

The Effect of Sibship on Infant Reactions to Unequal Resource Distribution

Madison P. Tollinger

Oklahoma State University

Abstract

The ability to behave prosocially is something that develops throughout the course of infancy and childhood just as many other cognitive traits do (Dunn & Munn, 1968). Eventually one will develop enough cognitively to be capable of the various instances of social interactions and evaluations that aid in the development of this behavior. Despite these prosocial traits not being fully developed until an older age it has been found that infants possess the ability to evaluate situations of resource distribution as either prosocial or antisocial as young as 18-months-old (Geraci & Surian, 2011). Research regarding sibling interactions suggests that sibship aids in the ability to behave prosocially (Dunn & Munn, 1986; Fehr et al., 2008; Lamb, 1978). Previous work regarding the response of infants to unequal resource distribution does not often account for the effect that an infant's sibship status has or would have on their ability to react to unequal resource distribution. Studies aimed at assessing sibling interactions in relation to prosocial behavior and development do not often go as far as creating trials to test such behaviors under distributive circumstances. The purpose of this study is to extend upon previous research done by Jordan (2018) to determine how sibship effects an infant's reaction to receivers of unequal resource distribution. Specifically, this study assesses infants reactions to trials involving both animate and inanimate receiving agents of unequal resource distribution and observing the infants looking behaviors to determine preference between the resource rich or the poor receivers.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	4
II. REVIEW OF LITERATURE.....	5
The Development of Prosocial Behavior and Resource Sharing.....	5
Response to Unequal Distribution.....	9
Violation of Expectation in Infants.....	13
Infant and Sibling Relations.....	16
III. METHODOLOGY.....	22
Participants.....	23
Recruitment.....	23
Measures and Materials.....	24
Demographic Questionnaire.....	24
Distribution Display.....	25
Agents.....	25
Procedure.....	25
General Procedure.....	26
Distribution Phase.....	26
IV. FINDINGS.....	27
OOM Analysis.....	27
V. DISCUSSION.....	29
Hypothesis 1.....	29
Hypothesis 2.....	30
Implications.....	32
Limitations and Future Directions.....	32
Conclusion.....	34
REFERENCES.....	35

CHAPTER I

INTRODUCTION

The primary focus of this research is to assess the impact of having one or more siblings on an infant's reaction to unequal resource allocation, as well as to expand the knowledge on the development of these behaviors in infancy and early childhood. It has been noted that children experience a development in prosocial behavior within the first two years of life (Brownell, Iesue, et al., 2013; Shaw & Olson, 2012). Additionally, it has been observed that the socialization between sibling groups aids in the development of prosocial and antisocial behaviors (Dunn & Munn, 1986; Fehr et al., 2008; Lamb, 1978). Research also suggests that infants have the ability to recognize and react to situations of antisocial behavior and unequal resource distribution (Geraci & Surian, 2011; LoBue et al., 2010; Meristo & Surian, 2014; Schmidt & Sommerville 2011). Finally, infants react to these scenarios of inequality by looking both more frequently and for longer durations of time at these situations of behavior and distribution. Throughout this paper is a collection of literature regarding prosocial behavior, antisocial behavior, resource distribution and dilution, as well as sibship impact on various aspects of childhood all of which can be used to assess the research question.

CHAPTER II

REVIEW OF LITERATURE

THE DEVELOPMENT OF PROSOCIAL BEHAVIOR AND RESOURCE SHARING

Prosocial behavior can be defined as any act of voluntary behavior that is motivated purely by good intent for another without the need for reward or recognition (Eisenberg et al., 2007). Research regarding voluntary prosocial behavior in adults has provided considerably more knowledge than that of children's prosocial behaviors (Li et al., 2019; Light et al., 2015; Streit et al., 2020). Available research suggests that infants in their first year of life have the ability to recognize and react to certain prosocial and antisocial behaviors differently and that this ability increases across development. These reactions indicate that these behaviors are potentially learned at a much earlier age than most research is aimed at assessing (Geraci & Surian, 2011; Jordan, 2018). However, methodologies utilized in prosocial studies with older children and adolescents are influential in infant prosocial research.

Handlon and Gross (1959) analyzed children's sharing behaviors among children between the ages of 4 and 16. Participants were given a random but unequal amount of nuts and asked to distribute them to a peer and keep the remainder for themselves. In the first condition, the receiving participant was not present in the room where the distributing participant was dividing the resource to be shared. In the second condition, the receiving participant in question was then brought in and made to watch the individual allocate the resources in front of them. Results of this study indicated that younger children were more likely to keep a greater share of the nuts for themselves when distributing them, regardless of whether the receiving participant was present or not. However, as children aged the likelihood of them keeping the greater amount of the

allocated resource for themselves decreased (Handlon & Gross, 1959). Therefore, sharing at preschool age may be more motivated by self interest rather than egalitarian means, but the focus on equal distribution seems to develop across childhood and adolescence.

More recent research by Carson and Banuazizi (2008) focuses on a related concept of distributive justice in regard to individuals making choices when reallocating resources to themselves and others. The research was conducted using a within subjects approach in which fifth grade children from schools in the United States and the Philippines were read one of two scenarios and then asked to decide how to distribute the resources to the two individuals in the scenario. The first described two children picking up toys, one of the children picked up ten toys and the other only picked up three. Participants were also told that the child who picked up the least amount of toys was in more need of the reward, as they had not yet purchased all of their required art supplies, while the child who picked up the most toys had purchased all of the required supplies. They were then given ten colored pencils to be distributed between the two helpers in the scenario. In the second scenario, two children were planting trees on a playground, in which one child planted six trees while the other child only planted three. The child who had planted the most trees was saving money to buy themselves a toy, while the child who planted only three was saving up for their sister's birthday gift and the reward for helping plant the trees was \$10/100 pesos total. Participants from both countries reported that they preferred to distribute the resources equally, regardless of which child in the scenario had done more work. However, differences occurred in the remaining rankings with need (needing the extra art supplies or money for their sisters birthday gift) and merit (who had done the better job at cleaning up or planting trees) based distribution. Children from the Philippines valued the need of the receiver as the second most important factor and merit based distribution as the least

important, while participants from America placed more importance on merit than need (Carson & Banuazizi, 2008). This could be attributed to Filipino families being more collectivist compared to western individualists (Shapiro, M. E. 2005). The fact that both groups of children chose equality as their first choice of distribution indicates that they valued equal numbers between participants over need or merit. This also suggests that children at this age do not yet have the sociomoral capacity to realize that need based resource distribution may actually be more virtuous than the visual equality of the resources measured.

In a similar study conducted by Shaw and Olson (2012) they investigated inequity aversion in 3 to 8-year-olds. Inequity aversion in this case is operationally defined as the act of unequal distribution to individuals who did not do equal work. Twenty 6 to 8-year-olds and 24, 3 to 5-year-olds were informed by researchers of two non-present people who had completed the same task as one another for a reward. Children were then given an unequal amount of colorful erasers to be distributed as the reward. The distributing children were given the option to either throw away the extra eraser or to give one of the receivers an unequal amount despite their equal work. Six to 8-year-olds preferred to throw away the extra resource and the 3 to 5-year-old participants were more likely to give it away, despite creating an unequal distribution. While the 3 to 5-year-olds did display the occasional behavior of throwing the resource away, they did so at a much lower rate than the 6 to 8-year-olds. This suggests that children may not develop a more concrete understanding of equity until sometime after the age of 5-years-old (Shaw & Olson, 2012). Alternatively, failure to produce a reaction from children under five may be because the methodologies in place for the experiment were not aged appropriately for the younger children. It also suggests that the behavior of throwing the unequal resource away is not necessarily driven

by altruistic means, rather a general aversion to inequity that children seem to possess at this age according to the knowledge collected.

A more recent study that also involved the observation of children's behavior regarding resource distribution and sharing was conducted by Posid, Fazio, et al. (2015). The goal of their research was to investigate children's unsolicited decisions regarding resource distribution. Participants were 401 children ranging from 3 to 11-years-old, they were given either 12 or 30 stickers that they were to distribute. In one trial of the study the stickers were to be divided between the participant and *two* other receivers, in the second trial the stickers were to be divided between the participant and *one* other receiver. The children were then asked to distribute stickers to the other recipients into either one or two separate envelopes (depending on the number of recipients that child was assigned) as well as into an envelope for themselves. Whether participants engaged in prosocial sharing was dependent on how many stickers they had to distribute and how many individuals the resources had to be distributed between. This suggests that infants are more willing to share if given a greater quantity of resources when initially distributed. It was also found that the willingness to share increased with age (Posid, Fazio, et al., 2015). Overall, previous findings were supported through this research. These findings suggest that while children possess the ability to share resources at a young age (3 years of age in this study), the ability to share more prosocially, and be less concerned with one's own outcome, is something that increases in commonality with age.

A study done by Brownell, Iesue, et al. (2013) focused on sharing being a potential precursor for other prosocial behavior. The study itself focused specifically on other-oriented sharing, where the infants must physically give up something of their own in order to create a fair situation. Fifty-one 18 and 24-month-old infants were given toys to interact with, after the

infants played with the toys for several minutes they were asked if they would be willing to share the toy with an unknown adult experimenter, who either already possessed a toy or did not have any. It was found that infants were willing to share only when they would still have a toy available for themselves. While both ages were willing to share, 24-month-olds did so more often. Additionally, it was found that personal ownership of the toy impacted the child's willingness to share and they were less likely to share their own toy (Brownell, Iesue, et al., 2013).

The development of prosocial behavior and resource sharing is observable in infants as young as 18-months-old (Brownell, Iesue, et al. 2013). Research also suggests that there is a developmental milestone that is reached sometime between the age of 3 and 5-years-old, causing children of this age to become more aware of their prosocial behaviors, increasing their willingness to share both more generously and voluntarily (Handlon & Gross, 1959; Posid, Fazio, et al., 2015; Shaw & Olson, 2012). By studying the development of these behaviors in children, the assessment of the reactions infants have to these situations of unequal resource distribution can be properly researched and in turn better understood.

RESPONSE TO UNEQUAL RESOURCE DISTRIBUTION

Generally, unequal resource distribution of any sort is likely to elicit some sort of reaction from the recipient of the less plentiful resources. Adolescents are known to display both verbal and emotional reactions to unfair distribution, although knowledge regarding infant response to these scenarios is far less than that of adults and adolescents. In an attempt to assess at what age children begin to recognize equal versus unequal resource distribution, LoBue et al., (2010) conducted an experiment using 142 children, who were divided into three separate age

groups of three, four, and five. Children were matched into pairs by sex and age, and asked to play a game together to familiarize themselves with each other. Then the children were asked to clean up the game and given various designs of stickers as a reward, but distributed unequally between the pair. The children were then asked if they were satisfied with the number of stickers they received. Children who received fewer stickers reacted with confusion or irritation, while the children who received more stickers were either neutral or appeared happy. It was also found that in instances of unequal distribution, children over the age of three would sometimes offer their extra sticker to the disadvantaged receiver (LoBue et al., 2010). These findings suggest that children five and younger are particularly sensitive to contextual data that is associated with situations of unequal distributions that involve anything that focuses primarily on equality (equal amounts, portions, size comparison, etc.).

Geraci and Surian (2011) observed infants' reactions to agents interacting with both prosocial and antisocial distributing agents, as well as the infant's personal preference of the distributing agent. Participants consisted of 36, 10 and 16-month-old infants who began the study by being introduced to six separate familiarization trials, this was to provide the infants with background knowledge of the fair and unfair distributor. These familiarization trials consisted of the infants watching a distributing agent (a plush bear or lion) create multiple fair and unfair scenarios while distributing resources to a similar plush toy receiving agent. These events were repeated so that the infants could familiarize themselves with the action of resource allocation. Infants observed situations of both fair and unfair resource distribution, following this a previously unseen agent emerges and interacts with one of the two receivers. Infants were shown to look longer at the person interacting with the fair distributor, and less attention was given to those interacting with the unfair distributor. Findings also concluded that infants were sensitive

to the previous actions of the distributors and were shown to prefer the fair distributor to the unfair distributor by displaying longer looking times. The research concluded that it is more likely than not that the infants' evaluations were made based on previous social experiences regarding the positive and negative outcomes within the trial of unequal and equal distribution just witnessed (Geraci & Surian, 2011). These reactions suggest that infants prefer to fixate on the agents that distributed the resources in a way that would align with their expected outcome.

A study by Meristo and Surian (2014) examined how humans develop the ability to assess the fairness of resource allocation and to what extent socialization helps form these abilities. Three separate trials were involved in this study, each with a new group of 16, 10-month-old infants. Each experiment consisted of a scenario that displayed a scene involving fair and unfair agents/distributors. The first trial consisted of a distributor giving receivers either an equal amount (in which both receivers got one strawberry), or an unequal amount (in which one receiver got two strawberries and the other received nothing). The second trial consisted of both the fair and unfair distributors being treated prosocially or antisocially, by either having a strawberry taken away or distributed to them. The final trial was similar to the second trial, but instead of the object being taken away from the distributor entirely it was just moved away from them physically. The main finding from this study was that infants had longer looking times toward the scenarios involving the unfair distributors rather than the fair distributors. Although, in the third test the infants showed equal interest in both the fair and unfair distributors (Meristo & Surian, 2014). This suggests that the action of the strawberry being moved by a distributor rather than completely confiscated as previously observed conflicted with the infant's expected outcome, causing a longer looking time during the third trial.

Similarly, research from Scola et al. (2015) was aimed at determining if infants from 12 to 36-months-old show a preference for prosocial or antisocial behavior when demonstrated with human-like cartoons. The second question was whether or not the prosocial preference was still applicable when the character had darker skin or displayed a scrambled facial expression. Thirty-nine infants were separated into two groups based on their ages; 12 to 24 months and 24 to 36 months. Infants were shown videos depicting animated human-like characters performing different prosocial and antisocial behaviors. Afterwards the children were given dolls that were replicas of the characters in the film and observed to see how they played with the character considered “prosocial” versus “antisocial” (fair vs. unfair, giver vs. receiver, fair distributor vs. unfair distributor). Overall, infants showed preference for the prosocial characters over the antisocial characters regardless of facial expressions or skin color. Prosociality was prioritized above all variables in a majority of the participants, meaning the “giver” was almost always preferred over the “receiver” in the demonstration, this was true regardless of the age group (Scola et al., 2015). This suggests that after the first year of life infants have the ability to recognize and even demonstrate prosocial behavior, as well as show a strong preference for those who display this behavior regardless of physical appearance.

The research outlined above indicates that children five and younger recognize and respond to the social implications of unfair distribution (LoBue et al., 2010). Additionally, it has been observed that when approached with these scenarios of inequality infants will react by behaving differently towards the scenario of inequality. This could potentially be attributed to a violation of expectation regarding the outcome of resource distribution, this concept explains an infant's reaction to the observation of unequal distribution by describing longer and/or more frequent looking patterns (Schmidt & Sommerville 2011).

Violation of Expectations In Infants

Generally speaking, adults have the ability to recognize that the way others act and the outcome of an event may not always align with the perceived result. This is something that humans learn as they encounter these scenarios through standard socialization. Infants, however, have not yet experienced many situations that reaffirm the fact that one cannot predict the outcome of every situation. As referenced by Ziv and Sommerville (2016), this is considered to be the driving factor in regard to the violation of expectation paradigm, which has been an observed behavior among infants in numerous studies (Schmidt & Sommerville 2011; Sloane et al. 2012; Ziv and Sommerville 2012). The violation of expectation paradigm (VOE) can be described as a violation in the outcome of an event, which is not to be confused with a preference paradigm which is looking at the longer or more frequent looking times directed at an individual agent/s rather than the outcome (Jordan, 2018; Schmidt & Sommerville 2011). By studying the reaction to unequal resource distribution by nonverbal infants we can assess at what age infants begin to become aware of equal versus unequal scenarios. Previous research suggests that an infant's ability to become aware or make sense of physical events that surround them increases rapidly during their first 12 months. It is unknown as to what causes this substantial jump in development, but one theory is that infants learn things categorically, and form distinct opinions and knowledge based on these physical events they categorize within their minds (Shaw & Olson, 2012). The second theory is that infants are able to identify variables within these events that they can then categorize and in turn learn how to formally process and react to (Shaw & Olson, 2012).

A study aimed at assessing both the looking response of infants to equal versus unequal distribution as well as if infants were willing to share their personal resources with familiar

adults was performed by Schmidt & Sommerville (2011). Forty-seven 15-month-old infants observed a VOE paradigm, where they watched a third party individual distributing resources either equally or unequally between receivers. Infants were shown both equal/unequal scenarios in random order and their looking response was recorded. Following the initial paradigm researchers observed if infants were willing to share their own personal (preferred) toy with a familiar adult, share a random toy, or not share at all. These behaviors were recorded and defined as either altruistic sharing, selfish sharing, or not sharing (N/A). The data concluded that infants do indeed show knowledge of the principle of fairness and that they assume resources to be distributed equally when viewing a scenario involving distributive actions as they looked longer at the scenario that violated their expectation or was considered not normal. The second half of the study suggests that when it comes to sharing non-essential resources, infants of this age are willing to share with familiar adults. Furthermore, it was found that one third of the infants in the trial shared their preferred toy with the adult despite there being other options. This shows altruistic motive, suggesting that children of this age are capable of processing these sociomoral behaviors. The same infants that displayed altruistic sharing all stared longer at the unequal resource distribution scenario in the VOE paradigm segment of the experiment (Schmidt & Sommerville 2011). This suggests that they expected an equal resource allocation and the unequal distribution was a violation of their expected outcome of the events.

Sommerville et al., (2012) performed research in regard to infant reactions to violations of expectations, this was aimed at investigating how expectations are developed regarding resources, specifically in children's second year of life, overall determining an infants sensitivity to equity violations. Another objective was to determine if there was a correlation between infants' fairness expectations and their displays of prosocial behavior. Participants were healthy

12 and 15-months-old infants, the first study the infant participants partook in was in regard to VOE. A distributor gave two receivers either an equal or unequal amount of crackers as the infants observed, it was hypothesized the infants would look longer at the scenario that violated their expectations, the unfair distribution. The second was a sharing task experiment similar to that of Schmidt and Sommerville (2011), in which infants were allowed to select one of two toys, a familiar toy or an unfamiliar toy, they were then asked to share a toy with an unfamiliar adult, the infant could select either their preferred toy, unpreferred toy, or to not share at all. It was found that there was a close relation in how children share their own toys and resources and their personal perceived fairness sensitivity and their personal fairness expectations. Meaning if an infant was more willing to share their resources, they expected the same in return, this resulted in infants staring longer at the unequal distribution. Data from this study also suggests that there is a shift in fairness expectations between the months of 12 and 15 (Sommerville et al., 2012). Further research should be done to analyze the shift in expectations that occur between those three months of time.

Sloane et al. (2012) conducted two different trials to detect whether or not infants noticed a violation in the distribution of resources. In this experiment the violation was measured by a longer looking time, as in multiple other studies (Jordan 2018; Schmidt & Sommerville 2011; Sommerville et al., 2012 Ziv and Sommerville 2012). The violation of the expectation paradigm is described as an approach to study infant cognition, in which infants are observed as they themselves view an event or scenario. The violation of expectation is measured by the increased looking times infants show towards the event or scenario that did not align with their perceived outcome (APA Dictionary of Psychology, 2020). For trial one of the experiment 19-month-old participants observed an experimenter divide two desirable resources, either unequally or equally

between two receivers. Trial two of the experiment involved 21-month-old participants that viewed a scenario of unequal distribution in regard to the receivers merit. The infant viewed two individuals, one was completing chores while the other played with toys, these were labeled the worker and the slacker. Both individuals received the same reward for visibly different amounts of effort. Infants preferred the equal distribution of resources over the unequal distribution and they expected the receivers to be rewarded only when both partook in work rather than one working and one playing (Sloane et al., 2012). These findings align with others that suggest that infants are aware of not only fair versus unfair distribution but they also have the ability to form preconceived notions as to what they think an event's outcome may be.

The findings drawn from this body of literature suggest that infants are developmentally mature enough to recognize and react to unequal distributions of resources and that these scenarios violate the infants preconceived expectation of an outcome (Shaw & Olson, 2012; Ziv & Sommerville, 2016). Research shows that infants have been shown to react to these violations by looking longer at scenarios of unfair distribution, suggesting that this antisocial behavior violates their expectation (Jordan 2018; Schmidt & Sommerville 2011; Sloane et al., 2012; Sommerville et al., 2012 Ziv and Sommerville 2012). The approach of the violation of expectation paradigm research in regard to infant cognition proves to be helpful in identifying valuable data regarding unequal resource distribution scenarios and infant behavior.

INFANT AND SIBLING RELATIONS

The data regarding a siblings impact on an individual has long been studied, from the nature vs. nurture theory (Pike & Eley, 2009) to the countless twin studies done over the past few decades (Montag et al., 2016; Van Dongen et al., 2012; Segal, 1990) sibling relationships have

been under the microscope for some time. Although, when it comes to information on how sibling interactions can shape an individual's reactions to prosocial and antisocial behavior there is limited research. Dunn and Munn (1986) aimed to identify at what point younger siblings began to show concern or regard towards their siblings' emotions, such as distress or needing to be comforted by observing their interactions. Forty-three families, each with two children were used as participants for this study, with the second (or youngest) child being between the ages of 18 and 24 months. The sibling pairs were observed two times within one month, each for one hour at a time. The conversations between the siblings in their natural environments were recorded and categorized into positive and negative interactions. This was done initially to examine if there was already any present knowledge of the other's emotional needs. Results showed that the action of sharing and displaying emotional comfort was seen less frequently in 18-month-olds than it was in 24-month-olds. Researchers found that by the age of 24 months if there was a child with an increased ability to perform these prosocial actions it was often correlated with the positive interactions that were had between the two siblings (Dunn & Munn, 1986). This suggested that the stronger the relationship between the two children the more likely they are to display a more complex and consistent display of prosocial behaviors and those with siblings may generally have an increased ability to perform prosocial behaviors such as sharing or recognizing others' distress in this instance.

Research from Lamb (1978) attempted to assess the predictability of sibling interactions from a longitudinal approach. Infants' interactions between themselves and their siblings were observed and recorded by researchers. The infant participants were assessed at 12 months of age (+/- two weeks) and again at 18 months of age (+/- two weeks). The participants' siblings were between 18 and 46 months of age. Results showed that infant and preschool aged interactions

between siblings were not as predictable as researchers thought, sibling interactions change over time as both children mature and learn social cues. It was found that if the infant was more sociable towards their preschool aged sibling during the first encounter, then their sibling was often more sociable as well. Preschoolers were also found to be more active in offering toys and taking toys, while infants were more prone to observing the interactions of others and imitating them (Lamb, 1978). A more recent study from Baydar, Hyle, and Brooks-Gunn (1997) also took a longitudinal approach, and conducted a study investigating the different changes that can occur within a family structure after the birth of a sibling, specifically in preschool aged children. Two surveys were conducted after a two and four-year period with the same child participants. Results showed that when comparing the two surveys, the later study showed signs of depletion in developmental and monetary resources. This suggests that sibship does impact family dynamics in some form or another which in turn impacts the children within the family (Baydar, Hyle, & Brooks-Gunn, 1997).

Fehr et al. (2008) investigated the onset of prosocial traits in children by instituting three separate trials that tested multiple characteristics of egalitarianism. The first trial looked at prosocial interactions in children, the second focused on assessing envy, and the third examined the participant's concept of sharing. Generally speaking, it was found that children's sharing efforts increase with age, which is to be expected as they become continuously socially aware of these prosocial traits. Those without siblings were more likely to share than those with siblings though, as the age increased this correlation decreased slightly. It was also found that no matter the age, the youngest child was on average, less willing to share with others than those who were the eldest child. There was a significant effect on both those who are the youngest child or the only child in that these participants were exponentially more unlikely to be willing to share (Fehr

et al., 2008). This suggests an interesting idea that along with age, birth order itself may play a part in the development of these behaviors.

A more recent study that further confirms both an infant's ability to recognize unequal distribution and that having a sibling/s impacts potential response was conducted by Ziv and Sommerville (2016). They sought to discover what type of events are associated with an infant's ability to develop fairness expectations. This study took a look at how the action of random or spontaneous sharing might impact the development of fairness expectations in infants. They hypothesized that sharing interactions may shift the pattern of the developmental onset that aids in fairness expectations. Existing research shows that children tend to gravitate towards equality in scenarios of resource distribution. In third party scenarios it has been recorded that children will prioritize equal distribution amongst participants over familial relationship or friendships (Ziv & Sommerville, 2016). When children themselves get an unfair or unequal resource distribution they react negatively. This article also references another piece of literature mentioned in the present literature review, Schmidt and Sommerville (2011) and how they found that infants at 15 months looked at an unfair distribution outcome longer than a fair outcome (Schmidt & Somerville, 2011). The researchers attributed this to infant expectations, the infants expected a fair resource allocation scenario and were perplexed by the unfair scenario (Ziv & Sommerville, 2016). This could potentially be attributed to the violation of expectations paradigm where children are perplexed by scenarios that do not fit their perceived outcome. This study found that expectations in regard to fairness involving resource distribution emerge around a year-and-a-half to one-year-old. As well as that there was a strong correlation between sibship and fairness expectations, as the presence of siblings was associated with an increased looking time toward unfair distributions (Ziv & Sommerville, 2016). This information further validates

other studies that cite that fairness expectations exist at one year of age and that the looking behaviors vary across resource distribution scenarios.

Overall, the socialization between siblings appears to influence the development of both prosocial and antisocial behavior (Dunn & Munn, 1986; Fehr et al., 2008; Lamb, 1978). It has also been observed that prosocial interactions between two siblings increases the prosociality of the infant's behavior in general (Dunn & Munn, 1986). This suggests that infants with siblings may display an expedited development of both antisocial and prosocial behaviors, causing them to be more sensitive to scenarios of unequal resource distribution.

PRESENT STUDY

The information collected suggested that infants and children of young age do possess a sense of what is fair and what is not, as well as an expectation regarding resource distribution. Infants expect an equal resource allocation or fair outcome, so when they are met with an outcome that does not meet this preconceived conclusion, they react by looking longer or more frequently at the scenario. This suggested that infants have the ability to develop expectations as to what they deem as fair before the age of five. Research also found that an infants' expectations are violated when confronted with antisocial beings or behavior, whether they observe it or experience it directly (Jordan 2018; Schmidt & Sommerville 2011; Sloane et al. 2012; Ziv and Sommerville 2012). Data also found that sibling interactions have a positive effect on prosocial development, meaning that those with siblings are more likely to display behaviors that are considered prosocial; sharing, helping, volunteering, etc. It is known that prosocial behavior increases with age, meaning as a child ages their ability to share, recognize fair distribution of resources, and understand others emotions becomes more concrete (Brownell, Svetlova, et al.,

2013; Geraci & Surian, 2011; Handlon & Gross, 1959; Jordan, 2018; Shaw & Olson, 2012; Posid, Fazio, et al., 2015). While there is data regarding inequity aversion, resource distribution, and interactions between siblings, there is limited knowledge that bridges the gap between these areas of study (Li et al., 2019; Light et al., 2015; Streit et al., 2020). By studying the impact that sibship has on these variables not only do we better our understanding of sibling relationships and their impacts, but also on how prosocial and antisocial behavior and response develops over early childhood. This study was part of a larger body of research by Jordan (2018) that focused on infant evaluations of the agent on the *receiving* end of unequal resource distribution, an area largely overlooked in this body of research that traditionally focused on the evaluation of the *acting* or *distributing* agents. Additionally, as there were very few studies that focused on infant response to non-social entities (Gredebäck et al. 2015), Jordan (2018) included a manipulation of both animate and inanimate (lacking facial features) receiving agents in order to compare potential behavioral differences by the infant participants toward social vs nonsocial receivers. Based on this larger study the current study examines the impact that sibship directly has on an infant's reaction to both social (animate) and non-social (inanimate) agents on the receiving end of unequal resource distribution. After review of the literature aforementioned, we hypothesized that infants and their interactions with their siblings impacted the way they respond to unequal resource distribution. Specifically, we expect infants *with* siblings to look longer and more frequently at the agent interacting with the *inanimate* rich receiving agent compared to the *inanimate* poor receiving agent. This is also expected to be true regarding infants *without* siblings during *inanimate* receiver trials. We hypothesize these reactions as the presence of a greater quantity of resources is likely more desirable to the infant than a lack of resources when involving nonsocial (*inanimate*) entities. With regard to the *animate* trials, it is expected that

infants *with* siblings will look longer and more frequently towards the agent interacting with the *animate* poor receiver rather than *animate* rich receiver, the same is thought to be true regarding infants *without* siblings during *animate* receiver trials, although at consistently lower rates than their peers *with* siblings. We hypothesize these reactions as the *animate* agents possess facial features, creating a “like me” relationship between the infant and the agent (Metzoff, 2007). It is known that siblings aid in the development of prosocial behavior and socialization, this is why we believe that the infants *with* siblings will react more prosocially towards the *animate* agents than their siblingless counterparts.

CHAPTER III

METHODOLOGY

Participants

Participants were observed at Oklahoma State University in the Developmental and Psychophysiology laboratory, participants consisted of 27 infants, 9 of which were males and 18 being females, along with their caregiver. Based on previous research regarding similar topics of resource distribution within 12 to 16-month-olds, a two tailed, priori statistical power analysis (GPower 3.1) was used to estimate a reasonable sample size (Geraci & Surian, 2013; Sommerville & Schmidt, 2012). The effect sizes (ES) of the aforementioned studies ranged from .25 to .56 (d) depending on the constructs being assessed within the experiments, according to Cohen's conventions (1988) these were to be considered a small to medium ES. Due to this, the average estimated sample size for the experiment for within-group comparison was approximately $N=23$. A final sample size of 25 infants was analyzed, due to a machine malfunction, one infant's responses were unable to be coded, while one other infant did not complete all six trials and was pulled from the experiment due to the caregivers request based on the infant's excessive distress. The participants observed were all between the ages of 16 and 20 months of age ($M = 79.68$ weeks, $SD = 4.96$), every infant involved was carried to full-term and healthy for their age. Married caregivers accounted for 68%, while 12% were remarried, 8% were not married at all, and 4% were divorced. Maternal education level reported that 56% were college graduates, 28% had done post-graduate work, 8% had completed a part of college/taken a few courses, 4% were vocational-technical school graduates, while 4% had completed a few vo-tech courses. Paternal education level reported that 32% completed post-graduate work, 28%

completed a part of college/taken a few courses, 24% were college graduates, 8% were vocational-technical school graduates while the other 4% had completed a few vo-tech courses and lastly, 4% had graduated from high school only. A little over half of the caregivers (56%) reported a monthly income of over \$4,000, 32% of caregivers reported that they received some form of federal or state assistance in regard to their finances. The range of maternal ages went from 24 to 48 years of age ($M = 34.35$). Data collected from the questionnaire reported that maternal ethnicity for the study was 80% Caucasian, 16% claiming various ethnicities, and 4% were Asian. Paternal ethnicity proved to be 68% Caucasian, 12% African American, 12% claiming various ethnicities, 4% Asian, and 4% Native American.

Recruitment. To recruit participants for this study, paper flyers were distributed locally at infant and childcare facilities as well as across the campus of Oklahoma State University in Stillwater, Oklahoma. Social media was also used to advertise the study and increase potential participation. All volunteers participating in this study were treated in conformity of the rules and regulations stated in the Institutional Review Board of Oklahoma State University.

Measures and Materials

Demographic questionnaire. The primary caregiver of the infant participants were given a demographic questionnaire to fill out prior to the study, in order to obtain general information regarding the infant and immediate family. Personal knowledge regarding things such as; number of siblings the infant has, birth order of the infant, marital status of the parents, income level, if the infant was living in a monolingual vs. bilingual or other language speaking household, and the level of education of the infant's parents.

Distribution display. The distributive events took place in a display designed to replicate a “black box theatre”. Either two animate receivers or two inanimate receivers were placed opposite of each other within the display box while the infant observed from a distance. There was a cut-out in the back wall of the custom display that allowed for the animate distributing agent to allocate the resources to the receivers that were sitting in the display box. A wooden peg was fastened to the floor of the box in front of each receiving agent, this allowed for the resources to remain stationary throughout the procedure. The experimenter who was acting as the animate distributing agent in the experiment was hidden behind a floor length curtain, out of sight from the observation of the infant.

Agents. Six plush toys in geometrically even shapes (7 x 7 inches) consisting of various colors were used as the inanimate receiving agents. Even in trials consisting of inanimate receivers, animate agents were still used as the distributing agent, this explains why there is one extra animate plush than inanimate (see Appendix ? for agent key). Animate receivers consisted of seven various stuffed animals again, of various colors, each animate receiver was Ty brand to maintain consistency.

Procedure

General Procedure

The infants primary care givers were asked to fill out the demographic questionnaire for the study, and following this they were allowed to play with their infant for approximately 10 minutes to acclimate the infant to the studies environment. Then the caregiver was given a resource similar to that of the one distributed in the trial and asked to react excitedly to the reception of this resource and to attempt to share the resource with their infant and establish the

resource's desirability and importance. After the acclimation took place, the infant sat on their caregivers lap in the direction of the display, they then observed 6 counterbalanced distribution trials (consisting of 3 animate and 3 inanimate). Throughout the entirety of the distribution trial the caregiver was requested to behave neutrally and make no attempt in eliciting a reaction from their infant.

Distribution Phase

The curtain that was covering the front of the display opened to reveal two receiving agents sitting opposite one another with an empty wooden peg fixed in front of them. A third agent came through the cut out and distributed the resources using exaggerated motions in a 5:1 ratio before leaving the view the same way it entered.

CHAPTER IV

RESULTS

The data was analyzed using Observation Orientated Modeling or OOM (OOM; Grice, 2011; Grice et al., 2012). OOM assesses for the comparison in frequency of the looking times infants made throughout each trial, expected patterns of outcomes and the data collected was summarized using multiple accuracy index to identify how many participants fit the expected pattern of results. OOM utilizes a series of randomization tests that are free of assumptions that other traditional null hypotheses (NHST) sometimes contain, such as normality of population distributions and homogeneity. Many participants' behaviors violated the aforementioned assumptions, but because OOM is consistent with other non-parametric methods, more fluid measures such as the looking times, grasps, and reaches were able to be analyzed.

Sets of ordinal pattern analyses were conducted in order to determine if sibship impacted the results of agent preference. In *inanimate* receiving trials, the presumed ordinal pattern outcome for both infants with siblings and without was identical to that of the original hypothesis, inanimate rich > inanimate poor. Eight out of 12 infants *without* siblings matched this pattern and looked more frequently at the inanimate rich receiver compared to the inanimate poor receiver. For OOM this can be converted into a percentage correctly classified (PCC) of 66.67%. A randomization test based on 1,000 random trials then assigns a probability statistic of .06 referred to in OOM as a chance value (*c*-value). This value indicates that there was only a 6% likelihood that our PCC of 66.67% occurred by chance for this expected ordinal pattern. Similarly, infants without siblings were also found to look longer at inanimate rich receivers than inanimate poor, with 7 out of 12 (PCC = 58.33, *c*-value = .25). In the trial group containing infants *with* siblings 8 out of the 13 infants (PCC = 61.54, *c*-value = .18) looked more often at

the inanimate rich receiver than they did the inanimate poor. Infants also looked longer at inanimate rich receivers compared to inanimate poor receivers, with 6 out of 13 infants (PCC = 46.15, c -value = .70).

In the *animate* trials, the expected ordinal pattern result for infants both with and without siblings was again identical to the original hypothesis with a preference of animate poor over animate rich receivers. A majority of infants *without* siblings looked more frequently at the animate poor receiver than the animate rich with 9 of the 12 (PCC = 75.00, c -value = .08) but, less than half of the infants looked longer at the poor receiver compared to the rich with only 5 of the 12 (PCC = 41.67, c -value = .82) doing so. In the group containing participants *with* siblings, 5 of the 13 (PCC = 38.46, c -value = .58) looked more frequently at the animate poor receiver compared to the animate rich. Of the infants, 9 out of 13 (PCC = 69.23, c -value = .15) looked longer at the animate poor rather than the animate rich.

DISCUSSION

The purpose of the study was to assess how sibship impacts an infant's response to unequal resource distribution. Research regarding sibling relationships have been long studied, but predominantly in older ages rather than in infants alone (Montag et al., 2016; Van Dongen et al., 2012; Segal, 1990). Based on our extensive review of the literature, there is little research regarding the impact of sibling relationships and socialization on an infant's ability to recognize and react to scenarios involving unequal distribution and what little there is focused on evaluations of an active distributor compared to a passive receiver (Schmidt & Sommerville 2011; Sommerville et al.). Research that examines this in older children and adults aids in providing a better understanding of what prosocial and antisocial behavior is (LoBue et al., 2010; Posid, Fazio, et al., 2015), but researching infants will aid in a better understanding of not only antisocial and prosocial behavior but how socialization between sibling/s aids in its development.

Hypothesis 1

The purpose of hypothesis one was to determine if infants *with* siblings would react differently to the *inanimate* or non-social receiving agent when compared to those *without* siblings. Specifically, it was hypothesized that when facial features were not present on receiving agents that infants both *with* and *without* siblings would look longer and more frequently at the *inanimate* rich receiving agent compared to the *inanimate* poor receiving agent, possibly in an attempt to align with a greater number of resources. With regard to the *inanimate* trials our hypothesis was partially correct, as both groups of infants looked more frequently at the *inanimate* rich, as the hypothesis suggested. Although, in regard to the duration of looks, while infants *without* siblings did support the hypothesis and look longer at the rich receiver, the data

for infants *with* siblings did not align with the hypothesis as less than half of the participants (46.15%) looked longer at the rich than the poor. This suggests that while infants do prefer to look more often at the inanimate rich over the inanimate poor the data is not strong enough to relate this to causal findings.

While previous research has supported that infants as young as 10-months-old have the ability to evaluate scenarios of resource distribution (Meristo & Surian, 2013) and that they preferred equal distribution of resources over unequal distribution (Sloane et al., 2012), in many cases these evaluations were dependent on the previous actions of the distributors (Geraci & Surian, 2011). The receivers in the present study were inanimate and no indication of the receiving agents merit was provided, so infants were not provided a definitive explanation as to *why* the agent received an unequal number of resources. It is plausible to speculate that these reactions of longer and more frequent looking behaviors towards the rich receiver was based on a desire for more greater resources, something that could potentially have an evolutionary cause behind it (Geraci & Surian, 2011; LoBue et al., 2010), though further research regarding this is necessary before drawing conclusions.

Hypothesis 2

The purpose of hypothesis two was to determine if infants *with* siblings would react differently to an *animate* receiving agent when compared to those *without* siblings. Specifically, it was hypothesized that infants *with* siblings would look longer and more frequently towards the agent interacting with the *animate* poor receiver rather than *animate* rich receiver, the same was thought to be true regarding infants *without* siblings during animate receiver trials, although at consistently lower rates than their peers *with* siblings. Previous research suggests that sibling

interactions aid in prosocial development and behavior (Dunn & Munn, 1986; Fehr et al., 2008; Lamb, 1978). When taking into account that the *animate* objects resemble life like figures and the *inanimate* do not (plush toys with facial features versus geometric plush shapes) it was hypothesized that the infants *with* siblings would have an increased chance of empathizing, or acting prosocially towards an agent that was treated with unequal distribution, due to their increased prosociality that is influenced by their sibship. Mixed results from the original hypothesis were found as infants *with* siblings did not look more often at the *animate* poor when compared to the infants *without* siblings as originally hypothesized. Although it was also found that infants *with* siblings looked for a longer duration at the animate poor than those *without* siblings, this did align with the original hypothesis.

Despite previous findings that infants with siblings are found to be more prosocial (Dunn & Munn, 1986; Lamb 1978; Ziv & Sommerville, 2016) our study did not produce a drastic difference between the two groups of infants and the mixed results suggest no true impact of sibship in regard to looking behaviors towards agents of unequal distribution as was hypothesized. Ziv and Sommerville (2016) found that the presence of siblings was associated with an increased looking time toward unfair distributions. In this study siblings were not present in the experiment room, it is plausible to assume that due to the lack of the physical presence of the sibling the infants reactions were not necessarily based on anything other than the impact of their previous socialization.

Implications

To summarize, based on the data collected and analyzed regarding sibship within this research it is plausible to assume that siblings aid in some aspect of sociocognitive development that contributes to their ability to react to unequal resource distribution. Although, to what extent and how can not positively concluded as further research assessing other aspects of sibship in this area of research is still necessary. Previous research regarding response to unequal resource distribution has greatly aided in what is known about prosocial and antisocial behavior and response to unequal distribution. The study of infants in this area of research would aid in the collection of more knowledge regarding the development of these behaviors prior to adulthood. By understanding the development of these behaviors further research can be conducted regarding any disruptions or potential hindrances that infants face when developing these prosocial and antisocial abilities.

Limitations and Future Direction

Based on the findings from Ziv and Sommerville (2016), one aspect that could help produce stronger results, would be to allow the infant's sibling(s) to be present in the room where the study is being conducted. Infants of such a young age may only be influenced by the physical presence of one or more of their siblings and may not have the cognitive capacity to attribute decontextualized situations of unequal resource distribution to unfair distribution of resources between themselves and their sibling. This conclusion aligns with part of the data collected from the trials as it was found that in infants *with* siblings 69.23% looked longer at the poor receiver than the rich receiver, it was found that in those *without* siblings only 41.67% looked longer at the poor receiver rather than the rich in *animate* trials. By introducing the physical presence of a sibling(s) into the procedure the percentage of infants who look longer at the poor versus the rich may potentially increase.

Another modification that could help clarify the outcome of this study is to collect more information regarding the sibling(s) of the infant prior to the beginning of the trial such as; birth order, sibling age, and relation to the infant (step, half, biological, twin, etc.). Fehr et al. (2008) found in their study that there was a significant effect on both the youngest child or the only child, in that these participants were exponentially more unlikely to be willing to share than their older peers and those who were older siblings. This suggests that birth order could be another potentially influential aspect in regard to response to unequal resource distribution. In another study, done by Dunn & Munn (1986) researchers found that by the age of 24 months if a child had an increased ability to perform prosocial actions it was often correlated with positive interactions that were had between the two siblings. Dunn & Munn (1986) focused their attention on the younger siblings behavior rather than the latter and found that an increase in prosocial behavior from the infant was closely associated with prosocial interactions between the two siblings. By focusing solely on those with the youngest birth order it is easier to determine whether or not age has more of a factor in the development of these prosocial behaviors than sibling interactions do. The focus of the original study was on infant social evaluations, therefore extensive data regarding sibship was not collected. This is an aspect that could be applied to future research regarding this area of study.

Conclusion

Overall, the findings from this extension upon Jordan (2018) research was not as definitive in nature as previous literature in this area although, some of the data collected did

support the original hypothesis. While this data suggests, along with the aforementioned literature, that siblings may impact an infant's response to unequal resource distribution more research should be conducted as to what specific factors of sibship may impact this. Further research should take into account details such the age of the infants siblings, birth order, and relation to the infant (step, half, biological, twin) in order to further determine what aspects of sibship contribute most evidently to this area of research.

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