs, they don't have anyone in charge" And "These are the Flurps they do have someone in charge". Then throughout the story we repeated this.

Participants

We tested 92 children between the ages of 4 and 6 years old. We tested n=34 4-yer-olds, n=28 5-year-olds, and n=30 6-year-olds. Fifty parents said their child was a boy and 42 said their child was a girl.

Results

Can children tell the difference between the two groups?

When asked, "Which group had someone in charge"? Older children were more likely to answer the question correctly (BF= 1109 in favor of the alt. hypothesis; z=4.50 p<.001). Five and 6 year-olds answered this question correctly (22/26 of the 5-year-olds said that the group with one person making decisions had 'someone in charge', $p<.001$, BF=103 in favor of the alt. hypothesis; and 30/30 of the 6-year-olds got this question

correct (*p<.001,* BF>1000). Four year-olds still seemed to be guessing when answering this question (16/34 of the 4-year-olds said the hierarchical group when asked, *p*=.86, BF=2.85 in favor of the null which is that they were choosing one group 50% of the time).

Do children remember which character was in charge?

When asked, 'which one was in charge?', older children were more likely to answer correctly (BF=90.64 in favor of alt. hypothesis; *z*=3.73 p<.001). In contrast to their answer about which group was in charge, four year-olds were above chance in this case (19/34 4-year-olds correctly identified the leader, *p*=.009; BF=7.94 in favor of the alternative, note chance is 1/3 here). 5-year-olds were well above chance (20/26 chose the correct character, *p*<.001, BF=2006); as were 6-year-olds, all 30 got this question correct (30/30 *p*<.001; BF=1.2 x10^11). Thus, children could keep track of who the leader was—even the four year-olds who had trouble keeping the two groups straight.

Do children remember which group took turns?

It is unclear whether age influenced children's answers about who took turns. There was slightly more evidence for the null hypothesis but it is inconclusive (BF=1.97 in favor of the null; *z*=1.97, *p*=.29). Four-year-olds seemed to be guessing when asked which group took turns (17/34 of the 4 year-olds said that the correct group took turns, *p*=.441; BF=1.93 in favor of the null) as did the 5-year-olds (16/26 of the 5-year-olds said the egalitarian group took turns, *p*=.32, BF=1.71 in favor of the null). In contrast, 22/30 of the 6-year-olds said that the egalitarian group took turns (*p*=.016, BF=6.782 in favor of the alt. hyp.). Thus, even when we helped younger children answer the question about 'who is in charge?' they did not infer that the other group took turns.

Do children think one groups shares more?

When asked who shares more four year-olds also chose both groups equally often when asked who shares more (20/34 of the 4 year-olds said that the egalitarian group shares more; p=.394; BF=1.64 in favor of the null). As did the 5-year-olds (17/28 of the 5-year-olds said the egalitarian group shares more; p=.345; BF=1.4 in favor of the null). However, 21/30 of the 6-year-olds said that the egalitarian group shared more (p=.043; BF=3.34 in favor of the alt.).

Who would you rather be a Wug or A Flurp?

Each age group also seemed to be answering whether they'd rather be a Wug or a Flurp randomly. Of the 92 children we tested, 42 chose the hierarchical group (BF=3.31 in favor of the null). There was positive evidence that the age groups answered the same way (BF=4.3 in favor of the null that age did not predict children's answers). There was positive evidence for each age group that they were choosing the two groups randomly (15/34 of the four year-olds chose the hierarchical group; p=.86 BF=2.43 in favor of the null; 14/28 of the five year-olds chose the hierarchical group; p=1.0; BF=2.48 in favor of the null; and 14/30 of the six year-olds chose the hierarchical group; p=1.0 BF=2.30 in favor of the null hypothesis). Thus even when we told children which group had someone in charge, they chose the two groups equally often.

Who would you rather go camping with?

We found positive evidence that age did not predict which group children wanted to go camping with (BF=3.78 in favor of the null hypothesis). Of the 92 children we tested, 47 chose the hierarchical group (BF=3.90 in favor of the null) Each age group chose randomly (18/34 of the 4 year-olds chose the hierarchical group; p=.86 BF=2.43 in favor of the null;

13/28 of the 5 year-olds chose the hierarchical group; p=1.0; BF=2.48 in favor of the null; and 16/30 of the 6-year-olds chose the hierarchical group; p=1.0 BF=2.30 in favor of the null hypothesis).

Do children prefer the group they think shares more?

We also looked at whether children preferred the group they thought shared more. Using the same method as above, we again found evidence that it does (BF=11.75 in favor of the alternative hypothesis). And again, we found positive evidence that it did not influence who children wanted to go camping with (BF=3.77 in favor of the null hypothesis). Thus, it seems that children in this age group have different opinions about whether a group with a leader or a group that takes turns making decisions shares more, and that this is correlated more with their answer than the difference in decision making structure in the group.

It is worth considering why the 5-year-olds in this study did not prefer the hierarchical group. In Study 1, after we excluded the 5-year-olds who could not differentiate between the two groups, we found a fairly strong inclination toward preferring the hierarchical group (13/16 of the five year-olds said they'd rather be a 'Wug'). Here however, they showed no preference. The authors best guess is that the five year-olds in the second study who were able to answer the question correctly may not actually have been answering based on what they think about social structures of the groups. Rather, they may have just remembered that we said, 'this group has someone in charge' without knowing what 'in charge' actually means. For this reason, the study may not have have not tested our hypothesis about age related changes.

Discussion

In these studies we wanted to know if children would compare two groups and compare their social organization. Six, seven and eight year-olds reliably said that a group with one person who made decisions for the group had someone 'in charge'. These three age groups also inferred that the egalitarian group shared more than the hierarchical group. Thus, it seems that children not only recognize the difference between the two groups, but also use that information to infer a characteristic about the group.

When asked if they'd rather be a Wug or a Flurp, when we included all the children we tested, seven and eight year-olds preferred the egalitarian group over the hierarchical group, while four to six-year-olds were at chance. It was somewhat surprising that six-year-olds did not have a preference for either group since they could reliably say which group was hierarchical. This could mean that six-year-olds have a harder time using the information about group structure in their social evaluations. However, it could also reflect individual differences within six-year-olds, such that different children prefer different types of groups. It could also reflect a developmental change, such that children younger than six may prefer hierarchical groups while older children prefer egalitarian ones. This is reflected in way that the 5-year-olds responded to the question about which group they'd rather join. At least the children who answered the 'which group had someone in charge' correctly preferred the hierarchical group. There is also a hint of this idea when we look at the responses from the 4-year-olds in the camping question. The 4-year-olds who answered the 'which group had someone in charge?' question correctly chose the hierarchical group more often than the egalitarian group when asked who they would rather go camping with.

These findings agree with an earlier study about how children allocate rewards to others, discussed in the introduction of this chapter. In that study, 4 year-olds tended to give a larger cookie to a dominant individual, 5 and 6-year-olds gave the larger cookie to the dominant and subordinate puppet at equal rates, and 8-year-olds tended to give the larger cookie to the subordinate (Charafeddine, Mercier, Clément, Kaufmann, Reboul, & Van der Henst, 2016). Thus, there may be a developmental shift in how children feel about social hierarchy such that around the age of seven children begin to prefer egalitarian structures. This may reflect the things they are taught by caregivers or in school, or may reflect children's own experiences with social groups.

Of course, this evidence is a bit shaky since we did not find that 4 or 5 year-olds preferred the hierarchical group in Study 2, where we tried to make it easier for them to infer the difference between the two groups. One reason might be that 4 and 5-year-olds do not see decision-making power as a cue to dominance (see also Gülgöz & Gelman, 2016). Indeed even when we told them what group had someone in charge, 4-year-olds incorrectly answered the question. As for the 5-year-olds in Study 2, they may have said 'which group had someone in charge', by adapting a matching strategy without actually understanding what it meant. Future studies could attempt to further disentangle whether younger children prefer hierarchical structures while older children do not.

Another interesting finding from this data is that children seem to prefer groups that they think share more with one another. We found strong positive evidence that children's answer to 'who shares more?' agrees with their answer to which group they would rather join. This is also true for 8-year-olds when answering who they would rather go camping with. This could reflect the idea that children have different feelings about

hierarchical versus egalitarian groups, such that some children feel positively toward them while others feel more positively toward egalitarian groups. Perhaps whichever group children feel more positively toward, is the group they think shares more and the group they prefer. Or perhaps different children have different ideas about sharing in egalitarian versus hierarchical groups – such that some children really think that hierarchical groups share more. In any case this finding shows us that sharing seems to be a salient factor in children's social evaluations.

Another interesting question to consider is how context might influence children's answers. For example, would children prefer hierarchical structures in situations that were dangerous or scary? Might they prefer hierarchical structures when there is intergroup conflict? This would agree with theories about social hierarchy that claim people reinforce social hierarchy when they feel threatened. This is another potential future direction.

To sum, these studies show two things. The first is that children at least as young as six can compare two groups that differ only in their decision-making structure. The second is that children at least as young as seven have a preference for groups depending on their social structure, and prefer egalitarian groups to hierarchical ones.

CHAPTER 5

How Do Children Expect Leaders To Behave?

Ashley J. Thomas & Barbara W. Sarnecka

Abstract

As a social species, humans must be able to recognize types of relationships and use that information to predict people's behavior. Hierarchical relationships, where people are ranked by some dimension, are a common in human social groups. Scholars have described different ways people can achieve social rank. One is through dominance–sometimes people attain maintain rank by being 'bullies', intimidating or acting aggressive toward subordinates. Other times, people attain rank by providing benefits such as protection or guidance to subordinates. This study is about whether children's expectations of high-ranking people's behavior. Children were told stories about novel groups of characters and asked to guess who they thought did different actions. In Studies 1 and 2, children thought that high-ranking people were *less* likely to push over a group-mate than subordinates. They also thought the leader was more likely to 'kick-out' someone who had done the same thing. Children also thought leaders were equally likely as other group members to steal someone's cookie, but more likely to 'kick-out' someone who had stolen someone else's cookie.

How do children expect leaders to behave?

Hierarchical relationships, where people can be ranked, are very common across human society. They occur across cultures and across social settings. Across species, social hierarchies are thought to mitigate costly conflicts and for humans they are also thought to help establish order to coordinate group action (A. P. Fiske, 1992). Indeed, there are some studies that show group coordination is more pleasurable and more effective when groups are hierarchically organized (Halevy, Y. Chou, & D. Galinsky, 2011).

As discussed in the introduction of this dissertations, scholars characterize social hierarchy in different ways. In one account, people attain rank in two distinct ways—either through dominance or prestige (Henrich & Gil-White, 2001). In dominance-based hierarchies, people defer to those who are stronger, more aggressive, or control resources in order to avoid costly conflicts (Pratto et al., 2006; van Vugt & Tybur, 2014). For example a stronger sibling might maintain control over the television because their weaker sibling is scared to fight for the remote. Or people might always agree with a CEO that fires anyone who doesn't. This type of hierarchy is thought to be akin to hierarchies found in other species, where individuals attain rank through being able to inflict harm on others—either by being larger, having more allies, and/or more aggressive (van Vugt & Tybur, 2014).

In contrast, in prestige-based hierarchies people's rank depends on whether they can provide benefits to lower-ranked individuals. In these situations low-ranking people willingly defer to people who can provide benefits, such as knowledge or resources that they acquire through special skills (Cheng & Tracy, 2014). For example, it is common for cultures to respect the opinions of elders, who presumably have acquired more knowledge by being alive for longer. In societies where people rely on hunting for food, the best

hunters often enjoy more decision-making power (see Cheng & Tracy, 2014 for review), but in many cases these hunters must also display generosity by sharing most if not all of their meat with lower-status people to maintain their socil clout (see Boehm, 1999; Cummins, 2016).

As discussed in the introduction, it is not always easy to separate dominance and prestige. Often times, high-ranking people provide benefits, but also have the power to inflict costs. Indeed, according to ethnographic research, both high and low-ranking people see hierarchical relationships as mutually beneficial (Fiske, 1992). In these situations, leaders might enjoy more resources and more decision making power, but are also tasked with jobs that benefit the group, such as punishing people, protecting the group, or enforcing norms. For example, in the 1800s sailors who disobeyed orders were flogged by ship captains, who felt it was their moral obligation to enforce rules and keep order on the ship (A. P. Fiske & Rai, 2014). In other words, high-ranking people might be feared and might use violence, but not because they are more aggressive generally, but rather because they are tasked with the job of punishing people who disobey or break social norms.

In the current study, we were interested in whether children have expectations about the behavior of leaders that either agree or diverge from these two views of social hierarchy. From previous studies, we do know that children are sensitive to social hierarchy cues from a young age. As we have learned in previous chapters, infants and toddlers not only recognize cues about social rank but also base their social evaluations on these cues (See Chapters 1 through 3). We also know that older children can explicitly express who is 'in charge'. For example, children, ages 5 and 6 years say that a person who adopts a dominant posture by putting their hands on their hips and chest out, is 'in charge',

as opposed to a person who adopts a submissive posture by putting their shoulders rolled forward and their hands in front of them. They also use eye gaze—saying a person who looks straight ahead is 'in charge' as opposed to someone who looks down. And finally they use a person's head position –saying a person who has their chin up is 'in charge' as opposed to someone with their head down (Brey & Shutts, 2015). Thus, children use physical cues of dominance to say 'who is in charge'.

Children also say '*Who is in charge?*' when they are told stories about interactions between others. In one study, Gülgöz and Gelman (2016) told children, ages 3 to 9, about two novel characters in a variety of situations where the outcomes were positive for one person and negative for another person, and then asked children who they thought was 'in charge'. The researchers found that children think that someone who controls resources is 'in charge' (e.g. "*In the sandbox, there was only one toy truck. Both Zorp and Gorp wanted to play with the toy truck. Gorp played with the truck, and Zorp watched."*); someone who 'gets their way' is 'in charge'(e.g. "*Flip wanted to get ice cream, while Blip wanted to get candy. They could only go to one place. Flip and Blip went to the ice cream store and got ice cream.")* and that someone who gives permission is 'in charge' (e.g. "*Trup asked Grup, 'Can I play too?' Grup told Trup, 'No, you cannot.'")* .

Older children are also sensitive to two other cues—seven to nine-year-olds think that a person who gives orders is in charge (e.g. *"Raffy was telling Zaffy what to build. Raffy told Zaffy to build a house, and Zaffy built a house"*) and someone who sets norms is in charge (e.g. *"Dizz was telling Fizz and their friends that red is the best color and that from now on everyone should wear red. The next day, Fizz came to school wearing a red t-shirt, just like the one Dizz had been wearing"*.)

In a follow-up study, Gulgoz and colleagues found that it was more difficult for children to say 'who was in charge' when the outcome was positive for the lower-ranking person. Children again heard stories where one person gave permission to someone, one character achieved their goals, and one person controlled resources, but this time the lower status person benfited from the interaction. For example, in this study, children heard "*Trup asked Grup, ' Can I play too?' Grup told Trup, ' Yes, you can.'*" While in th first study they had heard " *Trup asked Grup, ' Can I play too?' Grup told Trup, ' No, you cannot.'*". Three and Four year-olds scored above chance only on permission, five and six-year-olds performed above chance only on resource control and permission, and none of the age groups performed above chance in the stories where the person who the authors meant to be in charge said, 'you can go first'. Although, children may have had a difficult time with this last scenarios because yielding the way is a common signal of lower-rank.

Other studies have found that children use other cues to say , 'who is in charge' or 'who is the boss'. For example, children three to five think that those who are stronger and those with more resources are 'the boss'. They also think that someone who gets their way when two people have a conflict over what game to play is 'the boss' (Charafeddine et al., 2015). Starting at around the age three, they think that 'the boss is right'—if children see a high and low-ranking person disagree about the name of a novel object, children endorse the high-ranking person's opinion (Bernard et al., 2016). As we learned in the Chapter 4 of this dissertation, children starting at around the age of 6 start seeing groups where one person who makes decisions as having someone in charge (See Chapter 4).

Each of these experiments suggest that children use a variety of cues to infer who is high-ranking. However it does not tell us if children have specific expectations about how

high-ranking people will act. For example, in the experiment where children endorsed the opinion of the high-ranking person—it could be because they see high-ranking people as those who provide benefits such as knowledge. However, it could also mean that children are afraid or uncomfortable with going against the opinion of a high-ranking person. These studies also don't tell us whether children have expectations about people who are 'in charge'. That is, do children think that people who are 'in charge' have obligations to act in particular ways?

This is what the current studies investigate. We were interested in whether children have expectations about the way that high-ranking individuals act. We were specifically interested in the characterizations of social hierarchy in the dominance-prestige account and Fiske's relationship regulation account. For example, will children expect leaders to be more aggressive than subordinates? Do they expect them to provide protection?

Study 1

Methods

Participants

We tested 191 children: 23 three-year-olds, 37 four-year-olds, 49 five-year-olds, 35 six-year-olds, 32 seven-year-olds, and 15 eight-year-olds. (Note our target age range was 4 to 7, but we tested at museums so incidentally tested a good number of 3 and 8-year-olds, they are included below, but the sample is small for both of these age groups).

Procedure

Children were told four stories about novel groups of characters (e.g. the Zazzos and the Rookas). Each group wore a different colored shirt. In the pictures that accompanied

the stories, one character wore a crown and sat on a throne. There were two stories about someone acting like a bully—someone pushed down an ingroup member down or stole someone's cookie, and two stories about protecting—someone kicked out an out-group member who had pushed a group member down or had stolen a group member's cookie. At the end of each story, we asked children who they thought did the action (i.e. who pushed someone over, who stole someone's cookie, or who kicked someone out for doing those actions). The stories were presented in a random order. After the children heard the four stories and answered the questions they were shown a new group (i.e. a group with a new colored shirt) and asked 'Who is in charge?'; 'Who would you most want to be friends with?' ;'And who do you think is the nicest?'.

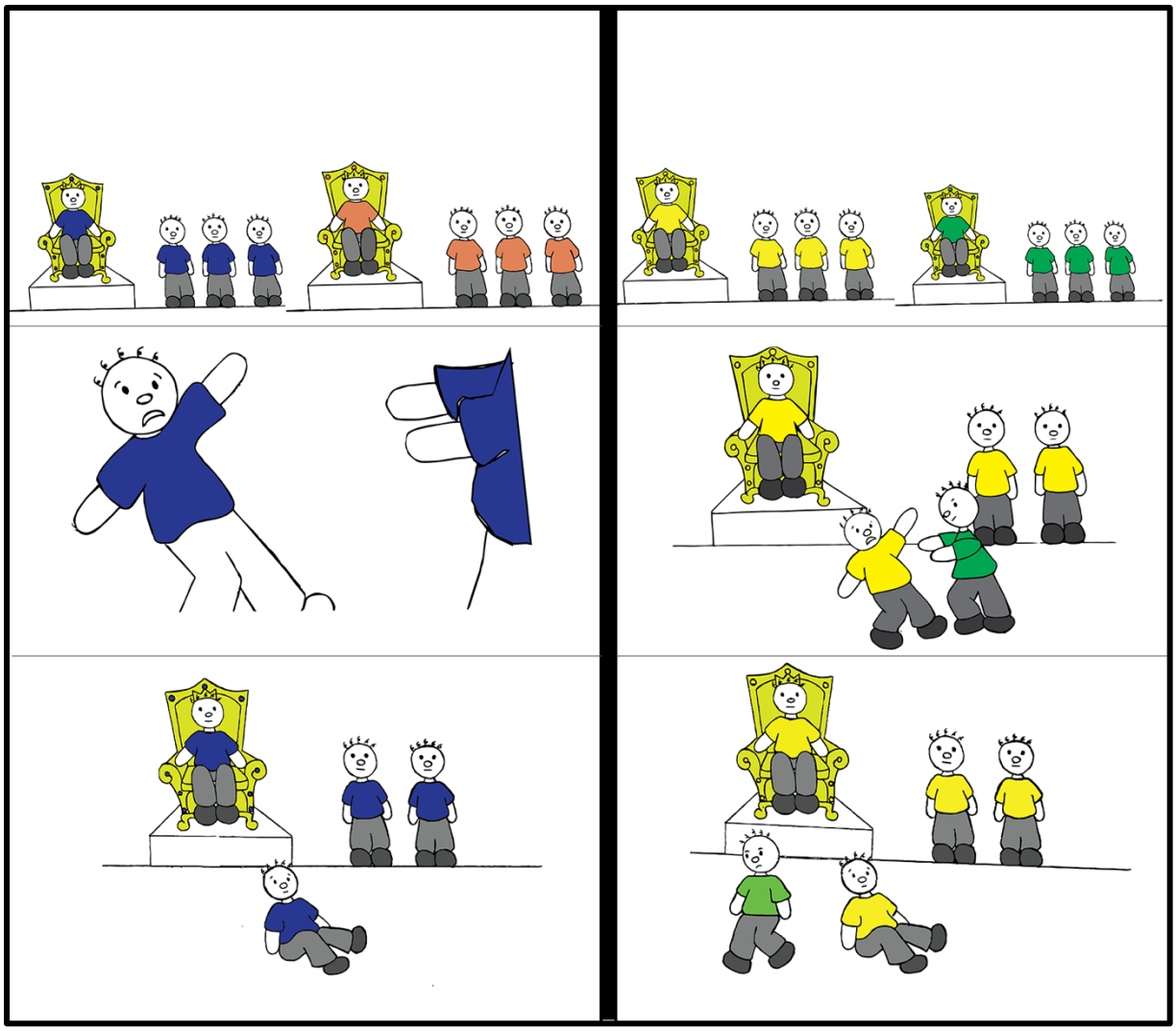


Figure 5.1 Two sets of pictures used in Study 1. [Left Panel] Pictures used for the story about someone pushing over a group member. [Right Panel] Pictures used for the story about kicking an outgroup member who pushed someone out.

Analysis

To analyze the data we used the Bayes Factor package in R (Morey, Rouder, & Jamil, 2014b; Team, 2015). In cases where we wanted to know if children were choosing the leader more or less likely than the other two characters, we used the ProportionBF function. This compares the likelihood of the data given the null hypothesis that children

were choosing the leader 1/3 of the time versus the alternative hypothesis that they were choosing the leader more or less than 1/3 of the time (in most cases, children were choosing from 3 characters, but a few cases they chose between 4 characters in which case the null hypothesis would be that they chose the leader ¼ of the time). We also used the function binom.test in R to do frequentists analyses.

To test whether a child's age predicted their answers to these questions we used lmBF which compares the likelihood of the data given models that include or do not include different factors. Here investigated whether the child's age or gender predicted their responses. We excluded 10 children who did not complete the study, or whose parents did not include their children's birthdate or gender on the consent form.

Results

Manipulation Check: Who is in Charge?

We wanted to make sure that children indeed thought that the person wearing the crown and sitting on a throne was higher ranked. To do this, after we told children the four stories, we showed children a novel group (wearing a new shirt color) and asked, "Who is in charge?" We found that age predicted whether children guessed that the character wearing a crown and sitting on the throne was 'in charge' (BF=27.53 in favor of the alternative hypothesis, meaning the data is more likely if age indeed affects whether children get this answer correct). Thus, we looked at each age group (4-year-olds, 5-year-olds, etc.) to see whether children seemed to be guessing when asked 'who is in charge?' Here, children were choosing from 4 characters, so we compared the likelihood of the data given the null hypothesis, which was that children chose the leader ¼ of the time and the alternative hypothesis that children chose the leader more or less than ¼ of the time.

Although we found evidence that age predicted children's answers, all age groups were more likely to choose the king than the other three characters (15/23 3-year-olds thought that the 'leader' (the character who sat on a throne and wore a crown) was in charge, $p<.001$; BF=314 in favor of the alt. hyp.; 28/36 4-year-olds thought that the leader was in charge $p<.001$;BF=8.3x10^7 in favor of the alt. hyp.; 40/47 of the 5-year-olds thought that the leader was in charge $p<.001$; BF=1.9x10^10 in favor of the alt. hyp.; 32/34 of the 6-year-olds thought that the 'leader' was in charge, $p<.001$; BF=4.4x10^13 in favor of the alt. hyp; 32/32 of the 7-year-olds said the leader $p<.001$; BF=4.4x10^15 in favor of the alt. hyp; and 14/15 of the 8-year-olds chose the leader when asked who is in charge, $p<.001$; BF=71175 in favor of the alt. hyp.)

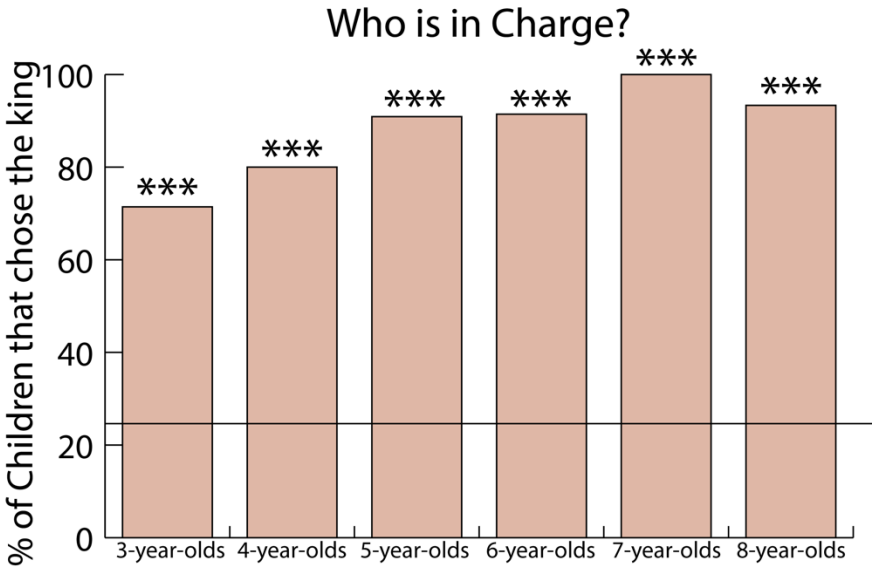


Figure 5.2 Percentage of children that pointed to the leader when asked, "Who is in charge?"

Who pushed someone over?

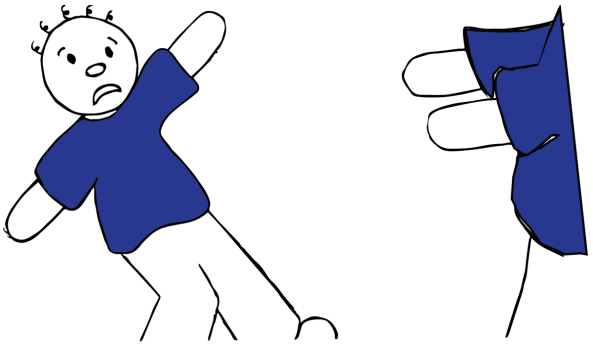
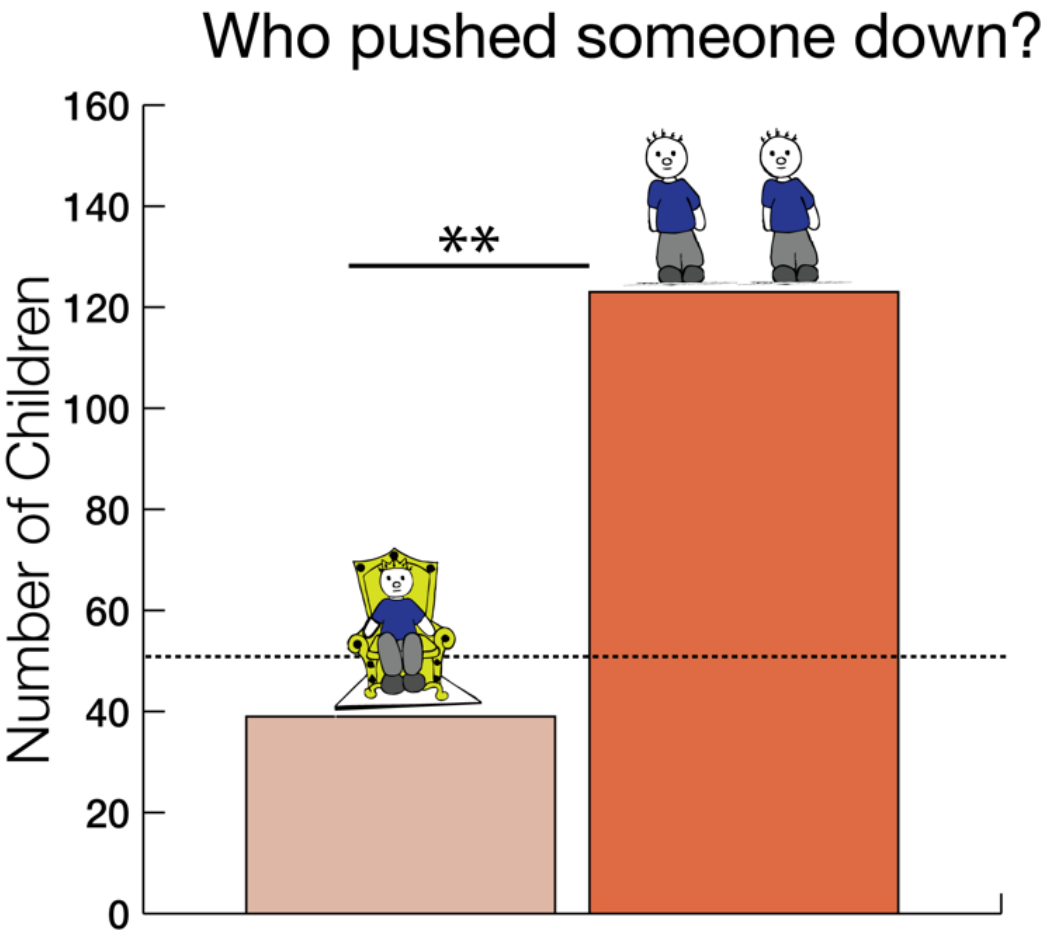


Figure 5.3 Illustration used in story about one of the group members pushing over another group member

Next, we wanted to know whether children thought that the leader was more or less likely to committee random acts of aggression toward other group members. First we tested whether children's answer to the question, 'who is in charge?' predicted there answer. We found there was positive evidence for the null (BF=2.56). Thus, we did not exclude children who answered this question incorrectly. When asked who pushed another group member over, children chose the leader less than 1/3 of the time (39/182 p<.001; BF=80.54 in favor of alternative hypothesis that the children were not choosing randomly, which is strong evidence). Here we found inconclusive evidence about whether age affected children's answers (BF=1.06 in favor of the null). Because we did not have evidence either way about whether age affected children's answers, we split up the groups by year.

We found anecdotal evidence that 3-year-olds chose the leader the same amount as the other characters (8/21 3-year-olds, BF=1.9 in favor of the null, p=.647*).* We found that 4 year-olds were less likely to choose the leader (6/35 4 year-olds; p=.0346 Bayes

Factor=4.08 in favor of the alt). There was inconclusive evidence for the 5 and 6 year-olds (12/44 5-year-olds; BF=1.887 in favor of the null hypothesis; 7/35 6-year-olds *p*=.11 BF=1.50 in favor of the alt.), and 7 and 8-year-olds were less likely to choose the leader (5/32 7-year-olds; 3.49 in favor of the alt. hypothesis, *p*=.038; 1/15 8 year-olds chose the leader (p=.03, BF=4.07 in favor of the alt. hypothesis). It is unlikely that 4 year-olds actually see the leader differently than 3 and 5-year-olds, thus we interpret this data to mean that children are less likely to choose the leader after the age of 6.



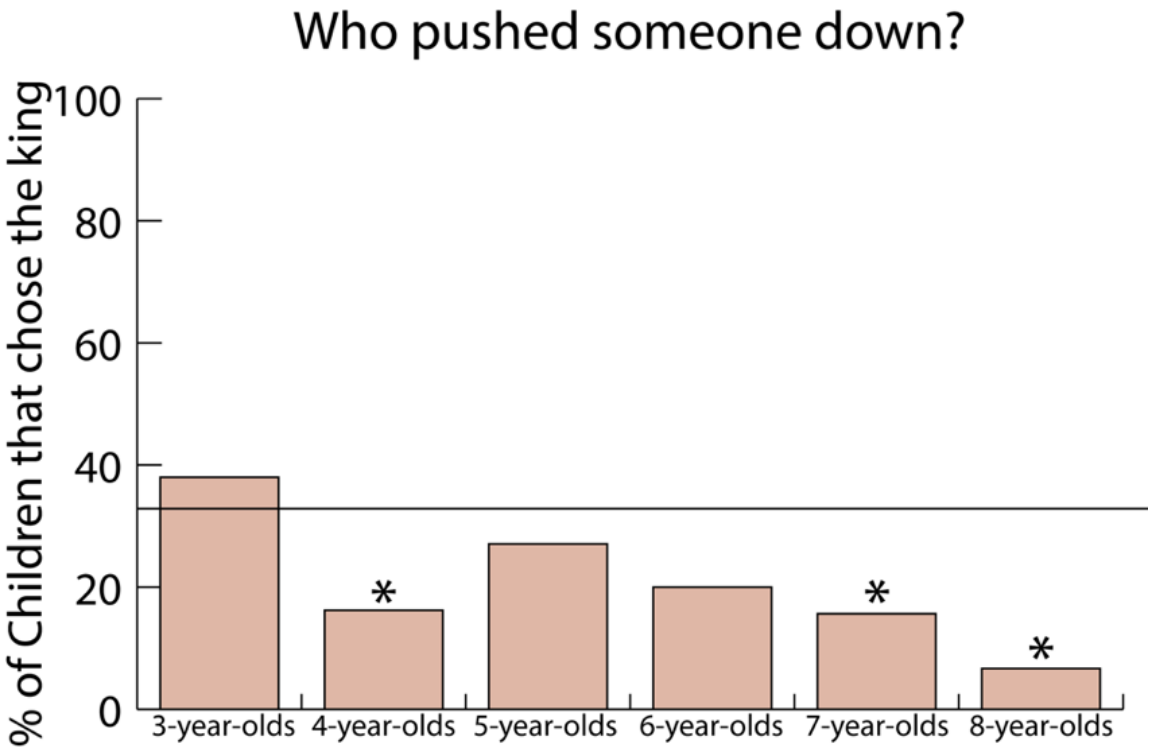


Figure 5.4 [Top Panel] Percentage of children that pointed to the leader when asked, who they thought pushed someone down. This includes all the children. [Bottom Panel] Percentage of all children who pointed at the leader when they asked who pushed someone down.

Who stole someone's cookie?

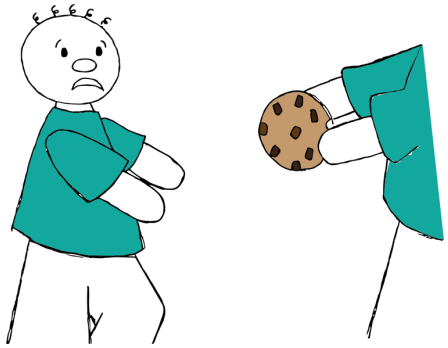


Figure 5.5 Illustration used in story about one of the group members stealing a cookie from another group member.

First, we tested whether the children's answer to 'who is in charge?' affected their answers, we found moderate evidence for the null (BF=4.2). Thus, we did not exclude children who answered that question incorrectly. When asked 'who stole someone's cookie?' 50/182 of the children we tested said the leader (p=.09; BF=1.877 in favor of the null, which is considered anecdotal evidence.) We also found moderate evidence that age did not affect children's answers (BF=4.2 in favor of the null). Thus, we have inconclusive evidence about whether children were choosing randomly, or thought that the leader was less likely to take someone's cookie. In any case we do have evidence that children are not *more* likely to think that the leader took someone's cookie (p=.965, BF=29.14 in favor of the null that children are not choosing the leader more than 1/3 of the time). Here, we did not analyze by age, since we had more evidence that age did not influence children's answers.

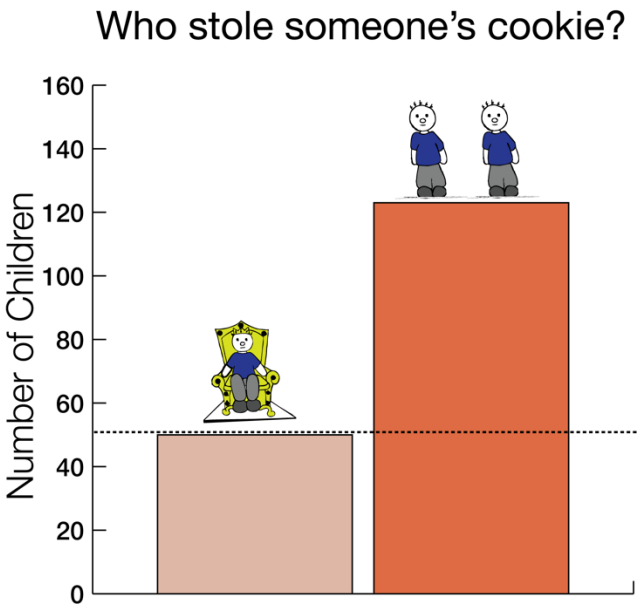


Figure 5.6 Percentage of children that pointed to the leader when asked, who they thought stole a cookie. This includes all the children.

Who kicked someone out for pushing someone over?

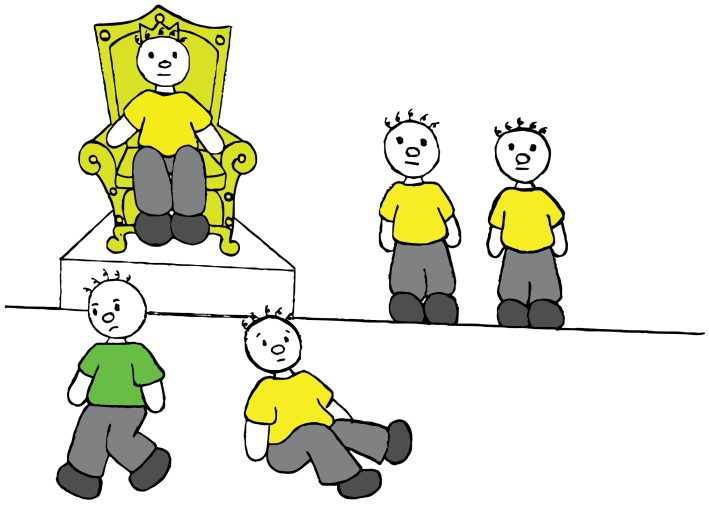


Figure 5.7 Illustration used in story about someone kicking an intruder out for pushing someone down.

When asked who they thought kicked someone out, 124 out of 182 chose the leader. p<.001 BF=1.6 x 10^23 in favor of the alternative hypothesis. Thus we have very strong evidence that children thought the leader would be the most likely person to 'kick out someone' who had come and pushed someone over. We also found strong evidence that age affected children's answers (BF=88.8 in favor of the alt. hypothesis) where older children were more likely to say the leader than younger children. We also found strong evidence that whether children answered the question about 'Who is in charge?' correctly predicted children's answers (BF=10221 in favor of the alt. hyp), thus we analyzed the data including and excluding children.

Including all children: 11/21 of the 3-year-olds; *p*=.11, BF=1.58 in favor of alt; 18/35 of the 4-year-olds said the leader, *p*=.0303, BF=2.89 in favor of the alt. hyp; 28/44 of the 5-year-olds said the leader, *p*<.001, BF=535 in favor of the alt. hyp; 29/35 of the 6-year-olds

said the leader, *p*<.001, BF=2.5x10^6 in favor of the alt; 29/32 of the 7-year-olds said the leader *p*<.001, BF=1.3 x 10^8 in favor of the alt; 10/15 of the 8-year-olds said the leader, *p*<.001, BF=6.18 in favor of the alt.)

Excluding children who didn't point to the leader when asked, 'Who is in charge?' 7/14 of the 3-year-olds, *p*=.25, BF=1.05 in favor of null (inconclusive evidence); 16/27 of the 4-year-olds said the leader, *p*=.007, BF=8.96 in favor of the alt. hyp; 28/40 of the 5-year-olds said the leader, *p*<.001, BF=535 in favor of the alt. hyp; 29/32 of the 6-year-olds said the leader, p<.001, BF=2.5x10^6 in favor of the alt; 29/32 of the 7-year-olds said the leader, *p*<.001, BF=1.3 x 10^8 in favor of the alt hyp; and 10/14 of the 8-year-olds said the leader, *p*=.004, BF=10.47 in favor of the alt.

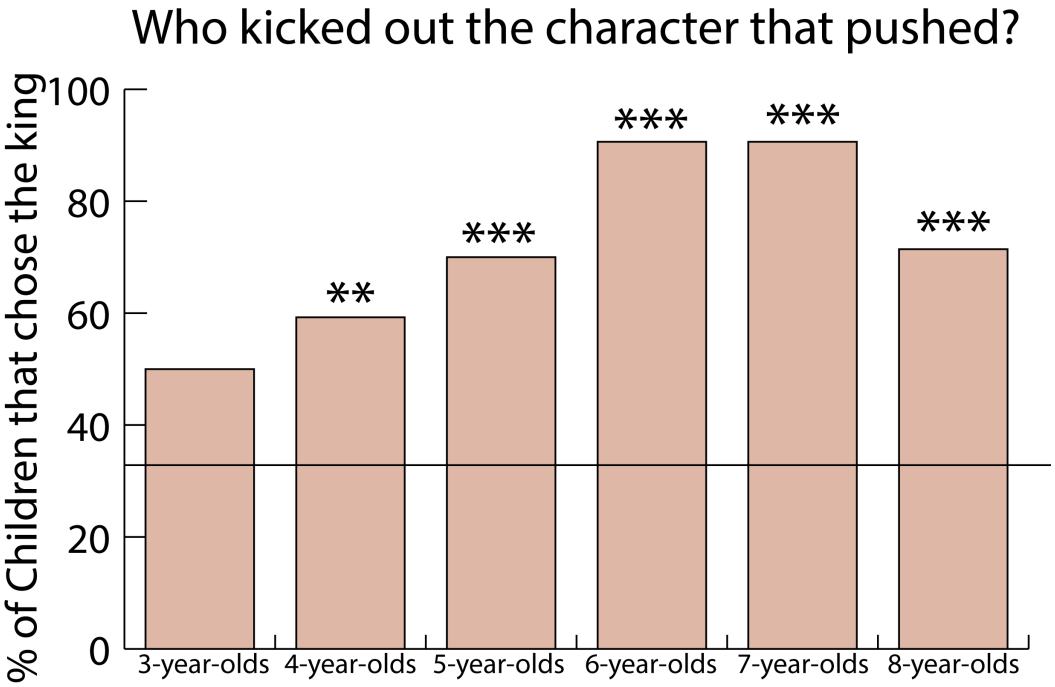


Figure 5.8 Percentage of children that pointed to the leader when asked, who they thought kicked someone out who had pushed someone down, excluding children who did not point at the leader when asked, "who is in charge?"

Who kicked someone out for stealing a cookie?

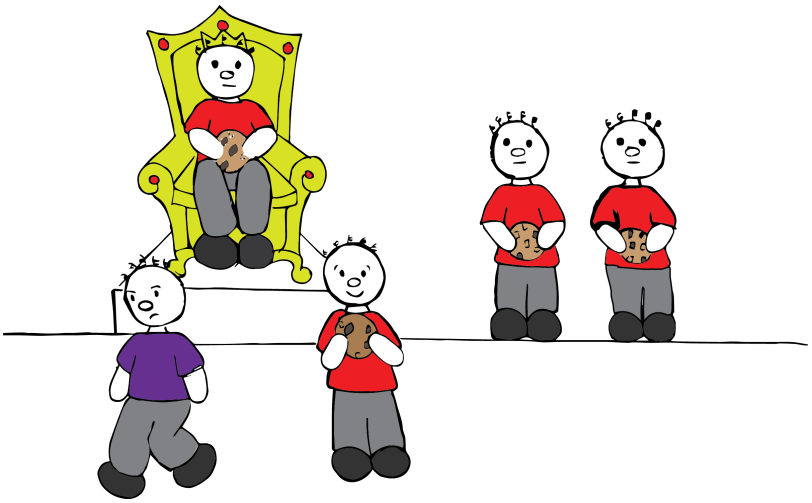


Figure 5.9 Illustration used in story about one of the group kicking someone out for stealing a cookie.

When asked who they thought kicked someone out for stealing a cookie we again found strong evidence that children thought the leader would be the most likely person to do so. (120/182 chose the leader. p<.001; BF=6.55 x10^18)

We also found evidence that age affected children's answers, older children were more likely to choose the leader than younger children (BF=9.70 in favor of the alt. hypothesis). We found strong evidence that whether children chose the leader when asked 'Who is in charge?' predicted their answers (BF=2361) .

Including all children: 11/21 3-year-olds chose the leader, *p=.*10, BF=1.58 in favor of the alt; 20/35 4-year-olds chose the leader, *p*=.004, BF=12.48 in favor of al. hyp.; 26/44 5-year-olds chose the leader, *p*<.001, BF=69.32 in favor of alt. hyp.; 23/35 6-year-olds chose the leader, *p*<.001, BF=247.5 in favor of alt. hyp.; 28/32 7-year-olds chose the leader,

p<.001, BF=60179 in favor of alt. hyp; and 12/15 8-year-olds chose the leader, *p*<.001 BF=76.02 in favor of alt. hyp.

Excluding children who answered 'who is in charge?' incorrectly: 9/14 3-year-olds chose the leader, *p*=.021, BF=3.75 in favor of the alt; 17/27 4-year-olds chose the leader, *p*=.001, BF=12.00 in favor of al. hyp.; 26/40 5-year-olds chose the leader, *p*<.001, BF=69.32 in favor of alt. hyp.; 23/32 6-year-olds chose the leader, *p*<.001, BF=487.12 in favor of alt. hyp.; 28/32 7-year-olds chose the leader, *p*<.001, BF=1.27 x 10^7 in favor of alt. hyp; and 12/14 8-year-olds chose the leader, *p*<.001 BF=186.58 in favor of alt. hyp.

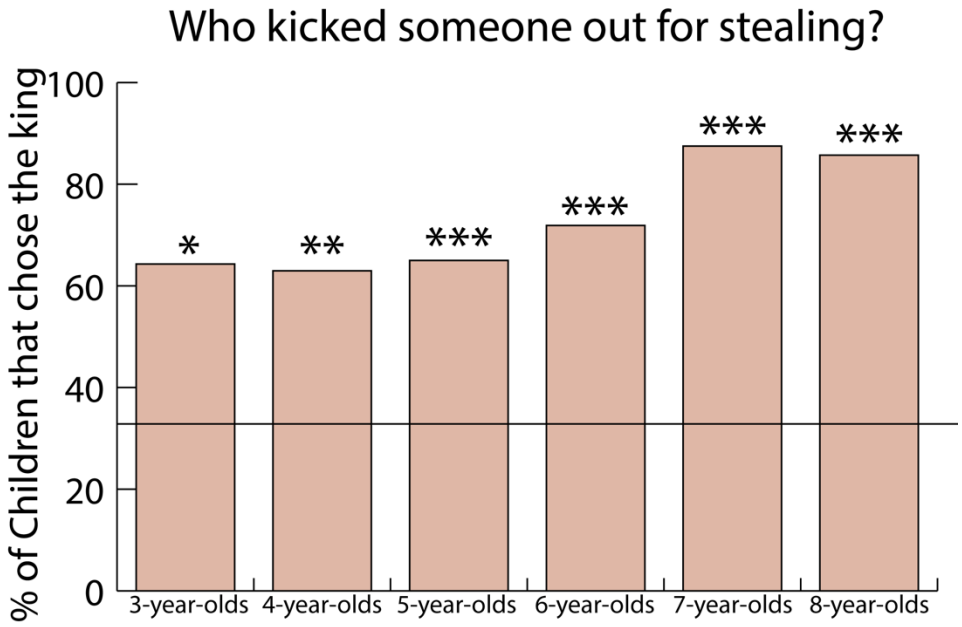


Figure 5.10 [Percentage of children that pointed to the leader when asked, who they thought kicked someone out who had stolen a cookie, excluding children who did not point at the leader when asked, "who is in charge?"

Who is the nicest?

After asking children 'who is in charge?', we asked children who they thought was 'the nicest'. Here, children chose each character equally often. There were six children who did not answer this question, and of the remaining 176, 51 chose the leader (Chance was ¼ because children were choosing from a picture where there were 4 characters; p=.223, BF=2.49 in favor of the null). There was inconclusive evidence about whether age influenced children's answers (1.238 in favor of the null) and moderate evidence that gender did not influence their choice (BF=8.78 in favor of null), and moderate evidence that their answer to 'who is in charge?' did not affect their answer to this question (BF=3.78 in favor of the null).

Since we didn't have evidence either way as to whether age affected children's answers, we analyzed the data separately based on age group. Two of the age groups seemed to prefer the king: the 6-year-olds (14/34 6-year-olds; p=.045; BF=2.26 in favor of the alt. hypothesis), and the 8-year-olds (9/15 8-year-olds chose the 'leader'; BF=9.65 in favor of the alt. hypothesis p=.004), both of whom seemed to prefer the leader over the other three characters.

For the other age groups, there was more evidence for the null. We found inconclusive evidence about whether 3-year-olds chose the leader more or less than ¼ of the time (4/21 3-year-olds chose the leader; p=.62, BF=1.58 in favor of the null), we found inconclusive evidence about whether 4-year-olds chose the leader (6/34 4-year-olds p=.42, BF=1.42 in favor of the null); we found positive evidence that 5-year-olds were choosing each character equally often (12/40 5-year-olds; BF=2.05 in favor of the null), as well as 7-year-olds (9/32 7-year-olds, p=.6844; BF=2.14 in favor of the null hypothesis).

As to why the 6-year-olds and 8-year-olds seemed to favor the leader, while the 7-year-olds chose each character equally often is uncertain. More data should be collected before any strong conclusions about whether leaders are 'nicer' than subordinates.

Who would you want to be friends with?

We also asked children who they would want to be friends with. Here, children were slightly more likely to choose the leader than the other characters (59/177, p=.015, BF=3.65 in favor of the null). We found positive evidence that age affected children's answers (BF=2.89 in favor of the alternative hypothesis) so we also analyzed this question by breaking down the data by age group. There was inconclusive evidence about whether a child said that the leader was 'in charge' affected their answer (BF=1.19 in favor of the null). So we provide analyses that include all the data and exclude children who answered the question incorrectly.

Including all the data: There was inconclusive evidence about whether the 3-year-olds chose either the leader or subordinate more often or if they were choosing randomly (4/21, p=.623; BF=1.19 in favor of the null). There was also inconclusive evidence about the 4-year-olds (5/30, p=.17, BF=1.21 in favor of the alt. hypothesis). Likewise, there was only anecdotal evidence that the 5-year-olds favored the leader (16/42, p=.077, BF=1.60 in favor of the alt. hypothesis). There was anecdotal evidence that the 6-year-olds favored the leader (p=.027, BF=2.79 in favor of the alt. hypothesis). There was strong evidence that the 7-year-olds favored the leader (BF=46.8 in favor of the alt. hypothesis, p<.001); and anecdotal evidence that the 8-year-olds were choosing randomly (3/14, BF=1.59 in favor of the null).

Excluding children who answered 'Who is in Charge?' incorrectly. Overall, the children who answered the question correctly about 'Who is in charge?" favored the leader: 56/154 children chose the leader (p<.001, BF=20.89 in favor of the alt. hypothesis). There was weak evidence that age predicted children's answers in this group as well (BF=2.38 in favor of the alt. hypothesis). There was moderate evidence that the 6-year-olds preferred the leader (BF=5.84 in favor of the alt. hyp., p=.0101), strong evidence that the 7-year-olds preferred the leader (BF=46.72, p<.001). The rest of the age groups had either anecdotal or inconclusive evidence as to whether they preferred the leader or a subordinate character. There was inconclusive evidence for the 3-year-olds(2/14 3-year-olds chose the leader BF=1.18 in favor of the null); there was inconclusive evidence for the 5-year-olds (5/27 4-year-olds, BF=1.56 in favor of the null); there was anecdotal evidence that the 5-year-olds preferred the leader 15/38 5-year-olds (BF=1.88 in favor of the alt. hyp), and anecdotal evidence for the null for 8-year-olds, 3/13 8-year-olds (1.604 in favor of the null).

Again this pattern of data is somewhat strange, especially when we compare across these two questions. These two questions were not the main purpose of the study, so in the opinion of the author, a more systematic approach could be taken to answer whether children indeed seem to favor a leader over subordinate in this context.

Study 1b

Here, we wanted to rule out the possibility that children were answering based on the details of the illustrations. For example, children may have thought it was more difficult for the leader to push someone over if he had to get off of his throne. Or perhaps they thought that the leader 'kicked out' someone because he was on the far left side of the

picture. In this study, we only tested the stories where on member pushes down someone, and the story where an intruder pushes down someone and get kicks out. The study used the same script for those two stories, except the pictures that we used placed the leader on the right instead of left side.

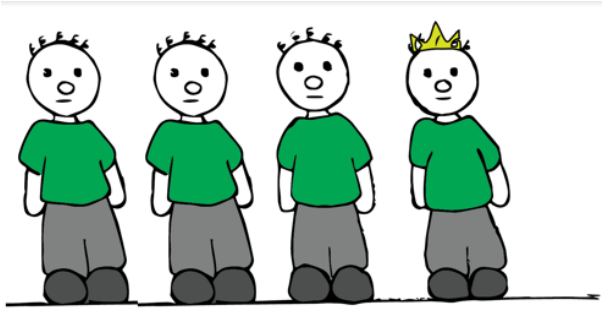


Figure 5.11 Example picture in Study 1b. The leader was moved to the right side of the picture and is standing on the same level as the others.

Participants

We tested 166 children between the ages of 4 and 8 years old (*M*=5.78 years, *SD*=1.78 years). We tested 30 four-year-olds, 42 five-year-olds, 39 six-year-olds, 44 seven-year-olds, and 11 eight-year-olds. When asked about their children's gender, 85 parents said their child was a boy, 67 said their child was a girl, and 13 parents did not fill in the question. Four children were excluded for not answering all of the questions. As in the first study, were recruiting four to seven-year-olds but incidentally tested some 8-year-olds, so we include them below.

Results

Manipulation Check: Who is in Charge?

Age predicted whether children said that the leader was in charge (BF=48.71 in favor of the alt. hypothesis). Overall, 148/162 children said the leader, when asked who was in charge. However, all of the age groups had a Bayes Factor of over 1000 in favor of the alternative hypothesis. In other words, we have strong evidence for each age group that children chose the character wearing the crown more than ¼ of the time when asked who is in charge? (21/30 of the 4-year-olds, 38/40 of the 5-year-olds, 38,39 of the 6-year-olds, 40/41 of the 7-year-olds and 11/11 of the 8-year-olds.)

Who pushed someone down?

When asked who they thought pushed someone down, 44/162 children chose the leader. The bayes factor was inconclusive about whether children chose randomly or whether they favored either the leader or the subordinates (BF=1.18 in favor of the alternative hypothesis). Here, age predicted children's answers, BF=6.88 in favor of the alternative hypothesis.

Four and five-year-old children seemed to choose the leader equally often to the other two characters (12/30 4-year-olds (BF=1.88 in favor of the null); 16/40 5-year-olds (BF=1.9 in favor of the null). There was anecdotal evidence that 6-year-olds were less likely to choose the leader (8/39 6-year-olds, BF=1.59 in favor of alt), and strong evidence that 7-year-olds were less likely to choose the leader (5/42 7-year-olds; BF=29 in favor of the alt. hypothesis; 3/11 of the 8-year-olds chose the leader).

Since it seemed like the older age group and younger age group were answering these questions differently we tested whether the data is more likely given a model where

age as divided into two categories younger children (4 and 5 year-olds) and older children (6 to 8-year-olds) than the model where age was divided by years. Indeed we found that the data was 3.8 times more likely when age was divided into 2 categories. However, there was still inconclusive evidence as to whether 4 and 5 year-olds chose the leader (BF-1.8 in favor of the null).

To sum, it seems that 6 to 8-year-olds were *less* likely to say that a leader would push someone over, while 4 and 5-year-olds chose each group equally often. Although as a whole, the children tended to choose the leader less often in Study 1, the developmental pattern was similar—older children chose the subordinates more often than the leader when asked who pushed someone down, while the 4 and 5-year-olds chose each character equally often. (See below for a direct comparison of the two studies).

Who kicked someone out?

When asked who children thought kicked someone out for pushing, we found strong evidence that children chose the leader more often than the other characters: 102/162 (BF=4.4 x 10^11 in favor of the alt. hypothesis, $p<.0010$). There was inconclusive evidence about whether children answered the question 'Who is in charge?" correctly affected their answers (BF=1.65 in favor of the alt. hypothesis). There was also inconclusive evidence that age did not affect their answers (BF=1.5488 in favor of the null). So, we provide analyses including and excluding children, and break the answers down by age below.

[Including all: 18/30 4-year-olds (BF=15.73 in favor of alt., $p=.003$), 19/40 5-year-olds (BF=1.55 in favor of alt. $p=.065$), 27/39 6-year-olds (BF=3079 in favor of alt. hyp, $p<.001$); 31/42 7-year-olds (BF=104238 in favor of the alt, $p<.001$); 7/11 8-year-old (BF=2.25 in favor of the alt, $p=.05$)]

[Excluding children who didn't get 'who is in charge' correct: 14/21 4-year-olds (BF=19.84 in favor of alt., p=.002), 19/38 5-year-olds (BF=2.44 in favor of alt. p=.0378), 27/38 6-year-olds (BF=6130 in favor of alt. hyp, p<.001); 30/40 7-year-olds (BF=114017 in favor of the alt, p<.001); 7/11 8-year-old (BF=2.25 in favor of the alt, p=.05)]

Who is the nicest?

There was one child who did not answer 'who is the nicest' and so is excluded from this analysis. Of the remaining children, 41/161 of the children said the leader was the nicest (BF=4.5 in favor of the null hypothesis that they chose the leader 25% of the time). There was moderate evidence that age did not predict who children chose for 'who is the nicest?' (BF=2.29 in favor of the null) and moderate evidence that whether they said the leader was 'in charge' affected their answers (B=3.98 in favor of the null. Thus, children seemed to choose each character equally as often when they answered who was the nicest.

Who do you want to be friends with?

There were two additional children who did not answer the question about who they would rather be friends with. Of the remaining children 48/159 chose the 'leader' when asked who they wanted to be friends with, which means there is anecdotal evidence for the null (BF=1.686 in favor of the null). There was moderate evidence that age did not predict children's answer to this question (BF=3.507 in favor of the null hypothesis), nor did whether children answered 'who is in charge?' correctly (BF=2.66 in favor of the null).

Analyzing Study 1 and Study 2 together

First, we wanted to see whether the placement of the leader affected children's answers to the questions. So, we combined the data from both studies into one data set.

Results

Who pushed someone over?

First, we found that the placement of the leader did not seem to influence children's answers to the question about who pushed someone over. We tested this by comparing models that either included the study or did not, and we found evidence that the data is more likely for a model that does not (BF=4.015 in favor of the null hypothesis). Thus, it seems that children were not basing their answers on low-level things about the illustrations.

We found moderate evidence that whether children said the leader was in charge did not affect their answers (BF=5.11 in favor of the null). We did find strong positive evidence that age affected children's answers (BF=12.3 in favor of the alt. hypothesis). Thus, below we re-analyze each age group including children from both the first and the second studies.

Overall, children chose the leader less often than the subordinates when asked 'Who pushed someone over?' Of the 344 children we tested in both studies, 83 children said that the leader pushed someone over (BF=131.667 in favor of the alt. hypothesis that the children were not choosing the leader 1/3 of the time, $p<.001$).

The 3 to 5-year-old children seemed to choose the leader as often as the other characters (8/21 of the 3-year-olds chose the leader, B=1.9 in favor of null, which is considered anecdotal evidence; 18/65 of the 4 year-olds chose the leader, BF=2.02 in favor of the null, considered anecdotal evidence; 28/84 of the 5-year-olds chose the leader, BF=3.613 in favor of the null, considered moderate evidence). The 6 to 8-year-olds seemed to choose the leader *less* often (15/74 of the 6-year-olds chose the leader, BF=5.12 in favor

of the alt. hypothesis, which is considered moderate evidence, p=.019; 10/74 of the 7-year-olds chose the leader BF=297.75 p<.001, considered strong evidence and 4/26 of the 8-year-olds chose the leader (BF=2.51 in favor of alt. p=.0605, considered anecdotal evidence).

We also tested to see whether it made sense to split the children up in terms of 3 to 5 year-olds and 6 to 8 year-olds, and we found evidence that this better predicted the data (the model that broke it up into two groups was 1.78 (BF=1.78), more likely than the model that broke it up by year which is anecdotal evidence). When we combine the 3 to 5 year-olds we get 54/170 children choosing the leader, which suggests they choose each character equally often (BF=4.87 in favor of the null). When we combine the 6 to 8-year-olds we get 29/176 choosing the leader (BF=31673 in favor of the alt. hypothesis). Thus, we have moderate evidence that younger children choose each character equally often, and strong evidence that the older children choose the leader *less* often.

Who kicked someone out?

Again we found positive evidence that the placement of the leader in the illustrations did not affect children's answers to this question (BF=5.15 in favor of the alt. hypothesis). We did find strong evidence that age, and whether children answered who was in charge correctly affected children's answers (BF(age)=85.70 in favor of the alt. hypothesis; BF(correct)=125000 in favor of the alt. hypothesis).

226/344 of all of the children we tested said that the leader would kick someone out who had pushed over a group member (BF=1.2 x10^31 p<.001).

Including all children 10/21 of the 3-year-olds chose the leader, which is inconclusive evidence about whether children were choosing the leader 1/3 of the time, or

not (BF=1.06). All other age groups were far more likely to choose the leader than the other characters (36/65 of the 4 year-olds; BF=117 p<.001; 47/84 of the 5-year-olds BF=1072 in fav. of alt. hypothesis, p<.001; 56/74 of the 6-year-olds BF>100000, p<..001; 60/74 of the 7-year-olds BF>100000 p<.001; 17/26 of the 8-year-olds BF=37.88 p<.001). Breaking the children up into two groups also better predicted the data (BF=10.01 in favor of the model where it broke up age into two groups instead of by year). However, both age groups chose the leader much more often than the other two characters, 93/170 of 3 to 5-year-olds chose the leader (BF= 1183252 in favor of the alt. hypothesis) and 133/174 of the 6 to 8-year-olds chose the leader.

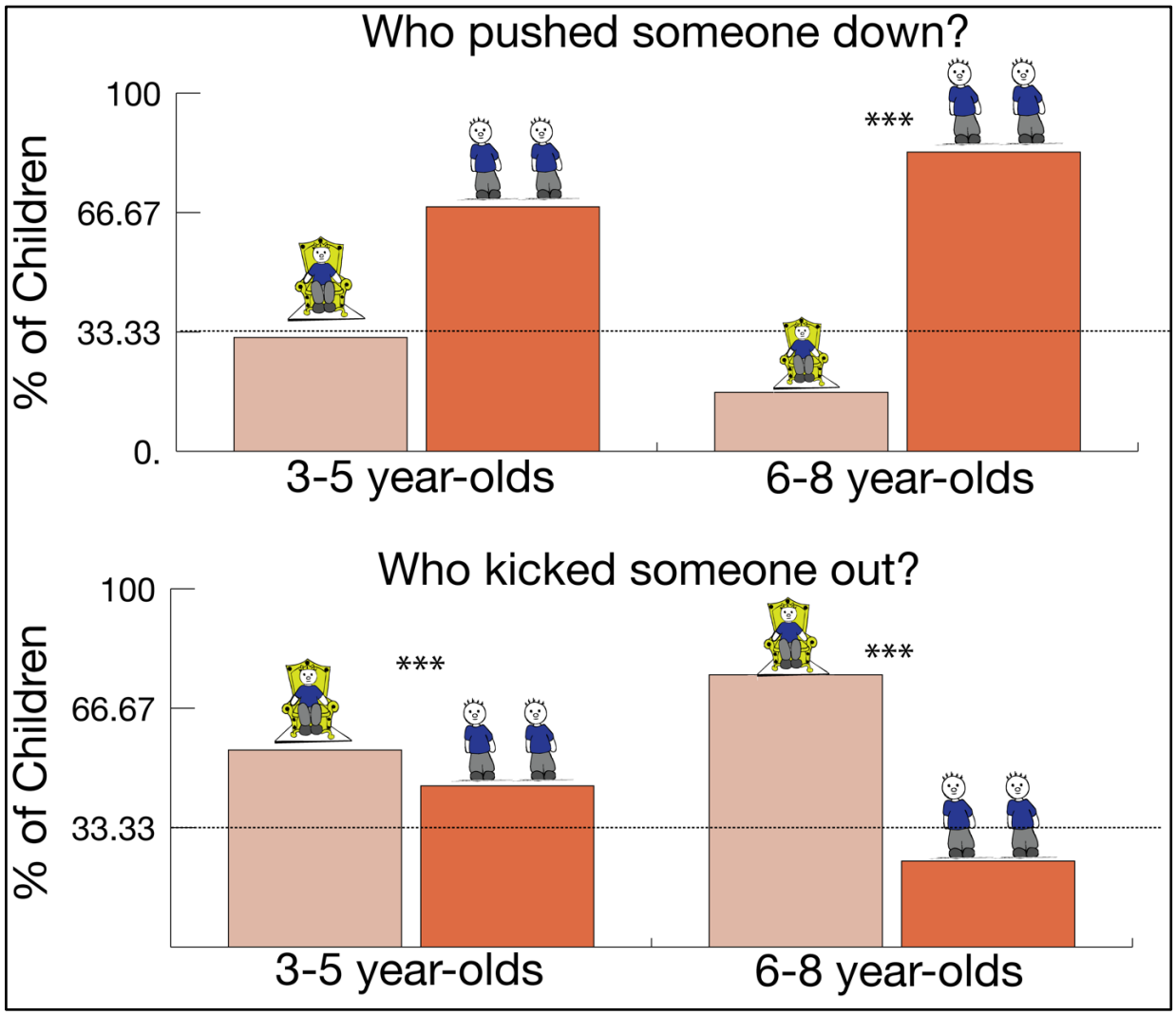


Figure 5.12 Percentage of children choosing leader versus the other two characters. Note that chance in this case was 1/3. * indicates that with a two sided binomial test, $p<.001$.**

Who is the nicest?

When asked, *who is the nicest?,* children seemed to choose each character equally often (92/344 chose the leader, BF=12.73 in favor of the null). We also found positive evidence that age did not influence children's answer (BF=7.49 in favor of the null). Thus,

children do not seem to think that leaders are either more or less likely to be nice than other characters and this does not differ by age.

Who would you rather be friends with?

When looking at the combined data we found moderate evidence that children chose the leader more frequently than the other characters (107/336 chose the leader, BF=6.96 in favor of the alt). However this affect does not seem to be strong. We also found positive evidence that age did not affect children's answer (BF=3.58 in favor of the null). Thus, it seems that children had a slight preference for the leader in this case, but not a particularly strong preference.

Discussion

In studies 1 and 1b, we found that children are much more likely to say that it was a leader who kicked out an intruder who has done something anti-social. These studies also show that children in none of the age-groups expected leaders to be *more* aggressive than subordinates. In fact, children who were 6 to 8 years old thought they were *less* likely to be aggressive than subordinates.

Study 2 (In Progress)

In Study 2 we wanted to further investigate children's expectations of leaders that are in line with theoretical accounts to social hierarchy. In this experiment, children heard 6 stories. First, we wanted to further investigate our hypothesis that children expect leaders to protect. In Study 1, children thought that leaders were much more likely to 'kick out' someone who had done something anti-social than non-leaders, but it was unclear whether children thought leaders enforced social norms, protected subordinates or both.

Thus, in this experiment we told children 4 stories that related to this question. Two were about norm enforcement (one of the characters was wearing the wrong shirt) and two were about protecting (we change the wording so we said, 'one of the characters came to help'). We also told children two stories about general prosocial actions – in one a character shared a cookie, and in the other a character helped someone up who had fallen.

Participants

So far we have tested 47 children ages 4 to 8 years old (M=5.89). When asked about their children's gender, 16 parents said their child was a boy, 30 said there child was a girl, and 1 didn't answer.

Preliminary Results

The results below are preliminary results.

Norm Enforcement

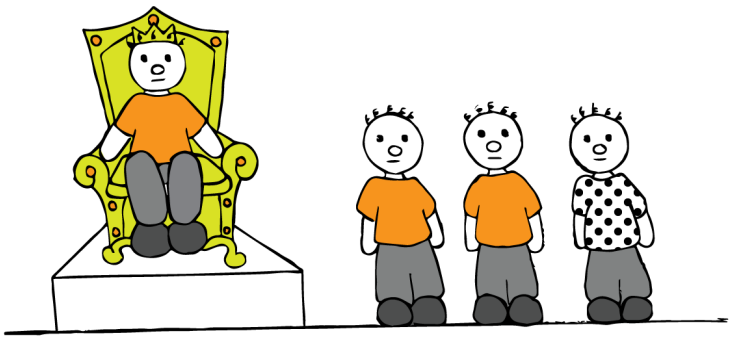


Figure 5.13 Illustration used in story about enforcing norms.

In this story children were told about a character who wore the wrong colored shirt, but that someone made them change it. Then, they were asked who they thought it was. So far, 29/48 of the children we have tested have said the leader (BF=288 in favor of the alt. hypothesis, p<.001)

Norm Opinions

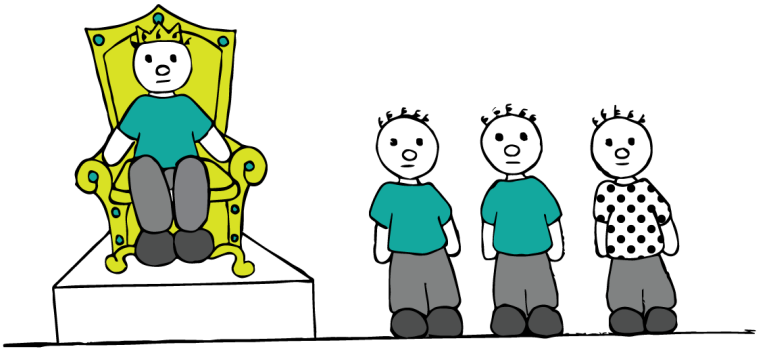


Figure 5.14 Illustration used in story about being too scared to norms.

We wanted to make sure that children thought that the important part of the story was that the leader made the character change it. Thus, we also told children a story where someone wore the wrong colored shirt, but this time children were told 'someone didn't think it was ok, but didn't say anything'. So far, children have picked the leader as often as the other characters (15/48, BF=2.79 in favor of the null). Thus, they don't think that leaders are particularly more likely to think it is 'not ok' to wear break a norm than another character.

Protection

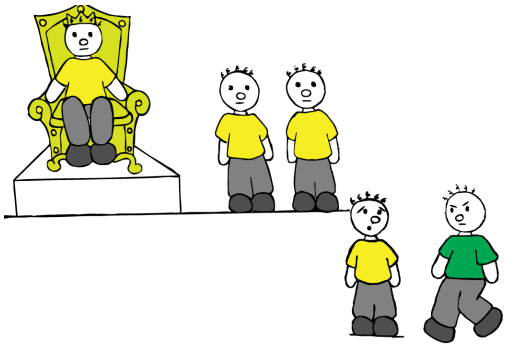


Figure 5.15 Illustration used in story about someone coming to help with an intruder

For this story, we were interested in further investigating if children think leaders are protective or if they expect them to enforce norms. Here, children were told that an intruder was coming to push down one of the subordinates, but someone was coming to help the subordinate. Note, we only have 33 data points for this experiment because the research assistant who collected the data did not follow the script for the first 15 children (instead of saying 'the wug was coming to push down a flurp' she said, 'the wug is coming to say something mean to the flurp'). Of the 33 children we have tested so far, 16 have chosen the king (BF=2.78 in favor of the alternative hypothesis that children are choosing the king more than 1/3 of the time).

Scared to Protect

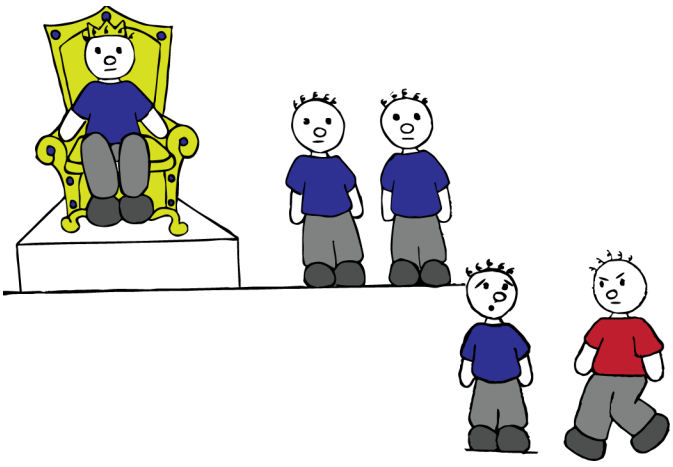


Figure 5.16 Illustration used in story where on character wants to help with intruder, but is too scared

We were also interested in situations where one of the characters wanted to help a subordinate who was getting attacked but was 'too scared'. This story was the same as the protection story, but children were told 'One of the Wugs wanted to come help the Wug,

but was too scared'. Here 8/33 of the children chose the leader, which is inconclusive evidence (BF=1.5 in favor of the null).

Helping

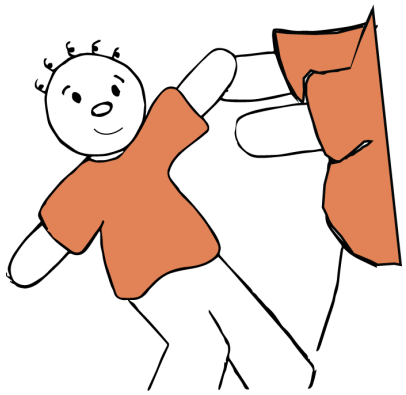


Figure 5.17 Illustration used in story about someone coming to help someone up.

Here, we wanted to test if children expected the leader to be generally helpful. Children were told a story about a character who fell, but that another character helped him up. When asked who they thought it was, 9/38 children said that the leader helped (BF=3.33 in favor of the alt. hypothesis). Thus, at least so far, it seems that children are actually *less* likely to say that the leader will be generally helpful.

Sharing

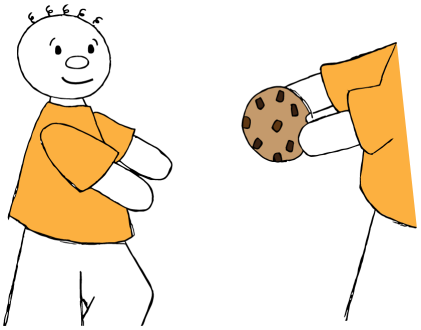


Figure 5.18 Illustration used in story about being sharing a cookie

We were also interested in children expected leaders be more likely to share with others than non-leaders. In this story, children were told that all the characters have a cookie except one. Then, they were told that one of characters shared his cookie, and asked who they thought did the sharing. So far, it seems that children are just as likely to choose the leader than the other characters, 18/48 have chosen the leader and may be slightly more likely to choose the leader(BF=1.78). Thus, it seems that children do not necessarily expect leaders to hoard resources, but it is up in the air as to whether they expect them to actively share them.

General Discussion

Overall, these studies suggest that children indeed expect leaders and subordinates to behave in certain ways. Moreover, children's idea of leaders, at least as we have manipulated leadership, seems to match most closely with the Fiskean account of human social hierarchy. They expect leaders to provide specific benefits—including protection and norm enforcement. This was true in Studies 1 and 1b, where children of all ages expected the leader to kick out someone who stole a subordinate's cookie, or pushed a subordinate down. Moreover, the preliminary results in Study 2 suggest that children think the leader is more likely to come 'to help' a subordinate who is about to be attacked.

However they do not expect leaders to be generally helpful. In Study 2, preliminary data suggests that children do not expect the leader to be more helpful if a character falls down. In fact, the data seems to be trending toward children expecting leaders to be *less* helpful in this situation. Thus, it seems that children expect leaders to provide *specific*

benefits (in this case protection). It is unclear whether children expect that leaders will be generous in sharing their resources—when asked who they thought shared a cookie, children didn't choose the leader *less* often, but it is unclear if they are choosing him more often.

Children also do not seem to think that leaders will be more aggressive. We saw this in studies 1 and 1b where children of all ages did not think that leaders were likely to be aggressive than subordinates. In fact, older children thought that leaders were *less* likely to commit random acts of aggression. Likewise, children do not seem to expect dominant individuals to take resources from subordinates. When asked who took a cookie from someone, children of all age groups chose the leader equally often as the subordinates. Thus, it seems that all children do not see leaders as *more* antisocial than subordinates and older children might see them less so (at least when it comes to aggression). In fact, in study 2, we are asking children who they think *shared* a cookie and preliminary results suggest that children do not think leaders are *less* likely to do so, and may even think they are more likely.

The fact that children do not seem to see leaders as more aggressive is especially interesting considering how dominance hierarchies work in non-human primates. Dominant individuals often commit random aggressive acts on subordinates, which is thought to maintain rank without having to engage in costly fights over resources (Silk, 2002). This is echoed in the dominant-prestige account of human social hierarchy in that those who are 'in charge' maintain their position through aggression. But for human children, it seems that being in charge does not mean they will act aggressively, in fact for older children it means they will act *less* aggressively.

In Study 2, children seem to be choosing the king more often when asked who they think enforces social norms. This is not surprising given previous studies showing that older children say that someone who enforces norms is 'in charge'. However it will be interesting once we get more data to see if only the older children expect the leader to do this, or if younger children do as well. It might be easier for children to guess who did something rather than say 'who is in charge' given a an interaction between others. Thus, enforcing social norms might be an earlier developing aspect of children's ideas about social hierarchy than previously thought.

To sum, these findings suggest that children as young as 4 have expectations about the roles of leaders and subordinates. This could reflect children's own experience with social hierarchy or it could also reflect how the adults in their lives think that leaders *should* act. In any case, when children are shown groups of characters with one leader, they use that information to guess who did certain actions. Overall, they seem to think that leaders will do specific things like protect subordinates or enforce norms.

CONCLUSION

As we have seen, social hierarchy plays an important role in the cognition children in many stages of development. Infants and children not only pay attention to 'who is in charge' they also use social rank in their evaluations of others, evaluations of groups, and to predict other people's behaviors.

However, children's ideas and feelings about social hierarchy seems to change throughout development. The main place we saw this is in children's evaluations of those in a conflict. While infants, ages 10 to 16 months, prefer those who yield in conflicts, toddlers prefer those who are yielded to. Although we don't have conclusive evidence about the underlying cause. One plausible explanation is that conceptual changes affect how toddlers and infants see the interaction. In line with the previous work showing that infants expect larger individuals and individuals with more allies to win, they may see the interaction in terms of dominance—infants may see the winner as stronger, or more aggressive and think winners are best avoided. Toddlers, on the other hand, may see the interaction in terms of authority or prestige—the winner is yielded to not because of strength or aggression, but because they have something to offer and thus should be approached.

In other words, one (very speculative) way to think about this is that human's mental representations of hierarchy are *based* in dominance, but they change throughout development. This could be useful if the change depends on a person's specific culture or social environment. The fact that preverbal infants and several other animals represent dominance, including our nearest primate relatives, suggests that at least the basic ability

to represent dominance could have evolved. But human social hierarchy also seems to be different than the dominance hierarchies found in other species[3]. Thus, either through cultural learning or experience or some later developing mental representation, children may begin to see the zero-sum conflict in a different light. Again, the underlying cause of this change is unclear—toddlers may pick up on the moral or normative judgements of the adults around them, children's new found ability to use language may allow them to combine different concepts together such as 'rank' and 'helpfulness' to form a new concept that is akin to prestige.

Or, this shift may not be due to a conceptual change at all—it may be a shift in priorities—toddlers may be particularly motivated to approach high-ranking individuals who can provide the most cultural knowledge, or toddlers may have learned that affiliating with high-ranking individuals is beneficial. In that sense, toddlers may not see the puppet show any differently than infants—they may just think it is beneficial to approach dominant individuals, as adult bonobos seem to do (Krupenye & Hare, 2018). Distinguishing these two possibilities seems difficult—but one idea is to ask if toddlers, like infants, expect that larger individuals will be yielded to. If they don't it would tell us that their concept of social hierarchy is closer to one that is about authority or prestige.

There does seem to be another developmental shift in how children evaluate people based on their social rank. Charafeddine and colleagues (2016) asked 3 to 5-year-olds and 8 year-olds if they'd rather play with a dominant or subordinate puppet (based on who got

[3] In fact, hierarchy seems to be work differently in many different primate species (see Watts, 2010).

their way in a series of conflicts over what game to play). Although the authors concluded that the 3 to 5 year-olds were at chance when making this choice, a Bayesian analysis of their data suggests that age indeed predicted children's answers—5 year-olds were more likely than 3 year-olds to choose the subordinate, and there was inconclusive evidence as to whether 3 year-olds were actually choosing both puppets equally (see Appendix A). Thus it might be that children between the ages of two and six go through yet another developmental phase where they become more likely to choose the subordinate puppet when asked who they like.

What might explain this second developmental shift? One explanation is that older children become more aware of cultural norms and their own reputation. For example, at least in the United States, there are cultural norms that discourage people from being a 'suck-up' a 'bootlicker', or a 'teacher's pet'. Thus, children's explicit evaluations of high and low-ranking individuals may not match their behavior toward them. As children get older they may become more aware that it is socially desirable to say that they'd rather be friends with subordinates, even if they wouldn't rather be friends with subordinates.

Another explanation is that context may matter: perhaps as children get older the contexts in which they prefer high to low-ranking people becomes more specific. For example, in Chapter 5, we asked children were shown a picture with a leader—someone sitting on a throne wearing a crown—and subordinates and asked who they would rather be friends with. In this case, 4 to 8 year-olds were slightly more likely to choose the leader than the subordinates. In fact, in one of the studies, we found that 8-year-olds were the group that most often chose the leader. Thus, as children get older they may feel differently about those 'in charge' depending on the way that social rank is manipulated.

It is interesting to consider the social evaluations of children in light of the evolutionary game model presented in the introduction, where social interactions are modeled after a game of chicken. (A game where two cars are headed toward each other on a collision course, and the loser is the car the swerves) (Smith & Price, 1973; van Vugt & Tybur, 2014). It seems that from a very young age, humans have opinions about the individuals they witness in conflicts. Thus, one piece that might be missing from the 'chicken model' is the reputational concerns of the parties involved. People in public conflict don't want to be seen as aggressive or pushy (even toddles will negatively evaluate you, see Chapter 1) but there may also be consequences to backing down. Of course, the way in which this would affect one's reputation depends on the age of the person and likely the context. If you care about the opinion of infants, then backing down would be good, if you care about the opinion of toddlers, then backing down would be bad, and, it is unclear exactly how adults and older children would feel about those who back down. Based on this data, it may depend on the context. The point is, that as far as we assume the evaluations of infants and toddlers show that people do care about social rank when they are evaluating others, then we can assume that adults would use this information in their evaluations. Thus, people who find themselves in at least public conflicts may very well incorporate these reputational concerns into their decisions about whether to back down or not.

There are also hints of developmental shifts in how children evaluate groups based on the way they are organized. In Chapter 4, six to eight year-old children agreed that a group with one person who makes decisions has someone in charge, while only 7 and 8-year-old children showed a preference, saying they'd rather join the egalitarian group. So why could six year olds tell the difference but didn't have a preference? There were hints

that the 6-year-olds were at chance because of a developmental change such that younger children preferred the hierarchical group—4-year-olds said they'd rather go camping with the hierarchical group, and 5-year-olds said they'd rather be a part of the hierarchical group. This, of course, should be interpreted cautiously because this didn't hold true for all conditions. This could be explored in future studies along with studies that look at whether the context affects children's answers.

In Chapter 5, we learned that children predict the behavior of others based on their social rank. In this last chapter we learned that children, ages 3 to 8 do not expect high-ranking individuals to be more aggressive than subordinates. In fact, older children think they are *less* likely to be aggressive than subordinates. This is particularly interesting because one might think that 7 and 8 year-olds prefer the egalitarian group in Chapter 5 because they expect leaders to be particularly aggressive or anti-social. However, this is not what we found in Chapter 5. In contrast, children expect leaders to provide benefits to the group—children of all ages expect that leaders will 'kick out' someone who has been aggressive or antisocial. And, based on preliminary findings, children seem to expect leaders to be just as likely as anyone else to share a resource, and more likely than others to help when a group member is being attacked. These preliminary data also suggest that children do not seem to think that high-ranking people are generally more helpful—it seems they think the leader is *less* likely to help up someone who has fallen. Thus, children may expect leaders to be helpful in ways that benefit the group as a whole.

One thing is clear from these studies – social hierarchy is an important aspect of children's social cognition. This is perhaps not surprising given its role in human society and its prevalence in other species. We found that infants at least as 10-months old

evaluate others based on their relative rank and children as young as 7 evaluate groups based on their social organization. Children also have very specific expectations about how leaders will behave, that align with a large body of ethnographic work about how people around the world think leaders ought to act.

So what do these studies teach us? First, they teach us something about social hierarchy: we have found that humans from a very young age seem to be equipped to understand unique qualities of human social hierarchy—where rank can be based on more than dominance. Second, they teach us something about the development social cognition: humans can understand relationships between people from a very young age and use that information in their evaluations, but these evaluations can also change throughout development. What may cause these changes is a question left for future research.

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APPENDIX A.

Reanalysis Of Charafeddine Et. Al. Data

The following is a re-analysis of the data from Charafeddine et. al. What is important for the discussion: they did not actually find *positive* evidence that 3-year-olds chose randomly—24/38 of the 3-year-olds chose the 'dominant' puppet, which means an inconclusive Bayes factor (BF=1.16 in favor of the alternative that children were choosing more or less than 50% of the time over the null which is that children were choosing 50% of the time). Likewise, there was only anecdotal evidence that 4-year-olds were at chance (27/47 chose the dominant puppet; BF=1.87 in favor of the null) and anecdotal evidence that the 5-year-olds chose the subordinate more often (18/49 chose the dominant; BF=1.55 in favor of the alt.). Indeed, there is positive evidence that age predicts children's answer based on these numbers such that older children are more likely to choose the subordinate (just including the data for the three to five year-olds, BF=3.57 in favor of the alternative hypothesis that a model where age is included is more likely than a model that it is not). Moreover, 8-year-olds, strongly prefer the subordinate (3/29 chose the dominant; BF=1926 in favor of the alt. hypothesis). The details of this are important because it suggest that between the ages of 3 and 7, children begin to say out loud that they like the subordinate.