Origins and Implications of Prosocial Behavior in Early Development

by

Sarah Probst

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Psychology)
in the University of Michigan
2024

Doctoral Committee:

Professor Felix Warneken, Chair
Professor Susan Gelman
Associate Professor Dr. Kaitlin Raimi
Professor Emeritus Henry Wellman

Sarah Probst

saprobst@umich.edu

ORCID iD: 0009-0006-2642-9915

Dedication

I dedicate this dissertation to my family and friends, my partner Alex, and my late dog Sushi, all of whom have been important sources of emotional support throughout my graduate school journey. I am grateful to all the wonderful folks in my life who have helped me prioritize my physical and mental wellness throughout graduate school, from hikes to happy hours and everything in between.

Acknowledgements

This dissertation would not be possible without the mentorship and feedback of my dissertation chair, Dr. Felix Warneken, and the thoughtful comments of my committee. I would like to acknowledge all the hard work of the Social Minds Lab research assistants and interns I have had the pleasure of working with on these projects, who were a big help with recruiting participants, running studies, and coding and transcribing data. I would also like to give a special thanks also to our lab managers of past and present who were instrumental in keeping day-to-day research operations going, and to the post-docs and graduate students in the lab who have heard about these projects at many different stages and have always offered helpful feedback.

Table of Contents

List of Tables

List of Figures

Abstract

Why do people help others, and how can children's prosocial tendencies be leveraged in real-world contexts? In this dissertation, I bring together two lines of research–a project investigating the ontogenetic origins of prosocial behavior in infancy, and two projects investigating how framing preventative health measures as prosocial influences children's reasoning.

My project on infant prosociality aims to shed light on the debate over whether people are predisposed to help others or are socialized to be prosocial (see Warneken, 2015; Brownell, 2016) by studying whether young infants will help others utilizing novel eye-tracking methodology. Across two studies ($N = 60$), infants had the opportunity to help others using their gaze. I found initial evidence for helping behavior among 9–12-month-olds, but further research is needed to rule out alternative explanations.

My project investigating children's reasoning about mask-like behaviors aimed to uncover whether emphasizing the prosocial features of novel public health measures would be more effective and moralizing for children, as it is for adults (e.g., Ceylan & Hayran, 2021; Luttrell & Petty, 2020). In two studies ($N = 109$) conducted using hypothetical vignettes over Zoom, I found that children readily endorse novel protective behaviors, and think about them in moral terms when they are framed as benefiting others. I also examined this effect in a vaccination context using similar methodology. Across two studies ($N = 120$), I again found that children endorsed the behaviors at high rates, but also found an age effect: younger children

thought these behaviors were important regardless of condition, while older children thought of them in moral terms when they were framed as protecting others.

Taken together, these three manuscripts constitute important theoretical and methodological contributions. I develop novel ways to investigate how infants and children reason about others. I also shed light on the developmental origins of helping behavior. Finally, I demonstrate how the implications of children's prosociality for their reasoning about public-health measures.

.

Chapter 1
General Introduction

Our willingness to help and care about others is a crucial part of human existence. It is also the centerpiece of many debates that have fascinated humans for centuries–are people essentially good, or must they learn to suppress selfish instincts to cooperate and help? In the following dissertation, I explore the phenomenon of prosociality in terms of its origins in infancy as well as its applied functions in childhood.

Prosocial behavior refers to behaviors intended to benefit others (Eisenberg et al., 2015). It emerges around the second year of life and becomes more sophisticated and robust throughout development (Eisenberg et al., 2015). It consists of the discrete subcategories of helping, sharing, and comforting, with instrumental helping–aiding the completion of someone's concrete goal–among the earliest of behaviors to develop (Dunfield et al., 2011; Warneken & Tomasello, 2009). As children progress through early and middle childhood, they demonstrate a wealth of prosocial behaviors, at first doing so indiscriminately and eventually tempering their prosociality with considerations of need, reputation, reciprocity, trust, and other contextual factors (Eisenberg et al., 2015).

While much research has focused on the types of prosocial behavior children engage in, the contexts and conditions under which they occur, and their various correlates, other aspects of prosociality are understudied. One component of prosocial development that is difficult to study is its origins, or understanding whether people come into the world ready to behave prosocially or need to learn it from their surroundings. Another understudied component of prosocial

behavior is its applications–we know that children are very prosocial, but can this be leveraged in contexts such as public health to maximize societal good? I address these two broad questions in this dissertation.

Origins of Prosocial Behavior

One key debate in the prosociality research field is whether humans are born evolutionarily predisposed to behave prosocially, or whether prosocial development occurs through experience and socialization. Much of the research on early prosocial behavior has focused on two competing hypotheses aimed at explaining the origins of prosocial behavior: the inherited predisposition hypothesis and the socialization hypothesis.

The inherited predisposition hypothesis stipulates that humans are predisposed to engage in prosocial behavior due to evolved biological mechanisms that developed over the course of phylogeny. These mechanisms are thought to have developed because cooperative behaviors such as hunting together and distributing resources aided the survival and proliferation of our evolutionary ancestors (Warneken, 2016). Moreover, Tomasello & Vaish (2013) argue that humans evolved to be 'hypercooperative' due to the unique challenges that faced the earliest humans. Increased population density resulted in a scarcity of resources that drove early humans to band together in collaborative feeding, living, and child-rearing practices (Tomasello & Vaish, 2013).

Cross-species research with nonhuman primates helps demonstrate what cooperative abilities our evolutionary ancestors may have had, and what behaviors can occur without social-cultural influences. Chimpanzees, for example, can perform basic forms of instrumental helping which do not depend on rewards, but require explicit communication of need and clear means of helping (see Warneken, 2016). These kinds of insights from other species suggest that, as

nonhuman primates can help in similar ways to young humans, evolutionary mechanisms may be responsible for our most basic forms of prosociality.

A biologically inherited predisposition for prosociality suggests that early helping is intrinsically motivated, and the literature seems to support this assumption. Material rewards decrease toddlers' helping, suggesting that an early intrinsic motivation could be compromised by extrinsic rewards (Warneken & Tomasello, 2008). Moreover, children demonstrate sympathetic arousal in response to seeing others in need. Toddlers show increases in pupil dilation–a proxy for internal arousal–when witnessing a need situation, which is decreased both when they themselves or a third party provided the necessary help (Hepach et al., 2012). This suggests that early helping is related to genuine sympathetic concern for others that is not based on more selfish factors like reputation or the expectation of praise.

If prosociality comes from an inherent predisposition, there should be cross-cultural similarities in early helping behavior. Indeed, Callaghan et al. (2011) studied toddlers in Canada, India, and Peru, and found that across all of these distinct cultures, toddlers understood actors' needs and helped them the same amount. Furthermore, the rates and emergence of helping behavior is the same across samples of Indian and German children (Kärtner et al., 2010). These studies both support the idea that the basic mechanisms prompting the emergence of prosocial behavior are universal, indicating some biological component.

On the other side of the theoretical debate are proponents of the socialization hypothesis, which posits that prosocial behavior is the product of socialization from caregivers and other members of society (Brownell, 2016). According to this perspective, humans inherited domain-general mechanisms for affiliation, social learning, and enjoyment of social interactions. These tools then allow prosociality to be socioculturally transmitted to young children from caregivers

or other experienced members of the community (Hammond & Brownell, 2018). This hypothesis thus asserts that prosocial behaviors are observed and scaffolded from the beginning of life.

Supporters of the socialization hypothesis point to findings which highlight the efficacy of socialization techniques on prosocial behavior as evidence that they are a crucial component. For instance, Pettygrove et al. (2013) found that socialization techniques such as encouragement and maternal directives increased helping in toddlers. Similarly, Dahl et al. (2017) found that such explicit scaffolding cues increased helping for younger but not older toddlers, indicating that the earliest helping may be susceptible to parental praise. Furthermore, priming toddlers with cues of affiliation increases helping, supporting the hypothesis that general social tendencies promote prosociality (Over & Carpenter, 2009). Taken together, these findings suggest that the helping behavior of infants and toddlers is malleable and receptive to social intervention.

Furthermore, the socialization hypothesis camp argues that helping can have different consequences and interpretations in different contexts. For instance, in Western societies, toddlers' "help" at home is not typically very helpful (e.g. a child attempting to assist in laundry and mixing up dirty and clean clothes) and caregivers find it cute or amusing but not actually useful. In contrast, young children in other cultures can be responsible for household chores such as meal preparation and care of siblings early on, and thus contribute in meaningful ways to their families (Hammond & Brownell, 2018). Additionally, while instrumental helping is exhibited around the same time and at about the same rates across several cultures, helping has different correlates depending on the cultural values, further indicating that culture plays a key role in shaping prosociality (Callaghan et al., 2011; Kärtner et al., 2010).

While we know that nature and nurture interact in general, the question of whether there is an inherent urge to help others that can then be built upon is difficult to address. Studying younger infants' prosocial capacities is warranted in that it would help to shed additional light on what humans are inclined to do even before they receive social input on prosocial behaviors.

Applications of Prosocial Behavior

In recent years, there have been increased efforts to connect developmental science to practical applications. Professional organizations in the field offer policy internships and statements, and a growing number of researchers have incorporated more applied studies into their work. For example, Hirsh-Pasek & Golinkoff (2019) advocate for researchers to balance both basic and applied science by taking what we have learned about child development and finding meaningful real-world contexts in which it could be of use. They argue, "If we keep our eye on theory and on the science, we can answer deep questions in a context that makes a difference for real people" (Hirsh-Pasek & Golinkoff, 2019, p. 40). In light of this trend, we also shift focus to examine how children's robust prosocial behavior might applied to more relevant, real-world questions.

While several studies have examined ways to increase children's prosocial behavior (e.g., Brazzelli et al., 2021; Pettygrove et al., 2013; Shoshani et al., 2022), few have examined how children's existing prosocial tendencies may be capitalized on. Among adults, moral appeals are often utilized to convince people to support issues or political candidates or perform behaviors, often invoking benefits to others to encourage cooperation (e.g., Chen, et al., 2009). However, I have been unable to locate any empirical work in which prosociality was invoked to appeal to children. This is surprising in that children are perhaps even more prosocial than adults, seeing as they act based upon strong moral convictions such as fairness and harm prevention (see Killen &

Smetana, 2022), and have less "real world" experiences that may jade them to the idea of helping others. They therefore may be particularly primed to comply with behaviors or support ideas that benefit others.

One relevant context is public health. Due to the COVID-19 pandemic, public health has received increased scrutiny and awareness, as children were asked to comply with preventative measures such as masking and increased hand washing. However, public health has long been a context in which it is important to appeal to children–most children spend their days in schools with many other children and adults, and childhood diseases such as RSV and chicken pox can be highly contagious. Therefore, understanding how to communicate the importance of public health measures to children is a crucial question both in relation to the COVID-19 pandemic as well as beyond it.

In adults, appeals stressing the benefits of public health measures such as hand washing and social distancing to others has been shown to be more effective than appeals stressing the benefits of these measures to the self in terms of people's intentions and behaviors (Ceylan & Hayran, 2021; Grant & Hofmann, 2011; Jordan et al., 2021). This therefore appears to be a context in which promoting the prosocial effects of a behavior may be particularly productive and should be explored in children.

Overview of Studies

My dissertation brings together two lines of research to address both the origins and applied implications of prosocial behavior, as well as to showcase a diversity of research methodology. Across these projects, I aim to address the two broad questions outlined above: a) Are humans born predisposed to be prosocial, and b) Can children's robust prosocial tendencies be leveraged in a public health context?

The first line of research explores the origins of prosocial behavior by investigating infants' propensity to help using novel eye-tracking technology. This project (Chapter 2; Probst & Warneken, in prep) investigates the question of whether young infants, who have not yet received scaffolding of prosocial behaviors and have minimal experience observing them, would help if given a developmentally appropriate opportunity to do so. Since infants are limited by their motor abilities, we employ a novel gaze-contingency paradigm whereby infants can "help" a character by using their gaze to trigger the removal of an obstacle. In Study 1, we found that infants triggered a button that helped a character more than they triggered a button that did not help the character. In Study 2, we found that infants triggered helpful and not-helpful buttons similarly in a go-no-go version of this paradigm. We conclude that there is some evidence for prosociality in early infancy, but further research is needed to confirm whether infants intentionally help others or are simply drawn to interact with gaze-contingent objects.

The second line of research involves online studies examining children's endorsement and moral reasoning about preventative health measures based on whether they are framed as prosocial or selfish. These studies were initiated due to the COVID-19 pandemic shutting down in-person research, and our desire to investigate how our research might be helpful in this new pandemic context.

Chapter 3 (Probst, Nowack, & Warneken, 2023) was recently published in the Journal of Experimental Child Psychology. The second author on this paper is an honors thesis mentee who was responsible for Study 2B in that manuscript. In this project, we framed hypothetical mask-like behaviors as benefitting the self or the other and assessed children's endorsement of these measures as well as their moral reasoning about them. Across two samples, we found that

children readily endorsed the prevention measures regardless of frame, but that the other-oriented frame caused children to see noncompliance as a moral violation.

Chapter 4 (Probst & Warneken, in prep) was recently submitted for publication to the Journal of Health Psychology. In this project, we utilized similar methods to those in Chapter 3, but did so in a vaccine-like context rather than a mask-like context. In Study 1, we found that children readily endorsed vaccine-like behaviors regardless of whom they benefit, and that children viewed noncompliance as a moral violation regardless of framing. We modified and improved our paradigm for Study 2, and found that with age, framing impacts children's social-moral judgements of others. With additional insight from free-response questions, we concluded that younger children saw vaccine-like behaviors as imperative regardless of who was protected, while older children considered the benefactor of these behaviors in their reasoning about others and were more clearly able to articulate the costs and benefits of engaging in these behaviors.

Across all three chapters, I employ novel methodology to answer challenging questions about prosociality in early development. This portfolio of studies ranges from basic to applied and helps shed new light on prosocial behavior from infancy through childhood.

References

Brazzelli, E., Grazzani, I., & Pepe, A. (2021). Journal of Experimental Child Promoting prosocial behavior in toddlerhood: A conversation-based intervention at nursery. *Journal of Experimental Child Psychology*, *204*, 105056. https://doi.org/10.1016/j.jecp.2020.105056

Brownell, C. A. (2016). Prosocial Behavior in Infancy: The Role of Socialization. *Child Development Perspectives*, *10*(4), 222–227. https://doi.org/10.1111/cdep.12189

Callaghan, T., Moll, H., Rakoczy, H., Warneken, F., Liszkowski, U., Behne, T., & Tomasello, M. (2011). Early social cognition in three cultural contexts. *Monographs of the Society for Research in Child Development*, 1–142.

Ceylan, M., & Hayran, C. (2021). Message Framing Effects on Individuals' Social Distancing and Helping Behavior During the COVID-19 Pandemic. *Frontiers in Psychology*, *12*(March), 1–14. https://doi.org/10.3389/fpsyg.2021.579164

Chen, Xiao-ping; Pillutla, Madan M.; Yao, X. (2009). of Cooperation Inducing and Maintaining Mechanisms in Public Goods Dilemmas : Sanctions and Moral Appeals. *Group Processes and Intergroup Relations*, *12*(2), 241–255. https://doi.org/10.1177/1368430208098783

Dahl, A., Satlof-bedrick, E. S., Hammond, S. I., Drummond, J., Waugh, W. E., & Brownell, C. A. (2017). Explicit Scaffolding Increases Simple Helping in Younger Infants. *Developmental Psychology*, *53*(3), 407–416.

Dunfield, K., Kuhlmeier, V. A., O'Connell, L., & Kelley, E. (2011). Examining the Diversity of Prosocial Behavior: Helping, Sharing, and Comforting in Infancy. *Infancy*, *16*(3), 227–247. https://doi.org/10.1111/j.1532-7078.2010.00041.x

Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Prosocial Development. *Handbook of Child Psychology and Developmental Science, 7th Edition*. https://doi.org/10.1002/9780470147658.chpsy0311

Grant, A. M., & Hofmann, D. A. (2011). It's not all about me: Motivating hand hygiene among health care professionals by focusing on patients. *Psychological Science*, *22*(12), 1494–1499. https://doi.org/10.1177/0956797611419172

Hammond, S. I., & Brownell, C. A. (2018). Happily unhelpful: Infants' everyday helping and its connections to early prosocial development. *Frontiers in Psychology*, *9*(SEP), 1–8. https://doi.org/10.3389/fpsyg.2018.01770

Hepach, R., Vaish, A., & Tomasello, M. (2012). Young Children Are Intrinsically Motivated to See Others Helped. *Psychological Science*, *23*(9), 967–972. https://doi.org/10.1177/0956797612440571

Hirsh-Pasek, K., & Golinkoff, R. M. (2019). Put Your Data to Use: Entering the Real World of Children and Families. *Perspectives on Psychological Science*, *14*(1), 37–42. https://doi.org/10.1177/1745691618815161

Jordan, J. J., Yoeli, E., & Rand, D. G. (2021). Don't get it or don't spread it: comparing self-interested versus prosocial motivations for COVID-19 prevention behaviors. *Scientific Reports*, *11*(1), 1–17. https://doi.org/10.1038/s41598-021-97617-5

Kärtner, J., Keller, H., & Chaudhary, N. (2010). Cognitive and Social Influences on Early Prosocial Behavior in Two Sociocultural Contexts. *Developmental Psychology*, *46*(4), 905–914. https://doi.org/10.1037/a0019718

Over, H., & Carpenter, M. (2009). Eighteen-month-old infants show increased helping following priming with affiliation: Research report. *Psychological Science*, *20*(10), 1189–1193. https://doi.org/10.1111/j.1467-9280.2009.02419.x

Pettygrove, D. M., Hammond, S. I., Karahuta, E. L., Waugh, W. E., & Brownell, C. A. (2013). From cleaning up to helping out: Parental socialization and children's early prosocial behavior. *Infant Behavior and Development*, *36*(4), 843–846. https://doi.org/10.1016/j.infbeh.2013.09.005

Shoshani, A., Nelke, S., & Girtler, I. (2022). Computers in Human Behavior Tablet applications as socializing platforms : The effects of prosocial touch screen applications on young children ' s prosocial behavior. *Computers in Human Behavior*, *127*(May 2021), 107077. https://doi.org/10.1016/j.chb.2021.107077

Tomasello, M., & Vaish, A. (2013). Origins of Human Cooperation and Morality. *Annual Review of Psycholgy*, *64*, 231–255. https://doi.org/10.1146/annurev-psych-113011-143812

Warneken, F. (2016). Insights into the biological foundation of human altruistic sentiments. *Current Opinion in Psychology*, *7*, 51–56. https://doi.org/10.1016/j.copsyc.2015.07.013

Warneken, F., & Tomasello, M. (2008). Extrinsic Rewards Undermine Altruistic Tendencies in 20-Month-Olds. *Developmental Psychology*, *44*(6), 1785–1788. https://doi.org/10.1037/a0013860

Warneken, F., & Tomasello, M. (2009). The roots of human altruism. *British Journal of Psychology*, *100*(Pt 3), 455–471. https://doi.org/10.1348/000712608X379061

Chapter 2

Eye Can Help! A Novel Tool for Exploring Infant Prosocial Behavior

(Probst & Warneken, in prep)

"When I was a boy and I would see scary things in the news, my mother would say to me, 'Look for the helpers. You will always find people who are helping.'" This quotation from Fred Rogers circulates frequently around social media, likely due to its truth: After disasters and hardships, we often hear about people going out of their way to take care of each other. Humans' tendency to help one another can be a considerable source of solace and a reminder of the good in the world.

Why do people help others? One hypothesis is that humans are predisposed to help others. Empirical evidence demonstrates that children begin helping others at around 14 months of age, and this helping appears to be intrinsically motivated (Hepach et al., 2012; Warneken & Tomasello, 2007, 2008). However, another hypothesis suggests that children learn to help from others, and already engage in this socialization process by toddlerhood (Brownell, 2016). Evidence of helping in younger infants, who are likely not receiving social input on their helping behaviors, can help to demonstrate whether humans come into the world ready to help others. However, it is difficult to study infants' prosocial inclinations due to their limited motor abilities. The current study therefore utilizes a new method of studying infant prosocial behavior which allows the infant to 'help' by simply using their eyes. If young infants choose to help in this developmentally appropriate paradigm, it will provide evidence that the mechanisms and

motivations underlying helping appear earlier in development than previously known, suggesting an early prosocial predisposition.

Prosocial behavior refers to "voluntary behavior intended to benefit another"—that is, when people choose to act in ways that promote the well-being of another person or group of people (Eisenberg et al., 2015, p. 1). Prosociality can take the form of behaviors such as helping, comforting, and sharing (Dunfield et al., 2011). The most basic prosocial behavior is instrumental helping, which emerges around 14 months of age and consists of actions intended to help somebody complete a concrete goal (Warneken & Tomasello, 2007). Because it is the earliest developing and most basic form of prosocial behavior, instrumental helping is the ideal subtype for study in infants and toddlers.

How do children come to help? The theoretical debate over the origins of prosocial behavior centers on two hypotheses: first, that humans evolutionarily inherit a predisposition to behave prosocially; and second, that prosocial behaviors arise due to socialization from members of their family and community. According to the inherited predisposition hypothesis, humans are predisposed to be prosocial due to biological mechanisms evolved over phylogeny as cooperative behaviors aided our species' survival (Warneken, 2016). This hypothesis is rooted in the idea that early humans had to become hypercooperative due to challenges such as resource scarcity that resulted in increased collaboration for feeding, living, and raising children (Tomasello & Vaish, 2013).

Cross-species comparison with nonhuman primates provides insights into what our evolutionary ancestors would be capable of even without social-cultural input. Like toddlers, chimpanzees perform simple helping behaviors (Warneken & Tomasello, 2006). Chimpanzees' helping does not depend on rewards or training, and while they require explicit cues for helping,

they do so in a variety of contexts with both humans and other chimps (see Warneken, 2016). This comparative work suggests that there is some evolutionary preparedness for prosocial behavior, though it is less sophisticated than that of humans.

Additionally, young children appear to help out of intrinsic motivation, further supporting the idea that helping is not based on external factors and may be inherited. Toddlers' helping decreases when they are provided with material rewards, suggesting that their initial motivation is intrinsic and could be corrupted by external factors (Warneken & Tomasello, 2008). Intrinsic motivation can also be assessed via physiological measures such as pupil dilation, a proxy for sympathetic nervous system arousal. Toddlers show increased pupil dilation when viewing others in distress, and this sympathetic arousal is decreased when either the toddlers themselves help, or they see a third party provide help (Hepach et al., 2012). This suggests that early helping is not dependent on external factors such as reputation or praise, and is instead something coming from within, lending support to the inherited predisposition hypothesis.

Finally, cross-cultural studies find that helping emerges around the same time in several different cultures (Callaghan et al., 2011; Corbit et al., 2020; Kärtner et al., 2010). This suggests that some basic mechanisms behind the emergence of prosocial behavior could be universal and are not dependent on cultural practices.

On the other hand, the socialization hypothesis maintains that prosocial behavior emerges out of socialization and cultural transmission (Brownell, 2016). This hypothesis is that rather than a specific mechanism for prosociality, humans inherit more general mechanisms for affiliation and social learning which then allow prosocial behaviors to be transmitted from caregivers and community members to young children (Hammond & Brownell, 2018). Therefore, if this hypothesis is supported, then we would expect infants to come into the world

without the inclination to help—they would have to learn these types of behaviors through observation and scaffolding.

The efficacy of socialization practices in promoting prosocial behavior lends support to this hypothesis. For example, encouragement and maternal directives increase helping among toddlers (Pettygrove et al., 2013). Moreover, explicit scaffolding cues have been found to increase helping in younger, but not older, toddlers, which may suggest that children are most influenced by others when they are just beginning to help (Dahl et al., 2017). Finally, longitudinal work demonstrates that scaffolding such as encouragement and praise provided in infancy can promote increased helping behaviors (Dahl et al., 2022). This suggests that the emergence of helping can be bolstered by socialization techniques. Additionally, some evidence supports the idea of general prosocial tendencies—priming toddlers with affiliation cues increases their helping behaviors (Over & Carpenter, 2009). Overall, it appears that early helping behavior is able to be bolstered with social intervention.

In addition, the socialization hypothesis implies that cultural contexts can influence differences in helping behaviors. For example, children have few opportunities to provide meaningful help in Western societies, but can be responsible for more household chores from early in development in more traditional societies (Hammond & Brownell, 2018). Cross cultural studies demonstrate that even though early forms of helping emerge around the same time and with about the same frequency in different cultures, there are cultural differences in costly helping and what cognitive factors helping is linked to (Callaghan et al., 2011; Corbit et al., 2020; Kärtner et al., 2010). This suggests that culture plays an important role in shaping helping behaviors.

Overall, both hypotheses have convincing supporting evidence. However, the evidence that is generally taken to support the socialization hypothesis does not necessarily preclude the possibility of a predisposition. An inherited prosocial predisposition may be refined and built upon by social factors (see Warneken, 2015). In other words, humans are born ready to help others and learn from others how help can be provided or in what culturally meaningful contexts to perform these behaviors. To understand whether this is the case or whether socialization indeed prompts the development of prosocial behavior, it is necessary to study the social inclinations of infants prior to the age at which helping emerges, and prior to the age at which they may receive prompting to help from their environment.

Some of the building blocks of helping are evident in infancy prior to the onset of helping. Infants as young as six months understand goal-directed action, a crucial component of understanding when help is needed, and nine-month-olds can distinguish between needy and non-needy agents (Köster et al., 2016; Woodward, 1998). Additionally, infants as young as three months demonstrate empathic concern, a rudimentary form of empathy involving concern for distressed others (Davidov et al., 2021). Thus, even young infants understand others' goals and care about others, suggesting that they may possess an inclination to help.

Longitudinal data also supports the idea that the mechanisms behind helping precede the onset of the behavior. Individual differences in empathic concern in infancy predict later prosocial behavior, suggesting that these empathic responses observed in young infants is a potential motivator of prosocial behavior (Davidov et al., 2021). Additionally, seven-month-olds' looking and neurological responses to fear faces predicted their helping later on, with infants who were able to regulate their responses to the fear faces helping more as toddlers (Grossmann et al., 2018). This suggests that the affective processing required for helping can be present early

in infancy. Finally, eight- to twelve-month-olds' intention understanding related to their instrumental helping at 18-25 months (Stout et al., 2021). This longitudinal work provides even stronger evidence that the cognitive and affective mechanisms prompting helping are present already in infancy.

If the building blocks of helping behavior are present in infancy, why is it not until toddlerhood that prosocial behaviors begin to appear? One possibility is that infants are simply not yet able to coordinate their motor functions sufficiently to enact prosocial behaviors. Supporting this hypothesis, Köster et al. (2019) found that better fine and gross motor skills related to more robust helping among 16 month-olds. This suggests that motor skills are the missing link which, once sophisticated enough, bring together the pre-existing mechanisms and ultimately allow the toddler to help. If this is the case, providing infants with opportunities to behave prosocially that do not depend upon motor functioning may allow for earlier production of prosocial behavior.

A new eye-tracking procedure provides a window into infant cognition by allowing infants to manipulate their environments via their eye movements. This procedure, known as gaze-contingency, gives infants the agency they lack due to their poor motor skills. In gaze-contingency paradigms, looking at a specific spot on a screen triggers a programmed reaction. These procedures have many applications and have been validated with infant populations (Deligianni et al., 2011; Keemink et al., 2019; Vernetti et al., 2018; Wang et al., 2012). One study demonstrated that by 6 months, infants can predict the outcome of a simple gaze-contingency paradigm (Wang et al., 2012). In this study, looking at a red dot on one side of the screen triggered the appearance of a photograph on the other side of the screen. Infants demonstrated anticipatory looking to the spot where the animal was going to appear after they

had looked at the dot but before the image appeared, indicating that they knew they had triggered the reaction (Wang et al., 2012).

A recent study applied gaze-contingency technology to examine infants' social evaluations. Kanakogi et al. (2022) exposed infants to clips in which a character was an aggressor or victim and gave them the opportunity to punish the character by triggering a gaze-contingent reaction that squished the character. Infants selectively punished aggressive characters, and did so in social, rather than abstract, contexts. This study demonstrates that not only are infants capable of learning complex gaze-contingent reactions, but also that infants can use these tools as an extension of their social reasoning (Kanakogi et al., 2022).

Given the recent work demonstrating the efficacy of gaze-contingency for infant research, we apply this technology in the current study by creating a gaze-contingent paradigm to assess helping behavior. This type of paradigm can help us gain insight into infants' helping inclinations and to answer the question, *Would young infants 'help' if given a way to do so that is developmentally appropriate and does not depend on sophisticated motor skills?*

In our gaze-contingent eye-tracking paradigm, infants aged nine to twelve months can 'help' an agent on screen. Infants learn that looking at a button on a wall causes the wall to move backward. Then, they learn that a character has a goal of reaching one of two objects. One hypothesis is that infants will 'help' in this paradigm by selectively triggering the button that helps the character. This would provide support for the inherited predisposition hypothesis by demonstrating helping inclinations in young infants. However, if infants non-discriminately look to helpful and non-helpful buttons, this would suggest either that infants do not understand the help situation of the paradigm, or that socialization is necessary for helping behavior to develop.

Study 1 (preregistration: https://aspredicted.org/FF1_QN7) constitutes the initial study in which children can look to either a helpful or non-helpful button. In Study 2 (preregistration: https://aspredicted.org/ZBW_BW5), we modified our procedure to rule out a possible looking bias. For both studies, we predict that infants will trigger buttons that help a character more than buttons that do not.

Study 1

Method

Participants

Our final sample were $N = 24$ infants (54% girls, 46% boys) aged 9-12 months (M_{age} = 10.81 months, SD_{age} = 0.90 months) recruited from a small college city in the United States Midwest. An additional 10 infants were tested but excluded due to technical error or failing to reach our inclusion criteria (see below). Participants were recruited by mailed brochures, social media ads, and flyers. We also recruited participants from shared databases hosted by the authors' home institution. Parents reported their children's race and ethnicity: 4% were Asian, 4% were Hispanic/Latino, 79% were White/Caucasian, and 13% were multiple race/ethnicities.

We chose the age range of nine to twelve months based on practicality and theory. In our piloting, we found that infants younger than nine months struggled to complete the procedure. Additionally, nine-month-olds understand when help is needed, a crucial component of our paradigm (Koster et al., 2016). We are most interested in studying infants who have not begun to help yet as the goal of our study is to determine whether younger infants are motivated to help. Thus, we set the upper bound of our sample at twelve months, before infants can be expected to help instrumentally (Warneken & Tomasello, 2007).

Procedure

Parents filled out a consent form prior to the study via Qualtrics. Upon arrival, a research assistant collected the family from the parking garage and showed them to the warm-up room. In the warm-up room, the primary experimenter (E1) explained the study to the parent verbally and gave them the opportunity to ask questions about the study while the research assistant helped acclimate the infant to the study room. Once the infant was adequately warmed up, E1 took the parent and infant to an adjacent room to begin the study.

The study took place in a designated eye-tracking room. The parent sat in a chair facing a Tobii Pro Spectrum screen-based eye-tracking system, and the infant sat on the parent's lap. The eye-tracker sat on a height-adjustable table, and E1 adjusted the table as needed so that the infant's eyes were perpendicular to the center of the screen. The parent was instructed to avert their gaze from the screen during the study to limit interference. If an additional caregiver attended the session, they were seated behind the participant and off to the side where they were not in the infant's immediate view. We placed moveable canvas screens on either side of the parent and infant to block out the infant's view of the rest of the room and limit distractions. E1 sat at a second computer on the other side of the table such that their face was blocked from the infant's view by the computer monitors when seated (Figure 2.1).

The study ran using the software *E-Prime 3 Extensions for Tobii Pro*, an integration of E-Prime presentation software and Tobii Pro eye-tracking software. Calibration was conducted using the E-Prime default 5-point infant calibration depicting a duck. Once an acceptable calibration was achieved, the gaze-contingency paradigm began.

Following the conclusion of the gaze-contingency paradigm, the participant received a small toy (teether, rattle, or stuffed animal) and the parent received $10 compensation for travel expenses.

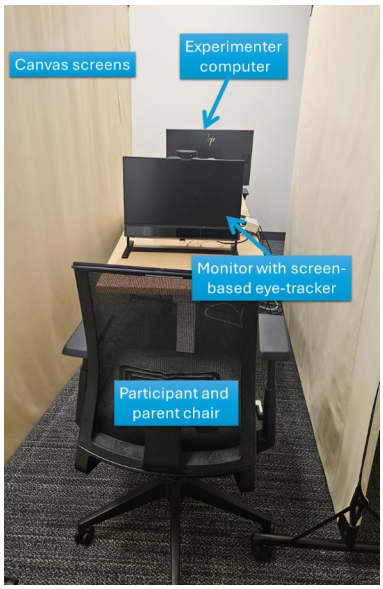


Figure 2.1. Diagram of room setup.

Gaze-contingency Paradigm

The gaze-contingency paradigm was entirely screen-based and used animated video stimuli. There were three phases to the paradigm: Training Phase, Goal Establishment Phase, and Test Phase. The gaze-contingency functioned by treating the participant's gaze as a cursor which can 'click' screen-based buttons that trigger specific reactions. In between each trial of each phase, infants were presented with a colorful and interesting attention-grabbing clip that lasted approximately two to five seconds. These clips varied between phases—there were 3 different clips in total.

Training Phase. In this phase, infants saw a still image of two animated gray walls that had orange buttons at the top. E1 encouraged infants to look to the buttons to scaffold their contingency learning (e.g. E1 said "What happens when you look here?" while pointing to the button). When the infant looked at a button for 500ms, the button turned red and the corresponding wall moved backward, and this action was accompanied by a sliding sound. E1 continued to encourage infants to get them to look at both walls several times in order to

demonstrate that both buttons work. This procedure was repeated for 8 trials. As outlined in our preregistration, infants needed to trigger both buttons in the Training Phase at least once to be included in analysis.

Goal Establishment Phase. Infants next saw a character (an animated yellow ball with eyes). The character started in the center of the screen, with two objects on either end of the screen that were different colors (pink, green) and different shapes (cube, cylinder). The character looked at one of the objects and moved toward it. Once the character reached the object, it jumped on it and emitted a happy noise, then returned to the center. This scene was repeated six times to establish the character's goal. The color and side of the goal object were counterbalanced between subjects.

Test Phase. This phase began looking identical to the Goal Establishment Phase. As in that phase, the character looked to the goal object and began to move toward it. Before the character reached the object, the walls from the Training Phase came down. One wall blocked the character's progress to the goal object, while the other wall fell behind the character, blocking their access to the alternate object. The video was cropped such that the buttons were not visible at this point to prevent the infant from prematurely looking at the buttons. The character looked at the wall that was blocking its path, then bumped against the wall 3 times as if trying to get through it. The image paused and the buttons were uncovered so that the infant could now look at them to trigger the contingency (Figure 2.2).

The button on the wall blocking the goal object was the "Helpful" button, and the button on the other wall that blocked the alternate object was the "Not Helpful" button. If the infant looked to the "Not Helpful" button, that button turned red and the wall behind the character moved backward. The character then looked again at the wall blocking its progress and bumped

up against it 3 times (the buttons were obscured again at this point because the infants could only trigger one reaction per trial). The trial ended with the character back in the center, still looking toward the obscuring wall.

If the infant looked at the "Helpful" button, the button turned red the wall blocking its path moved back. The character then continued its path to the goal object, jumped on it, and emitted a happy noise. The trial ended with the character back in the center, still looking toward the goal object. This phase was repeated for 6 trials. If an infant did not trigger either button after several seconds, E1 manually skipped the trial, and it was not included in analysis. Infants had to trigger a contingency at least once to be included in analysis. For each infant, we average the mean number of "Helpful" and "Not Helpful" button clicks, as well as the proportion they looked to the "Helpful" button ("Helpful"/("Helpful" + "Not Helpful).

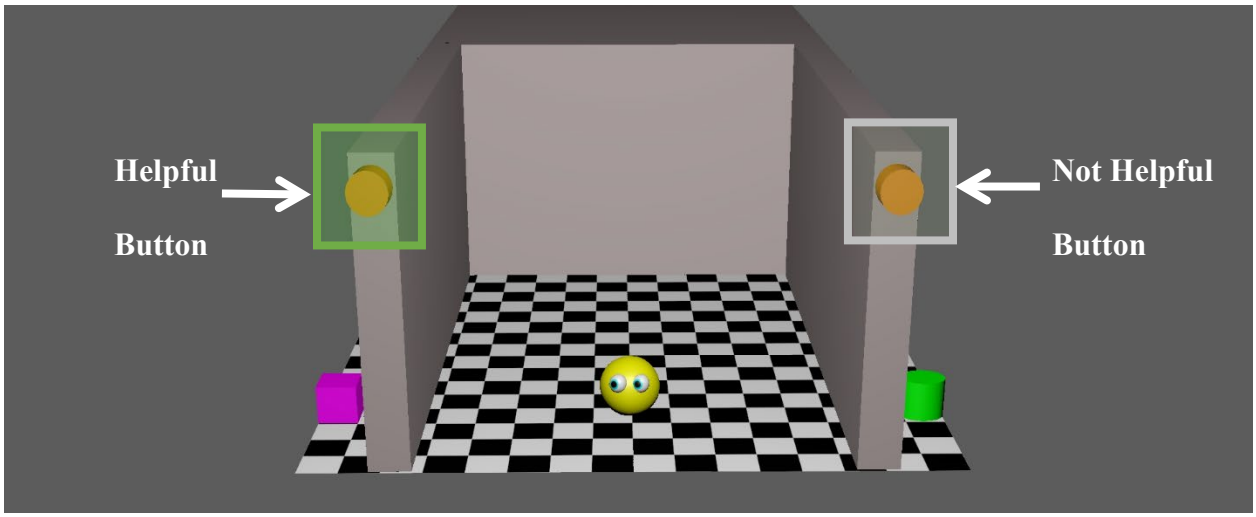


Figure 2.2. Screenshot and diagram of the gaze-contingent screen in the Test Phase. The boxes around the buttons represented our encoded gaze-contingent areas of interest and are shown here for clarity—they were not visible to participants.

As discussed in our preregistration, we ran basic inferential statistics for this initial study to assess whether infants looked more to the "Helpful" or "Not Helpful" button.

First, we ran a two sample t-test comparing the mean number of "Helpful" button clicks to the mean number of "Not Helpful" button clicks. We found that infants triggered the "Helpful" button ($M = 2.25$, $SD = 1.62$) significantly more than they triggered the "Not Helpful" button ($M = 1.08$, $SD = 1.10$; $t = 2.67$, $p = .01$, Figure 2.3).

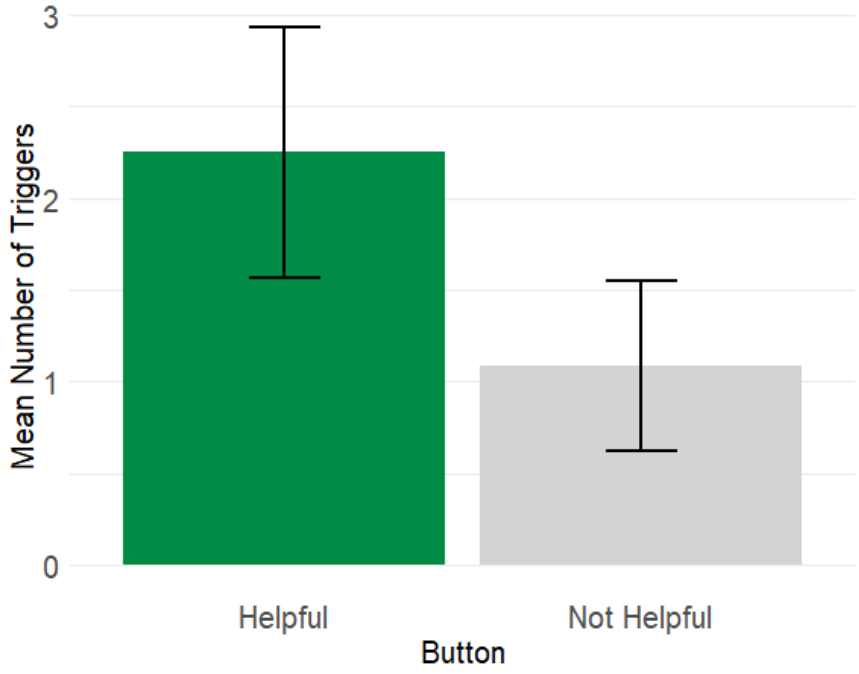


Figure 2.3. Mean number of triggers for the Helpful and Not Helpful buttons

Since infants varied on how many of useable trials they completed, we also ran a 1-sample t-test comparing the mean proportion of "Helpful" button clicks to 0.50 to determine if the majority of participants looked more to the "Helpful" button than the "Not Helpful" button. We found that the mean proportion of "Helpful" button clicks ($M = 0.67$, $SD = 0.35$) differed significantly from our test value of 0.50, $t = 2.32$, $p = .03$.

Discussion

In our novel gaze-contingent eye-tracking study, we found that infants looked significantly more to buttons that removed an obstacle to an agent's goal than to buttons that did not. We thus have initial evidence for helpful behavior in young infants, providing some support for the predisposition hypothesis.

As this paradigm is novel, we endeavor to rule out potential alternative explanations to our results. One alternative explanation is that infants in our study were biased to look at the "Helpful" button because it was central to the actions of the scene. In other words, the agent bumped against that wall and looked at that wall, so infants' gazes may have already been drawn to that area of the screen when the gaze-contingency portion of the study began.

To rule out this possibility, we developed a new version of the study which included both a Control and Experimental condition. Study 2 compared two scenes that were identical except for the position of the goal object either in front of or behind the wall to determine whether infants would selectively help when help was needed.

Study 2

We ran Study 2 to rule out a possible looking bias toward the side of the screen where the actions of the scenario were playing out. This new version followed a go-no-go format rather than a forced-choice format: there was only one button present on the screen which infants could either trigger, or not. In the Experimental condition, the wall blocks the agent's goal, as in Study 1. In the Control condition, the goal object is closer to the agent and thus the wall does not block the agent's goal, negating the need for help. We ran this study within-subjects, allowing us to compare infants' looking behavior in both conditions. We hypothesized that if infants were

motivated to help the character, they would trigger the button more in the Experimental than in the Control condition, where triggering the button was not a helpful action.

Method

Participants & Procedure

Our final sample were $N = 36$ infants (50% girls, 50% boys) aged 9 to 12 months old (M_{age} = 10.48 months, SD_{age} = 1.01 months). We utilized the same recruitment methods as in Study 1, except that we endeavored to get a more diverse sample by increasing the compensation for travel to $20, allowing us to recruit from a wider geographic area, as well as running more ads on social media. The racial-ethnic breakdown of our sample was: 6% Asian, 3% Black/African American, 3% Hispanic/Latino, 6% Middle Eastern/North African, 58% White/Caucasian, 22% Multiple race/ethnicity, and 3% a race/ethnicity not listed.

Based on our preregistered inclusion criteria, all tested infants were included in our final sample; one infant had one condition excluded due to a technical malfunction. The procedure and room setup for this study was the same as for Study 1.

Gaze-contingency Paradigm

The gaze-contingency paradigm was structured similar to in Study 1. Again, there were three phases (Training Phase, Goal Establishment Phase, and Test Phase) and trials were separated by attention-grabbing clips. A key difference was that we had two conditions, Experimental and Control. Infants saw the Training Phase and Goal Establishment Phase, and then the Test Phase of each condition (counterbalanced between subjects). In between the Test Phases of each condition there was a brief pause where we switched files and re-calibrated. We had several versions of each condition so that the sides were counterbalanced between subjects as well.

Another key difference for Study 2 was that we reduced the total time needed for the contingency to be triggered from 500ms to 300ms. We made this decision after examining the eye-tracking recordings from Study 1 and realizing that there were several "false negatives" in which infants glanced at one of the buttons, but not long enough to trigger the contingency. We reduced the trigger time to try to avoid these false negatives.

Training Phase. The Training Phase for this study was identical to that of Study 1, except that there was only one wall instead of two. The wall was on the side of the screen that matched the side of the Test Phase. The experimenter provided cues to prompt the infant to look at the button. If an infant was particularly distracted, the experimenter would manually skip a trial to reorient the infant with the attention-grabber. According to our preregistration, infants had to trigger 3/6 training trials to be included in analysis; all infants reached this threshold.

Goal Establishment Phase. This phase also closely resembled that of Study 1, except that there was only one object on the screen. Because there was only one object, the character started further over on the opposite side of the screen from the goal object to allow more space for the different location of the objects in the Test Phases. The character traveled to the goal object (always a pink box for Study 2), jumped on it, and emitted a happy noise. Infants saw three trials with the goal object on one side of the screen, and three trials with the goal object on the other side of the screen to allow the infant to encode the character's goal. The experimenter provided scaffolding cues to help establish the goal in the first three trials, then sat at the seat opposite of the infant and out of view for the final three trials leading into the Test Phase. Infants had to look at the screen for at least one Goal Establishment trial to be included in analysis; all infants passed this threshold and most (81%) looked at the screen for all 6 trials.

Test Phase. In the *Experimental Condition*, the goal object was on the furthest point of the screen away from the character. The character began to move toward the object but was then blocked by the wall from the Training Phase. As in Study 1, we cropped the video to obscure the buttons until the video ended to prevent the infants from looking at the buttons before they became active. Once the wall fell, the character glanced at it, then bounced against it three times. The bouncing motion followed an arced path to match the path of the character in the Control Condition (see below). While bouncing off the wall, the character emitted a sound of frustration to further emphasize the need for help.

After the three bounces, the buttons were revealed, and the infant could trigger the gaze-contingency. Infants had 10 seconds to trigger the contingency. If infants looked at the button for at least 300ms, the button was activated, and the wall moved backward. The character then traveled to the goal object and bounced on it, emitting the happy noise. If the infant did not look at the button after 10 seconds, the trial was manually terminated.

In the *Control Condition*, the goal object was closer to the agent. The agent moved toward the goal object, and then the wall came down. Since the goal object was closer, the wall fell behind the goal object, and was thus not blocking the character from the object. After the wall fell, the agent jumped onto the object three times, emitting a happy noise. The path of the character and the timing of the bounces matched that of the Experimental Condition. After the three bounces, the buttons were revealed, and the infants had the opportunity to trigger the gaze-contingency.

If the infants looked at the button for at least 300ms, the button was activated, and the wall moved backward. The character then jumped on the box three more times, emitting the

happy noise. If the infant did not look at the button after 10 seconds, the trial was manually terminated.

See Figure 4 for a depiction of the Experimental and Control test phases. Infants had to look at the screen Test trial total to be included in the analyses; all infants passed this threshold.

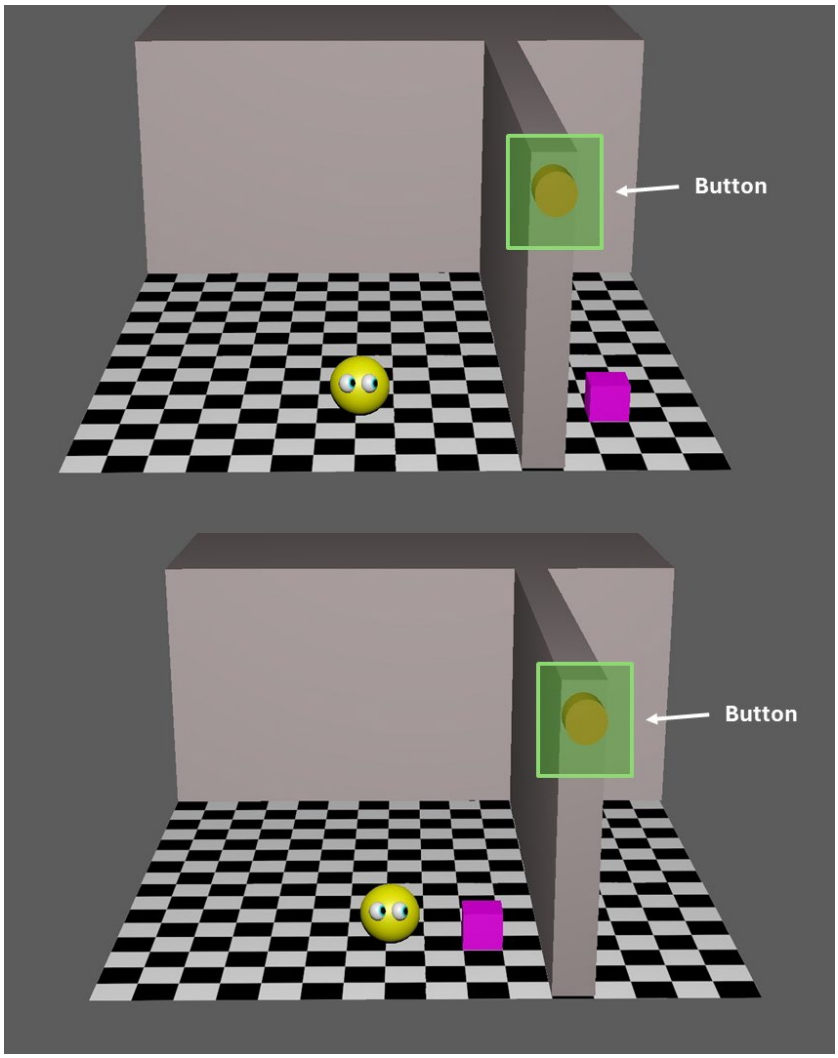


Figure 2.4. Test phase for the Experimental Condition (top) and Control Condition (bottom). The boxes around the buttons are visual depictions and were not visible to participants.

Results

Preliminary

We calculated the proportion of clicks out of the total number of trials presented to the infant for each condition and used these metrics as our dependent variables to account for varying numbers of trials for each infant (though most infants sat through all six possible trials).

As specified in our preregistration, we first checked for order effects to determine whether our main analysis would be within or between subjects. To accomplish this, we ran t-tests to examine whether our dependent variables (proportion of clicks in the Experimental condition and proportion of clicks in the Control condition) varied based on which condition was presented first. For the Experimental condition, there was a marginal effect of which trial came first: the proportion of clicks was higher when the Experimental condition came first (M = 0.50, SD = 0.20) than when the Control condition came first (M = 0.32, SD = 0.33) (t = -2.01, p = .05). Because this order effect was marginal and only evident for the Experimental condition, we ran both within- and between-subjects analyses.

Main Results

For our within-subjects analysis, we ran a paired t-test comparing the proportion of triggers in Experimental condition (M= 0.41, SD = 0.29) to the proportion of triggers in the Control condition (M = 0.37, SD = 0.30, Figure 2.5). We found no significant difference between these two means.

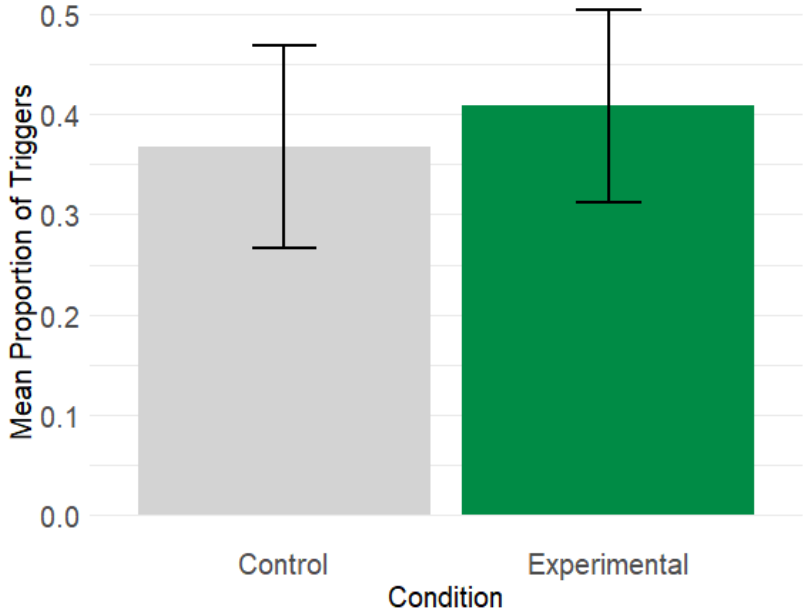


Figure 2.5. Mean Proportion of triggers for the Control and Experimental conditions. Error bars represent 95% confidence intervals.

For our between-subjects analysis, we used only the first condition presented to each infant and ran an independent samples t-test comparing the means for the Experimental (M = 0.50, SD = 0.33) and Control (M = 0.44, SD = 0.20) conditions. We also found no significant differences between these two means. Thus, across both analyses there was no difference between conditions.

Although we had no preregistered analyses with this metric, we examined the mean number of trials in each condition to better compare to Study 1. Notably, the mean number of trials in both the Experimental (M = 2.44, SD = 1.72) and Control condition (M = 2.20, SD = 1.80) were similar to those for the Helpful button in Study 1(M = 2.25, SD = 1.62). Thus, infants "helped" at similar levels in both studies, but they also "helped" when help was not needed in the Control condition.

Ad Hoc Analysis

To better understand our data, we ran a few additional analyses. First, there is a possibility that infants who encoded the agent's goal better were more likely to trigger the button in the Experimental condition than in the Control condition. Thought all infants passed our inclusion threshold of 1 Goal Establishment trial, and most infants attended to all 6 trials, we compared infants who had 6 valid Goal Establishment trials to infants who had less than 6 valid Goal Establishment trials; however, there was no difference between these groups.

We also examined whether there was any effect of age on whether infants triggered the button at different rates in the Experimental or Control condition. We ran a repeated-measures ANOVA with condition as a repeated measure and age as a covariate; however, there was no interaction between age and condition.

Discussion

In Study 2, we endeavored to rule out the possibility that infants in Study 1 were biased to look toward the side of the screen that the Helpful button was on. Because we found no differences between infants' triggering of the button in the Control versus the Experimental condition, we cannot rule out this possibility. Because the mean number of trials in both conditions were similar to the mean number of trials for the Helpful button in Study 1, we suggest that this null result is primarily driven by infants triggering the button more than expected in the Control condition. There were some limitations in Study 2 that may explain the similar triggers in the Control and Experimental condition.

One potential explanation for why we did not find a difference between conditions is that the Control condition may have been too engaging. The character bounced on the goal object and emitted a happy noise before the buttons were revealed, which may have helped retain infants' attention more than in the Experimental condition, in which infants may have been more likely to

look away because the agent bumping against the wall was less exciting. We chose this approach because we wanted to demonstrate to the infant that no help was needed as the character could happily achieve its goal, and we also assumed that because infants would see this action repeatedly in the Goal Establishment phase they would be habituated to it by the Test Phase. However, it may have had the unintended effect of capturing the infants' interest more so than the Experimental condition.

Moreover, the triggering of the wall had the same effect in each condition: the character bouncing on the box. We chose this approach because we did not want to confound our conditions by having different results of the contingency between the two conditions. However, infants may have realized in the Control condition that they could make the agent bounce on the box again, and they may have been motivated to do so just to make the character happy even though help was not technically needed. Moreover, the presence of a single button on the screen may have prompted the infants to look at it just for something to do and because triggering the contingency is interesting in and of itself.

Overall, it seems that our manipulation of conditions in Study 2 was not salient enough for infants. While we intended to demonstrate that help was needed in the Experimental condition and not in the Control condition, it is not clear whether infants grasped this distinction. It is possible that because the agent laughed and jumped on the object regardless of condition, that infants thought it was helpful to trigger the button in both cases. Therefore, we cannot confidently conclude whether young infants are motivated to help; further research is needed to fully understand the helping capacities of young infants.

While the results of this study were unclear, we did validate the utility of using gaze-contingent paradigms with young infants. Nearly all infants (35/36) triggered the contingency at

least once across the two conditions, and all were able to sit through both trials of each condition. We also only had to exclude one condition from one subject due to technical error. Thus, though our inclusion criteria were less strict than in Study 1 due to the go-no-go nature of the task, we vastly improved the attrition rate and were able to sustain infants' attention through this longer procedure.

General Discussion

Across two studies, we employ a complex novel gaze-contingent eye-tracking paradigm and demonstrate that infants can use their gaze to interact with their social environment. In Study 1, we find initial evidence that infants trigger a button that helps a character more than one that does not. We could not rule out an attentional bias in Study 2: it is possible that infants find it interesting to trigger the contingency and simply trigger a button that is nearby where they were already looking, regardless of helpfulness. However, it is also possible that infants are motivated to help, but that a) they thought that triggering the contingency in the Control condition was also helpful, or b) they also find triggering a gaze-contingent reaction interesting regardless of helpfulness.

Our findings provide some initial support for the predisposition hypothesis—we found a higher number of looks to the Helpful button in Study 1, and a similar number of looks in both conditions in Study 2. Thus, infants can and do help in a novel helping situation that they have no prior experience with and therefore could not have been socialized to help within. This set of studies is the first to our knowledge to demonstrate helping behavior so early in development. We cannot conclude with certainty that the helping behavior observed came from a true understanding of the need to help or something more superficial, but our studies represent an important first step in this direction.

Additionally, these studies were among the most complex gaze-contingency paradigms utilized with young infants; we equipped infants with a sophisticated way to interact with their social surroundings that did not rely on their developing motor skills. Together with Kanakogi et al. (2022), this work represents an exciting new frontier in infant research methodology. Eye-tracking studies with infants have been difficult to interpret in the past, due to evidence that infants look longer both at things that they prefer and things that surprise them (Paulus, 2021). Gaze-contingency paradigms such as the ones utilized in these studies enable more targeted research and more clearly defined actions for infants to execute.

There were several limitations to these studies that can help inform future research to get a better understanding of infant prosociality. As previously discussed, there were possible confounds in Study 2 due to the fact that infants saw the character bouncing happily prior to the gaze-contingency being active in the Control condition, which may have captured their attention better than in the Experimental condition, and the fact that triggering the contingency in both conditions had the same result of the infant getting their goal object. This may suggest that emotion plays a larger role in infants decision-making at this age than we previously thought. Future studies could lean into this idea and could introduce an object that the agent does *not* like and observe whether infants would be more likely to trigger the contingency when a barrier blocks an object the infant likes versus does not like or is afraid of. If infants consistently trigger the contingency even when it impacts the character negatively, it could be concluded that they simply like triggering the contingency; if they trigger the contingency only when it helps the character, this would help shed light on the current results and suggest an early propensity to help.

Another limitation to the current study is that it is unclear how helping in our paradigms relates to helping in the "real world". In developing a completely novel way to help early in development, we are able to gain insight into early social cognition, but do not have the ability to determine whether this is the same cognition as other kinds of helping. One obvious possibility for future directions would be to conduct a longitudinal study in which infants participate both in a gaze-contingent helping paradigm in infancy, and a physical helping task as they move into toddlerhood. It would then be possible to track individual differences over time; if infants who help more in the gaze-contingent paradigm also help more in other helping tasks, it would suggest that this behavior is genuinely prosocial and results from similar processes to other helping behaviors. Another possible future direction would be to measure psychophysiological metrics such as pupil dilation alongside the gaze-contingency paradigm to track whether infants demonstrate similar sympathetic responses in this situation as they do in real world helping situations (e.g., Hepach et al., 2012). This would help to make the case that helping in this paradigm comes from a genuine desire to help rather than a more superficial reason.

In summary, the current project is the first of its kind to give infants aged 9-12 months an opportunity to help that does not rely on advanced motor skills. We utilized an innovative new gaze-contingency paradigm and provided some initial evidence for prosocial capabilities in young infants. We hope this study lays the groundwork for future research which can help shed more light on the origins of helping. Investigating the origins of helping can have implications for parents and caregivers: if infants are indeed predisposed to be prosocial, parents can focus on teaching their babies *how* to help in practical ways rather than spending time explaining *why* to help. Additionally, seeing infants as prosocial agents may help parents to better respect their abilities from young ages rather than seeing them as devoid of intentions and goals.

References

Brownell, C. A. (2016). Prosocial Behavior in Infancy: The Role of Socialization. *Child Development Perspectives*, *10*(4), 222–227. https://doi.org/10.1111/cdep.12189

Callaghan, T., Moll, H., Rakoczy, H., Warneken, F., Liszkowski, U., Behne, T., & Tomasello, M. (2011). Early social cognition in three cultural contexts. *Monographs of the Society for Research in Child Development*, 1–142.

Corbit, J., Callaghan, T., & Svetlova, M. (2020). Toddlers' costly helping in three societies. *Journal of Experimental Child Psychology*, *195*. https://doi.org/10.1016/j.jecp.2020.104841

Dahl, A., Satlof-bedrick, E. S., Hammond, S. I., Drummond, J., Waugh, W. E., & Brownell, C. A. (2017). Explicit Scaffolding Increases Simple Helping in Younger Infants. *Developmental Psychology*, *53*(3), 407–416.

Dahl, A., Goeltz, M. T., & Brownell, C. A. (2022). Scaffolding the emergence of infant helping : A longitudinal experiment. *Child Development, 93 (3)*, 751–759. https://doi.org/10.1111/cdev.13710

Davidov, M., Paz, Y., Florina, R. R., Orlitsky, T., Mankuta, D., & Zahn-waxler, C. (2021). Caring babies : Concern for others in distress during infancy. *Developmental Science, 24 (2)*. https://doi.org/10.1111/desc.13016

Deligianni, F., Senju, A., Gergely, G., & Csibra, G. (2011). Automated gaze-contingent objects elicit orientation following in 8-month-old infants. *Developmental Psychology*, *47*(6), 1499–1503. https://doi.org/10.1037/a0025659

Dunfield, K., Kuhlmeier, V. A., O'Connell, L., & Kelley, E. (2011). Examining the Diversity of Prosocial Behavior: Helping, Sharing, and Comforting in Infancy. *Infancy*, *16*(3), 227–247. https://doi.org/10.1111/j.1532-7078.2010.00041.x

Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Prosocial Development. *Handbook of Child Psychology and Developmental Science, 7th Edition*. https://doi.org/10.1002/9780470147658.chpsy0311

Grossmann, T., Missana, M., & Krol, K. M. (2018). The neurodevelopmental precursors of altruistic behavior in infancy. *PLoS Biology*. https://doi.org/10.1371/journal.pbio.2005281

Hammond, S. I., & Brownell, C. A. (2018). Happily unhelpful: Infants' everyday helping and its connections to early prosocial development. *Frontiers in Psychology*, *9*(SEP), 1–8. https://doi.org/10.3389/fpsyg.2018.01770

Hepach, R., Vaish, A., & Tomasello, M. (2012). Young Children Are Intrinsically Motivated to See Others Helped. *Psychological Science*, *23*(9), 967–972. https://doi.org/10.1177/0956797612440571

Kanakogi, Y., Miyazaki, M., Takahashi, H., Yamamoto, H., Kobayashi, T., & Hiraki, K. (2022). Third-party punishment by preverbal infants. *Nature Human Behavior*. https://doi.org/10.1038/s41562-022-01354-2

Kärtner, J., Keller, H., & Chaudhary, N. (2010). Cognitive and Social Influences on Early Prosocial Behavior in Two Sociocultural Contexts. *Developmental Psychology*, *46*(4), 905–914. https://doi.org/10.1037/a0019718

Keemink, J. R., Keshavarzi-Pour, M. J., & Kelly, D. J. (2019). Infants' responses to interactive gaze-contingent faces in a novel and naturalistic eye-tracking paradigm. *Developmental Psychology*, *55*(7), 1362–1371. https://doi.org/10.1037/dev0000736

Köster, M., Itakura, S., Omori, M., & Kärtner, J. (2019). From understanding others' needs to prosocial action: Motor and social abilities promote infants' helping. *Developmental Science*. https://doi.org/10.1111/desc.12804

Köster, M., Ohmer, X., Nguyen, T. D., & Kärtner, J. (2016). Infants Understand Others' Needs. *Psychological Science*, *27*(4), 542–548. https://doi.org/10.1177/0956797615627426

Over, H., & Carpenter, M. (2009). Eighteen-month-old infants show increased helping following priming with affiliation: Research report. *Psychological Science*, *20*(10), 1189–1193. https://doi.org/10.1111/j.1467-9280.2009.02419.x

Paulus, M. (2021). Should infant psychology rely on the violation-of-expectation method? Not anymore. *Infant and Child Development*, *31*(1), 1–12. https://doi.org/10.1002/icd.2306

Pettygrove, D. M., Hammond, S. I., Karahuta, E. L., Waugh, W. E., & Brownell, C. A. (2013). From cleaning up to helping out: Parental socialization and children's early prosocial behavior. *Infant Behavior and Development*, *36*(4), 843–846. https://doi.org/10.1016/j.infbeh.2013.09.005

Stout, W., Karahuta, E., Brandone, A. C., & Laible, D. (2021). A longitudinal study of the differential social-cognitive foundations of early prosocial behaviors. *Infancy, 26* (2), 271–290. https://doi.org/10.1111/infa.12381

Tomasello, M., & Vaish, A. (2013). Origins of Human Cooperation and Morality. *Annual Review of Psycholgy*, *64*, 231–255. https://doi.org/10.1146/annurev-psych-113011-143812

Vernetti, A., Senju, A., Charman, T., Johnson, M. H., Gliga, T., Baron-Cohen, S., Bedford, R., Bolton, P., Cheung, H. M. C., Davies, K., Elsabbagh, M., Fernandes, J., Gammer, I., Guiraud, J., Liew, M., Maris, H., O'Hara, L., Pasco, G., Pickles, A., … Yemane, F. (2018). Simulating interaction: Using gaze-contingent eye-tracking to measure the reward value of social signals in toddlers with and without autism. *Developmental Cognitive Neuroscience*, *29*, 21–29. https://doi.org/10.1016/j.dcn.2017.08.004

Wang, Q., Bolhuis, J., Rothkopf, C. A., Kolling, T., Knopf, M., & Triesch, J. (2012). Infants in control: Rapid anticipation of action outcomes in a gaze-contingent paradigm. *PLoS ONE*, *7*(2), 1–6. https://doi.org/10.1371/journal.pone.0030884

Warneken, F. (2015). Precocious prosociality: Why do young children help? *Child Development Perspectives*, *9*(1), 1–6. https://doi.org/10.1111/cdep.12101

Warneken, F. (2016). Insights into the biological foundation of human altruistic sentiments. *Current Opinion in Psychology*, *7*, 51–56. https://doi.org/10.1016/j.copsyc.2015.07.013

Warneken, F., & Tomasello, M. (2006). Altruistic helping in human infants and young chimpanzees. *Science*, *311*(5765), 1301–1303. https://doi.org/10.1126/science.1121448

Warneken, F., & Tomasello, M. (2007). Helping and cooperation at 14 months of age. *Infancy*, *11*(3), 271–294. https://doi.org/10.1111/j.1532-7078.2007.tb00227.x

Warneken, F., & Tomasello, M. (2008). Extrinsic Rewards Undermine Altruistic Tendencies in 20-Month-Olds. *Developmental Psychology*, *44*(6), 1785–1788. https://doi.org/10.1037/a0013860

Woodward, A. L. (1998). Infants selectively encode the goal object of an actor's reach. *Cognition*, *69*(1), 1–34. https://doi.org/10.1016/S0010-0277(98)00058-4

Chapter 3

Children's Moral Reasoning About Self- vs. Other-Benefitting Public Health Measures

(Probst, Nowack, & Warneken, 2023)

The COVID-19 pandemic upended the lives of children around the world: schools closed, playdates were canceled, and visits with family members became Facetime calls. One particularly salient change for adults and children alike was the introduction of novel public health measures such as masking and social distancing. For children, masking became an increasingly important behavior in slowing the spread of COVID-19 so that schools could safely re-open (Donovan et al., 2022). Because behaviors such as masking are crucial in preventing the spread of COVID-19, it is imperative to identify how to best communicate these measures to children to maximize their compliance. Moreover, it raises important questions about children's socio-moral reasoning that inform theories of moral development and in turn can have practical implications for what kinds of messaging is most persuasive. Preventative behaviors such as masking and social distancing have both self- and other-benefitting effects—wearing a mask can prevent one from getting the virus as well as prevent them from spreading the virus to others (Gandhi et al. 2020). It is not yet known whether children focus more on the selfish or prosocial aspect of mask wearing. This is a central question given that framing influences the attitudes and perceptions of public health measures in adults (e.g., Grant & Hoffman, 2011; Ceylan & Hayran, 2021; Jordan et al., 2020; Luttrell & Petty, 2021). For this reason, we first review findings from adults and then develop our rationale for testing for such effects in children.

Framing effects occur when the way information is presented influences how people think about that information (Chong & Druckman, 2007). Framing effects have been demonstrated in a variety of contexts and have been distinguished as *emphasis* framing effects and *equivalency* framing effects. *Equivalency* framing effects present logically equivalent information in different perspectives, such as framing a disease or disaster in terms of lives saved versus lives lost (e.g., Tversky and Kahneman, 1981). On the other hand, we focus here on *emphasis* framing effects, which highlight different relevant aspects of an issue (e.g., framing a policy in terms of economic versus social impact) (see Chong & Druckman, 2007). Most relevant to the current study, message framing effects that characterize a behavior as either self- or other-focused have been found to influence health-related decisions: One famous study investigated framing effects in hospitals and found that posting signage emphasizing the importance of hand-washing for protecting *others* was more effective than signage framing it as protecting the *self* (Grant & Hofmann, 2011).

More recently, a few studies with adults have applied the effects of self versus other framing to COVID-19 preventative measures. Ceylan and Hayran (2021) manipulated the framing of messages regarding social distancing to prevent COVID-19 as either prosocial ("For all our health, stay home") or self-interested ("For your own health, stay home") and found that participants in the prosocial condition found the message more persuasive and were more motivated to help others. Jordan et al. (2021) conducted a similar study and found that, at least early in the pandemic, messaging emphasizing the benefits of preventative measures for others yielded higher levels of prevention intentions. Additionally, Gillman et al. (2022) found that people were more receptive to other-focused messages about COVID-19 than self-focused

messages, suggesting that prosocial frames may be an effective way to communicate about novel public health measures.

One reason why other-focused framings may be more effective than self-focused framings is that other-focused framings are more morally relevant due to their focus on the interpersonal consequences of an action. Luttrell and Petty (2021) found that people were more likely to perceive other-focused messages regarding social distancing as moral arguments than self-focused messages. Thus, other-focused framings seem to tap into people's moral reasoning, which may make them a particularly effective communication tactic for adults and children alike.

In contrast to this research with adults, it is not known whether similar effects would be found among children. Evidence from other domains, such as gain and loss framing, suggests that children are susceptible to framing effects on decision-making, similar to adults (e.g., Schlottmann & Tring, 2005; Wyllie et al., 2015). However, no studies to date have investigated the effectiveness of self- and other-oriented framings on preventative health measures in children. This is important to explore considering that other-oriented frames seem to have moralizing effects in addition to affecting decision-making.

While no study has investigated how framing might influence children's evaluations of public-health measures, developmental research has started to address children's knowledge of COVID-19 and corresponding health-measures. For example, a COVID-19 "quiz" administered to children aged 6-16 in India asked children about their awareness of how COVID-19 is transmitted, its symptoms, and measures to prevent its spread such as social distancing, handwashing, and masking (Shaikh & Likhite, 2020). The results showed that the majority of children's scores (93%) fell within the "good" or "excellent" knowledge categories, suggesting that children generally had a good understanding of what COVID-19 is and how to prevent it. In

addition, qualitative studies with children in several different countries found that school-aged children are concerned about COVID-19 and protecting themselves and others from it (Bray et al., 2021; Sarkadi et al., 2021; Thompson et al., 2021). Finally, children participating in COVID-19 related studies in the United States (Howe et al., 2021) and China (Xue et al., 2021) report high levels of adherence to preventative health guidelines. Children therefore pick up on information about COVID-19 and are familiar with preventative measures. Consequently, it would be prudent to explore how children might be susceptible to self- versus other-oriented framing – not only for the current pandemic, but also for future situations where novel preventative measures would be necessary.

Will children, like adults, find other-oriented framings more persuasive and moralizing? Children are attuned to moral decision-making from a young age. Even beginning in infancy, children prefer more moral characters and are capable of evaluating moral situations (Hamlin, 2013). As children progress through childhood, they show increasingly nuanced moral decision-making, considering contextual factors as they determine right from wrong across several domains (for an overview, see Killen & Smetana, 2015). Before entering middle childhood, children reason and respond with moral convictions; for example, they intervene in the face of third-party transgressions and police the behaviors of others (Heyman et al., 2016; Vaish et al., 2011).

Further evidence also suggests that framing behaviors as other-oriented would be moralizing and effective for children. It is known that by preschool ages, children rate moral transgressions against others as more wrong than violations of personal rules (Tisak, 1993). Because of this, other-oriented frames may provoke a sense of morality that would not be induced in self-oriented frames. Moreover, children by middle childhood view the avoidance of

transgressing against others as morally obligatory—even more obligatory than engaging in positive moral acts (Kahn, 1992). In other words, it is more important to children to not harm others than it is to help others. Taken together, although none of this work has tested other- versus self-regarding frames, it supports the prediction that children would be more sensitive to other-oriented appeals and that they may elicit moral thinking.

An additional study manipulated whether school-aged children saw somebody lie to benefit themselves or others (Fu et al., 2015). While children judged both types of lying as bad, they judged selfish lying as worse than lying to benefit others and found those who lied to benefit themselves to be untrustworthy. This suggests that the same act can be judged differently depending on who it benefits and may indicate that in our public health context, children will be more favorable to behaviors that benefit the others.

While we so far have argued for the hypothesis in favor of other-oriented over self-oriented frames, we also must consider the counterhypothesis that self-oriented frames prove more effective. This alternative hypothesis is not without merit: young children (i.e., 4-5-year-olds) are known to consider their own self-interest in resource sharing and decision making more strongly than older children (i.e., 8-9-year-olds) and adults (e.g., McAuliffe et al., 2017). Additionally, children who are primed to think of themselves demonstrate less helping and sharing behaviors, suggesting that self-oriented framings may influence children's social cognition and behavior (Weltzien et al., 2018). Therefore, while other-oriented frames may be effective because they prompt children to moralize preventative behaviors, it might turn out that self-oriented framings are more effective drivers of behavior as they prompt children to think about preserving their own well-being. The current study aims to adjudicate between these two hypotheses.

Current Studies

Here we test the effects of self- versus other-oriented framing on children's moral evaluations of public health measures similar to COVID-19 prevention behaviors. We deliberately chose to use *hypothetical* scenarios with *novel* public health measures because of the polarized opinions regarding the pandemic and possible preconceived notions by children about specific rules such as mask-wearing and social distancing. This was a particularly strong concern given that our data collection took place during the summer and fall of 2021, after children were already exposed to a multitude of information about COVID-19. Furthermore, as developmental psychologists interested in cognitive development, our aim was to understand the underlying cognitive processes and representations of children, rather than children's specific opinions regarding mask-wearing and social distancing. Therefore, instead of asking directly about COVID-19 prevention behaviors, we constructed hypothetical situations that mirror the inherent dilemmas caused by behaviors such as mask-wearing, wherein a prevention behavior has a health benefit to the self or others but comes with a cost to the self because of the disutility of having to wear a mask or not being able to move freely without needing to keep social distance. This methodological approach has a long tradition in moral psychology: To get at the underlying concepts it is beneficial to use hypothetical scenarios that are structurally similar to real-life moral problems, rather than directly asking individuals about current controversies (e.g., abortion, euthanasia, fair wages) for which people might just repeat rehearsed answers or have preconceived notions that mask their actual reasoning (see Greene, 2013 and Mook, 1983 for extensive discussions on the advantages of such methods to understand psychological mechanisms).

The general method across our series of experiments was to use illustrated hypothetical scenarios involving novel aliens—an approach that has been shown to be useful in other moral decision-making studies with children (i.e., Rottman & Kelemen, 2012). Specifically, children viewed vignettes of alien characters who faced dilemmas such as covering up spikes on their body with heavy caps to prevent poking themselves (self-oriented frame) or poking other aliens (other-oriented frame). We also manipulated the severity of these situations, with spikes either poking (high severity) or brushing against (low severity) the recipient. The reason for this manipulation was to determine whether children would be attentive to the potential harm caused by the action and adjust their responses accordingly. We used several structurally similar scenarios with different kinds of dilemmas. Children were then asked to evaluate the behaviors and express their preferences for agents who did or did not perform the protective behaviors.

Because this topic has not yet been addressed in children, we decided to recruit a broad age-range to track any developmental changes that may occur throughout middle childhood. Previous research suggests that moral reasoning abilities are fairly well-developed by five years of age (see Killen & Smetana, 2022). In addition, piloting suggested that 5-year-olds were a viable age-group for online testing, while younger children had difficulties. For these two reasons, we used five years as the lower bound of our age range. The upper bound of our age range was set to ten years old because this generally constitutes the end of middle childhood and we were most interested in developmental change across this life period.

We conducted two studies. The main goals of Study 1 were to validate our paradigm and assess whether framing the protective behaviors as either self- or other-oriented influenced children's evaluations. In a within-subjects 2x2 design, we manipulated the framing (other-oriented vs. self-oriented) and severity (low vs. high) of the aliens' dilemmas. Our dependent

measures were children's endorsement of the behavior and their evaluations of individuals who did or did not perform the protective behavior. We hypothesized that children would be more likely to endorse the protective behaviors and show more positive socio-moral evaluations of followers over violators in the other-oriented over the self-oriented condition. We also hypothesized that children would be more likely to endorse the behaviors and show more socio-moral reasoning in the high severity compared to the low severity condition, and that there would be an interaction such that the high severity/other-oriented condition would yield the highest rate of endorsement and socio-moral judgment. We had no predictions about developmental changes but included age as an exploratory variable. The same applied to gender.

Study 2 was conducted with a separate sample and had two main parts. The goal of Study 2a was to conduct a direct replication of the main results from Study 1 in a larger sample. Study 2b was conducted directly after Study 2a with the same children in the same test session and aimed to extend our previous findings by further exploring children's moral judgements within the other-oriented framing condition. All methods and hypotheses were pre-registered at AsPredicted (Study 1: https://aspredicted.org/DMD_YYK, Study 2a: https://aspredicted.org/4P8_SRY, Study2b: https://aspredicted.org/NVJ_7XN).

Study 1

Method

Participants

The final sample was $N = 48$ children aged 5-10 ($M = 8.02$, $SD = 1.73$, with equal numbers of girls and boys per age. One additional participant was excluded from analyses because of failure to pass the comprehension checks. Parents identified their children as follows: 10% as Asian American, 4% as Black/African American, 69% as White/Caucasian, and 17% as

of multiple race/ethnicities. Participants were recruited primarily through a research database hosted at the authors' home institution, the lab website, and social media ads.

Design

We employed a 2x2 design with the variables severity (high vs. low) and framing (other-oriented vs. self-oriented) tested within subjects. Therefore, each child saw four different aliens representing the four different combinations of manipulations (high severity other-oriented, high severity self-oriented, low severity other-oriented, low severity self-oriented). We counterbalanced the order and combinations of conditions, as well as the order and conditions of the aliens, to create 16 unique sequences that were randomly assigned to children within each of three age-groups created for counterbalancing purposes (5-6, 7-8, 9-10).

Procedure

This study was conducted online by an experimenter over Zoom. Parents completed consent forms prior to the study session. During the test session the researcher verified the parent's consent and obtained verbal assent from the child. The study was presented via Qualtrics, with the experimenter sharing their screen with the child. All stimuli were read aloud and the child's responses were obtained verbally and recorded in Qualtrics by the researcher as the study proceeded.

We included two manipulation check questions and one comprehension check for each vignette (described below). If the child answered a manipulation or comprehension check question incorrectly, that portion of the vignette was repeated and the child was re-asked the question. If they failed the question a second time, the incorrect answer was recorded and that trial was subsequently excluded from analysis. Of the 192 trials (4 per child, 48 children), eight

trials were excluded due to failed manipulation checks and seven trials due failed comprehension checks, for a total of 15 excluded trials (< 8%).

The procedure was the same for all four vignettes presented in counterbalanced order (see above). At the end of the session, we thanked the child for their participation and emailed a $5 Amazon online gift code and a form explaining the purpose of our research to the child's parents.

Stimuli

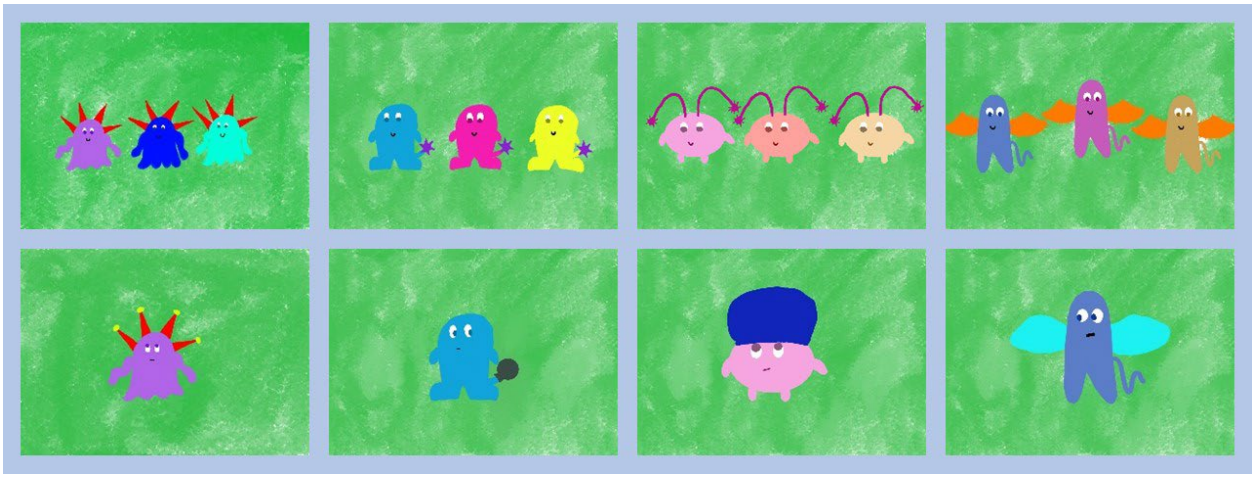


Figure 3.1. Examples of stimuli used in the study. The top row is the introduction image for each alien (Furpees, Ollers, Blickets, Zibs), and the bottom row is the prevention behavior for each alien.

The stimuli for this study consisted of cartoon-like drawings of aliens. There were four different types of aliens, each with some bodily appendage that presented a potential problem for themselves or others, depending on the condition. As shown in Figure 1, the Furpees had large spikes on their bodies, the Ollers had spiky balls on the end of their tails, the Blickets had spiky antennas, and the Zibs had wings with spiky protrusions. The type of harm or inconvenience (i.e., poking or brushing against) was held constant. Children saw illustrations of the aliens alongside text vignettes that were read aloud by the experimenter. We provide the full text and image stimuli, as well as dependent variables, as presented to the children in Appendix A.

Each vignette opened with an introduction to the alien, the planet they live on, and a short description of their appendage. An illustration depicting three of these aliens in different colors accompanied the description (see the top row in Figure 3.1). This introduction was held constant in all conditions for each of the aliens.

In the next step, the alien either poked or brushed against themselves or another alien. This step introduced the two manipulations, framing and severity. The framing manipulation refers to whether the alien's appendage affects themselves (self-oriented) or another alien (other-oriented); the severity manipulation refers to whether the alien's appendage pokes (high severity) or brushes against (low severity) themselves or the other alien. For example, *"Sometimes the Furpees' spikes poke other Furpees"* (Other-oriented/High severity).

Following the depiction of the manipulation, a speech bubble re-emphasized the severity (*"Ouch!"* in the high severity and *"Oh!"* in the low severity condition) along with an additional description stating whether this hurts (high severity) or does not hurt (low severity). Two manipulation checks assessed whether the children understood a) which alien is affected (e.g., *"Who does the Furpee poke?"*) and b) whether or not harm is caused (e.g., *"Does it hurt when the Furpee pokes other Furpees?"*).

Next, the children saw the protective behavior that prevented the alien from poking or brushing against themselves or others. The protective behaviors, intended to reflect the inherent conflict of health measures such as mask-wearing in that they provide protection but are uncomfortable, were as follows: the Furpees could cover up their spikes with caps, the Blickets could put a hat over their antennas, the Zibs could put a wrap over their wings, and the Ollers could put a cover over their tail. The comprehension check question here assessed whether the children understood the discomfort of the alien (*"How do you think they feel? Comfortable, or*

uncomfortable?"). At the end of each vignette, children saw the result of doing the protective behavior (i.e., *not* poking or brushing against the self or other).

Dependent variables

Immediately after each story vignette, children saw a different member of the alien type (denoted by a different color) debating whether to perform the protective behavior. We asked children whether or not the alien should do the behavior (*Endorsement*), followed by a free response question of "*Why?*" to keep their attention. Because their justifications were purely exploratory and not part of our hypothesis, we did not include them in our main analysis; however, we do provide a description of general trends in our Results section.

Children then saw both a violator alien (an alien who failed to do the prevention measure) and a follower alien (an alien who decided to do the prevention measure). For each of the four vignettes, the children first separately evaluated the follower and the violator (order counterbalanced) on Likert-scales assessing their *Action Rating* (on a 5-point scale from very bad to very good), *Friendship Quality* (on a 4-point scale from very bad friend to very good friend), and *Smartness* (on a 4-point scale from very not smart to very smart). Then, children responded to two forced-choice questions where the participant chose which alien (follower or violator) they would rather be friends with (*Friend Choice*) and which is smarter (*Smarter Alien Choice*). The questions asking how good or bad the follower and violator aliens' actions were and the questions assessing how good or bad a friend the aliens were constitute sociomoral questions and allow us to examine whether our manipulations impacted children's moral thinking about others. The inclusion of the smartness questions allows us to assess whether the effect of framing is specific to social-moral evaluation or is evident in other more general evaluations of competency.

For the Likert-scale ratings, difference scores were calculated by subtracting children's ratings of the violator alien from their ratings of the follower alien. These difference scores were used as the dependent variables—higher positive scores reflect more positive ratings of the follower and more negative ratings of the violator, and lower scores reflect more similar ratings of the two aliens. Higher positive difference scores on the *Action Rating* variable would suggest children see a refusal to perform the protective barrier as morally bad, and higher positive difference scores according to framing on the *Friendship Quality* variable along with a higher proportion of follower on the *Friend Choice* variable would suggest that this extends to a moral judgment about the alien as a social partner. Effects of the independent variables on *Smartness* and *Smarter Alien Choice* would suggest that children's evaluations of the aliens are more global and not specific to sociomoral considerations. See Table 1 for a summary of the six dependent variables.

Table 3.1: *Summary of dependent variables.*

Variable Name	Description	Text of Question	Measurement
Endorsement	Whether or not the alien should do the behavior	What do you think? Should the [alien] [do the protective measure]?*	Binary: Yes/No
Action Rating	Rating of the follower and violator's action	Do you think what the [color] [alien] did was good, bad, or just OK? A little good/bad, or very good/bad?	Continuous: Difference score between two 5-point Likert scales
Friendship Quality	Rating of the follower and violator's friendship quality	Do you think the [color] [alien] is a good or bad friend? A little good/bad, or very good/bad?	Continuous: Difference score between two 4-point Likert scales
Smartness	Rating of the follower and violator's smartness	Do you think the [color] [alien] is smart or not smart? A little smart/not smart, or very smart/not smart?	Continuous: difference score between two 4-point Likert scales
Friend Choice	Forced choice of which alien is a better friend	Which of the two [alien]s would you rather be friends with?	Binary: Follower/Violator
Smarter Alien Choice	Forced choice of which alien is smarter	Which of the two [alien]s is smarter?	Binary: Follower/Violator

*Exact wording depends on the alien type; see Appendix A

Analysis approach

We used generalized linear mixed models for the three binary dependent variables (*Endorsement, Friend Choice, Smarter Alien Choice*), and linear mixed effects models for the three continuous dependent variables (*Action Rating, Friendship Quality, Smartness*). All analyses were performed in R, version 3.6.3, using the package lme4 (Bates et al., 2015).

For each model, the fixed effects were trial, gender, age, framing, severity, and the interaction between framing and severity. Subject ID was included as a random effect to account for within-subjects testing. For each analysis, we first compared a full model that included all predictors of interest to a null model only containing trial and subject to test whether the predictors combined had a significant effect on our dependent variable, preempting concerns of multiple analyses inflating the rate of false positive results (Forstmeier & Schielzeth, 2011). If

this comparison showed a significant effect, we proceeded by comparing the full model against a series of hypothesis-driven models to compare model fit using likelihood ratio tests and assessing the effects of each predictor on the dependent variables. Age and gender were pre-registered as exploratory analyses as we did not have any prior hypotheses regarding their potential effects. We include a regression table of the final models (age and gender were only included in final models if they showed an effect in model comparisons) for each of the following analyses in our Appendix A. In these regression tables, the beta values can be interpreted as effect sizes as the variables are standardized. A summary of the significant effects of Studies 1 and 2a can be found in Table 3.2.

Results

Endorsement of Behavior

Our first question was whether our experimental manipulation influenced children's endorsement of the protective behaviors (Figure 2A). Specifically, we built a generalized linear mixed model with the aforementioned predictors and children's endorsement of the protective behaviors as a binary outcome. There was a significant difference between the full model and the null model, χ^2 (5) = 62.21, $p < .001$. Model comparisons revealed a main effect of severity, reflecting stronger endorsement of the behavior in the high severity compared to the low severity condition, χ^2 (2) = 59.08, $p < .001$. There was no effect of framing, gender, age, or the interaction between framing and severity. However, there was a significant interaction between age and severity: younger children showed high levels of endorsement even in the low severity condition, and with age children endorsed less in the low severity condition while consistently showing near ceiling levels of endorsement in the high severity condition, χ^2 (1) = 15.02, $p < .001$.

Overall, severity appears to matter the most for children's endorsement of the protective behaviors.

Sociomoral Evaluations

The next series of analyses assessed children's sociomoral evaluations of aliens who did (follower) or did not (violator) perform the protective behavior by assessing children's rating of the *Action Rating* (Figure 2B), *Friendship Quality* (Figure 2C), and Friend Choice (Figure 2D).

Action Rating. We built a linear mixed model to examine how children differentially evaluate the follower's and violator's decisions to do or not do the protective behavior, using the difference score as a continuous outcome variable. There was a significant difference between the full and null model, $\chi^2(5) = 68.35$, $p < .001$. Model comparisons revealed a significant main effect of severity: in the high severity condition, children had higher positive difference scores, reflecting higher ratings of the follower over the violator, whereas in the low severity condition, children rated the followers and violators similarly, $\chi^2(2) = 54.25$, $p < .001$. Additionally, there was a main effect of framing: when the behavior was framed as other-oriented, children had more positive difference scores, whereas when the behavior was framed as self-oriented, children's difference scores hovered around 0, $\chi^2(2) = 7.79$, $p = .020$. There was no effect of age or the interaction between severity and framing. However, there was an effect of gender, with girls rating violators and followers more evenly than boys, who tended to show a slight favoring of violators overall, $\chi^2(1) = 8.20$, $p = .004$. Taken together, these analyses show that children evaluate aliens who do protective behaviors more positively and evaluate aliens who do not do protective behaviors more negatively when the behaviors prevent harm or protect others. By contrast, children show similar ratings of followers and violators when the behaviors only prevent mildly inconvenient outcomes or protect the self.

Friendship Quality. We constructed a linear mixed model to examine whether severity or framing predicted differences in children's rating of how good or bad of a friend the violator and follower are, using the difference score for this measure as a continuous outcome variable. There was a significant difference between the full and null model, χ^2 (5) = 57.50, $p < .001$. Model comparisons revealed that there was a significant main effect of severity, such that children in the high severity condition had higher positive difference scores, rating the follower as a better friend and the violator as a worse friend, than children in the low severity condition, whose difference scores were near zero, rating the aliens more similarly, χ^2 (2) = 25.65, $p < .001$. There was also a main effect of framing, such that children in the other-oriented condition had higher positive difference scores, rating the follower as a better friend and the violator as a worse friend, than children in the self-oriented condition, whose difference scores were near zero, rating the two aliens more similarly, χ^2 (2) = 30.30, $p < .001$. There was no effect of the interaction between framing and severity, and no effect of age. However, like the ratings of the aliens' actions, there was a slight main effect of gender where boys tended to have more negative difference scores, slightly favoring the violators, whereas girls tended to have more positive difference scores, slightly favoring the followers, χ^2 (1) = 4.63, $p = .031$. Overall, children think aliens who do protective behaviors are better friends than those who do not when the behaviors prevent harm or protect others, and think follower and violator aliens have about the same friendship quality when the behaviors prevent inconvenience or protect the self.

Friend Choice. The binary measure of whether the child would rather be friends with (the violator or the follower) mirrored the effects found using the difference score measure. The full model significantly differed from the null model, χ^2(5) = 59.55, $p < .001$. Model comparisons revealed a main effect of severity, such that children's preference for the follower as a friend was

more pronounced in the high severity compared to the low severity condition, $\chi^2(2) = 50.39$, $p < .001$. Additionally, there was a marginal main effect of framing, such that children chose the follower alien as the better friend more when the behavior was framed as other-oriented compared to when the behavior was framed as self-oriented, $\chi^2(2) = 6.17$, $p = .046$. Although this effect is slightly weaker than the scale response questions, Figure 2D demonstrates that this is because a majority of children chose the follower in the high severity condition regardless of framing, suggesting a near ceiling effect. Overall, our results show that children think aliens who perform protective behaviors are better friends when those behaviors prevent harm or when those behaviors protect others. There was no effect of age or the interaction between severity and framing. However, there was an effect of gender, with girls choosing the follower more and boys choosing the violator more, $\chi^2(1) = 5.70$, $p = .020$.

Across three socio-moral evaluation measures, both severity and framing impacted children's ratings and choices regarding the follower and violator aliens. Children thought followers were better friends and performed more morally good actions than violators if the protective behaviors aimed at protecting others from harm.

Evaluation of Smartness

In the final series of analyses, we examined children's evaluations of the aliens' smartness with the goal of assessing whether framing effects are specific to socio-moral evaluations or might engender generally more positive evaluations of norm-followers. Our dependent variable was the difference score of children's smartness ratings for the violator and follower (Figure 2E), and the binary measure of which alien is smarter (Figure 2F).

We ran a linear mixed model to examine whether severity or framing predicted differences in children's rating of how smart or not smart the violator and follower are. The

dependent variable in this model was a difference score calculated by subtracting the children's 4-point Likert-scale rating of the violator's smartness from their 4-point Likert-scale rating of the follower's smartness. There was a significant difference between the full and null models, χ^2 (5) = 61.42, $p < .001$. Model comparisons revealed a main effect of severity: children in the high severity condition had higher positive difference scores, rating followers as smarter and violators as less smart, compared to children in the low severity condition, whose difference scores were near zero, rating the follower and violator aliens about the same, χ^2 (2) = 52.55, $p < .001$. There was also an effect of gender, driven by boys' slightly negative difference scores, revealing they had higher ratings for the violator overall, $\chi^2(1) = 5.78$, $p = .016$. A marginal trend of framing also emerged here, with children in the other-oriented condition having higher positive difference scores, rating followers more positively than violators in the other-oriented condition, and children in the self-oriented condition having difference scores closer to zero, rating followers and violators about the same, $\chi^2(2) = 5.75$, $p = .057$. It is worth noting that while this trend looks similar to the results of the social-moral evaluation measures, it is a smaller effect and does not reach statistical significance, suggesting that framing has a lesser impact on smartness evaluations. There was no effect of age or the interaction between severity and framing. Thus, children think followers are smarter than violators when the behaviors prevent harm to the self or to others. In contrast to social-moral evaluations, framing these behaviors as other-oriented does not have a significant effect on evaluations of aliens being smart.

The binary measure of which alien is smarter provided more evidence that the self-oriented and other-oriented framings were not as influential when it comes to the issue of competency. We constructed a generalized linear mixed model with participants' choice of the smarter alien (follower or violator) as the dependent measure. The full model significantly

differed from the null model ($\chi^2(5) = 42.70$, $p < .001$), and subsequent model comparison revealed a significant main effect of severity: children said the follower alien was the smarter alien more in the high severity than the low severity condition, $\chi^2(2) = 39.18$, $p < .001$. Nearly all children in the high severity condition chose the follower as the smarter alien, while slightly over half chose the follower in the low severity condition (Figure 2F). However, there was no effect of framing, age, gender, or the interaction between framing and age. Therefore, we conclude that children think aliens who do protective behaviors are smarter than those who do not when those behaviors prevent harm, but whether the behavior protects oneself or others does not have any bearing on the alien's perceived smartness.

Justifications

In addition to the quantitative measures aimed to test our hypotheses, we also added a "Why?" question to keep children engaged. We coded these responses in the interest of transparency and for exploratory purposes, even though we had no specific predictions on how children would respond. Research assistants transcribed children's responses from video recordings, and those transcriptions were used to generate a coding scheme. The first author then coded each response. In most cases, children's responses were repetitions of aspects of the stories: most commonly justifications for "yes" focused on the outcome of the preventative measure either for others (46% of responses; e.g., "So other Furpees don't get hurt) or themselves (32% of responses; e.g., "So they don't poke themselves), and justifications for "no" focused on the discomfort for the protagonist (33% of responses; e.g., "Because it's very uncomfortable"). A few responses reflected a cost-benefit analysis, with children weighing the pros and cons of the behavior (17% of responses; e.g., "Even though it's uncomfortable, it's better than getting hurt"). Twelve percent of responses mentioned an alternative solution to the

dilemma (e.g., “Because they could tie up their antennas and make a braid or something so it doesn’t brush against anyone”) and three percent directly cited moral principles (e.g., “Even if it feels bad, you should always help others”). Two percent of respondents were unable to give any justification (e.g., “I don’t know”). Overall, these justifications did not add much to our understanding of the phenomena but did provide additional evidence beyond our manipulation checks that children were attending to the dilemmas and manipulations.

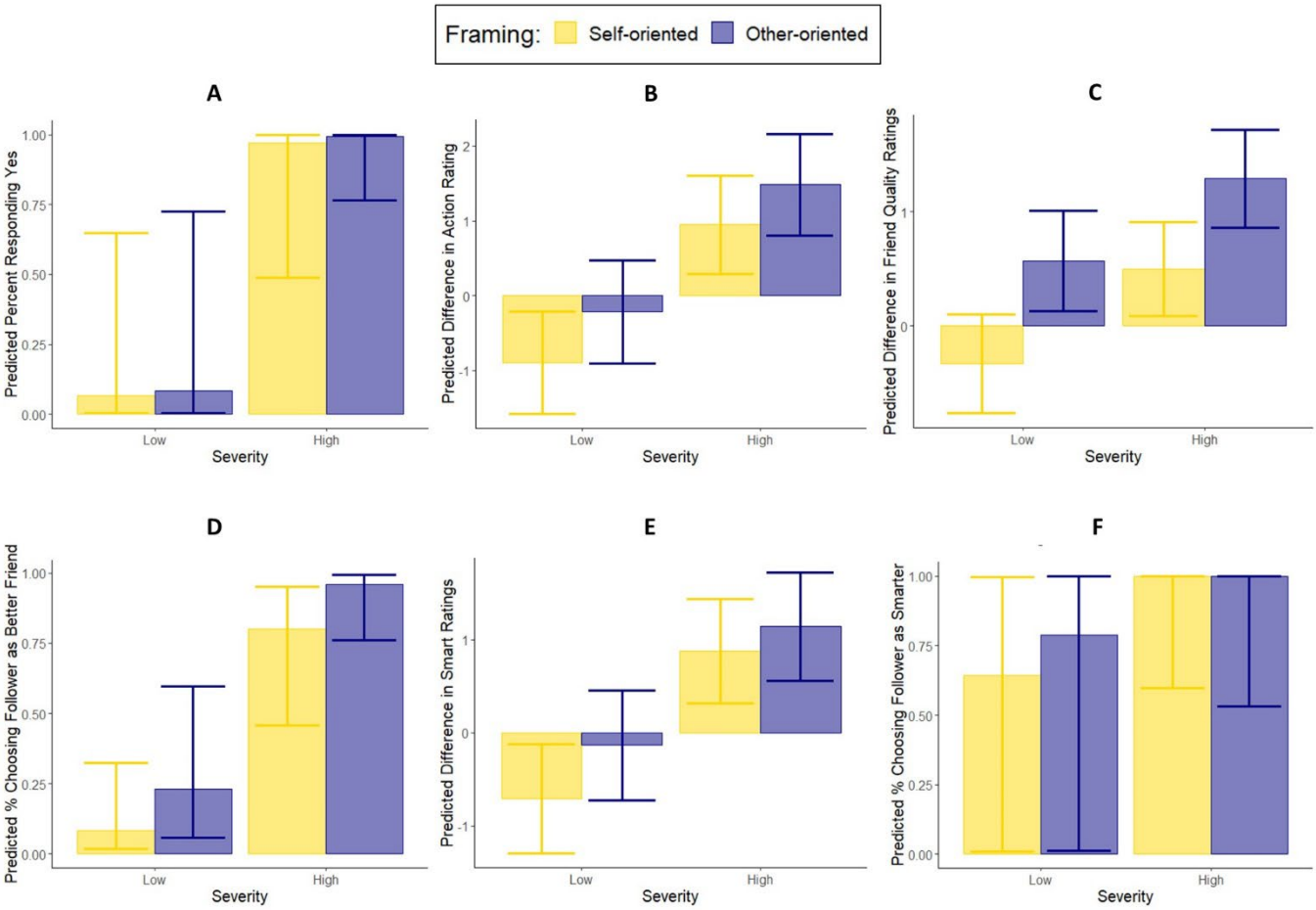


Figure 3.2. Bar charts of model predicted values for Study 1 by Framing (Self-oriented vs. Other-oriented) and Severity (Low vs. High). The dependent variables are *Endorsement* (Fig. 2A), *Action* (Fig. 2B), *Friendship Quality* (Fig. 2C), *Friend Choice* (Fig. 2D), *Smartness* (Fig. 2E) and *Smarter Alien Choice* (Fig. 2F). Error bars represent 95% confidence intervals. Note that the y-axis for Figures B, C, and E are difference scores calculated by subtracting the violator rating from the follower rating.

In summary, these analyses indicate that the effect of framing behaviors as other-oriented or self-oriented affects social-moral evaluations but does not impact a more general evaluation of the aliens' competency. The present findings seem to suggest that children find protective measures to be wise and practical regardless of framing—they endorse the behaviors and rate them as smart in both framings provided they prevent harm (i.e., high severity context). However, the self-oriented and other-oriented framings *do* have an effect when it comes to how children evaluate the social and moral characteristics of aliens who do or do not do the behaviors. We can thus tentatively conclude that framing novel public-health behaviors as other-oriented taps into children's social-moral thinking.

There were a few limitations to Study 1 which we hoped to address in Study 2. First, we recruited a modest sample size for Study 1–in the absence of any prior work on this topic, our sample of 48 was chosen based on convention rather than power analyses using pre-existing effect sizes. Therefore, our aim of Study 2a was to replicate the findings of Study 1 in a larger sample determined with power analyses using the effect sizes of the initial study. Additionally, we aimed to further explore children's moral thinking by focusing on the other-oriented condition in particular. One important aspect of children's moral reasoning is the attribution of intentionality: children consider the role of intention in moral violations, showing more negative evaluations of intentional over accidental violators (e.g. Cushman et al., 2013; Grueneich, 1982, Piaget, 1932). In Study 2b, we manipulated the intention of aliens who did not perform the protective measures to observe whether children would show similar patterns of responding as they do in other moral contexts.

Study 2

Our first study indicated that other-oriented framing elicits children's socio-moral reasoning. As a next step, we aimed to study how children reason about the *intentions* of the protagonists who fail to engage in protective health-measures. This is because the ability to take into account the intentionality behind a transgression is regarded as a fundamental aspect of moral reasoning. If children show sensitivity to intention in this domain, it would suggest that other-oriented frames induce a moral norm and lead children to think about violators of public health behaviors in moral terms.

A long tradition of developmental research has highlighted how reasoning about intentions influences children's moral judgment differentially over development: Younger children tend to focus more strongly on the outcomes of an action, while older children are more likely to evaluate norm violators based on whether they are well- or ill-intentioned (Piaget, 1932/1965). For example, younger children are more likely to make more negative evaluations of people who have caused negative outcomes even with the knowledge of these actions as unintentional (Grueneich, 1982). By around 4 to 8 years of age, children make more intent-based judgments of the actor, and this developmental shift to a more intent-based moral judgment (e.g., Costanzo et al., 1973; Hebble, 1971; Piaget, 1965; Yuill & Perner, 1988) highlighting an important developmental shift towards evaluating actions based on intentions rather than mere outcomes.

While various research has addressed the role of intentionality in children's judgment, the concept of an explicit shift from outcome to intention-focused judgements and the trend of this shift developmentally is still debated. Work with infants' behavioral responses showcased an understanding of intentional and goal-related actions at around 9 to 12 months of age (Behne et al., 2005, Kuhlmeier, et al., 2003). Intentionality is an important factor in interpreting others'

behavior. The trend of considering intentionality in moral evaluations may occur earlier than previously predicted considering the importance in understanding intentions for a child's social development. Children as young as age four or five consider intentionality as a basis of evaluating behavior when the amount of harm or damage caused is held constant (Costanzo et al., 1973). However, while 4-year-old children can consider relevant social information in their moral evaluations, with age they value intention more and by age eight they tend to think of accidental harmers as less naughty and punishable and intentional harmers as more naughty and punishable (Cushman et al., 2013). These studies articulate how this outcome-intention shift is less precise as we previously have assumed. There are important developments involving intentionality from infancy to puberty. This prior work therefore suggests that across our sample of 5- to 10-year-olds, children might already be able to take intention into account when making moral decisions. Moreover, the wide age-range allowed us to observe possible developments in incorporating more social information in their moral evaluations. As such we included age as an exploratory variable with no specific predictions about it to investigate more into this wide range of development.

The aims of Study 2 were thus to (a) conduct a replication of the framing effects from Study 1, and (b) to further investigate whether other-oriented framing induces moral reasoning. We predicted that Study 2a would replicate the findings from Study 1: framing would have an effect on our sociomoral variables, but not on endorsement, and severity would impact all variables. In Study 2b, we predicted that children would be sensitive to intention in their evaluations of violators, which would provide further evidence of moral reasoning in this context.

Study 2a

Method

Participants

The final sample for Study 2a was $N = 61$ children aged 5-10 ($M = 7.79$, $SD = 1.71$, 30 girls). Parents identified their children as follows: 3% as Asian American, 3% as Black/African American, 5% as Hispanic/Latino, 72% as White/Caucasian, and 16% as of multiple race/ethnicities. As with Study 1, participants were recruited primarily through a research database hosted at the authors' home institution, the lab website and social media ads. The sample size was determined by a power analysis using SimR function in R, based on the results from Study 1. We computed the minimum sample size necessary to detect an effect of framing with at least 80% power on one of our primary variables, *Action Rating*. We chose this variable because it had a smaller effect than *Friendship Quality*, therefore ensuring to have sufficient power to adequately assess all variables. We chose to use the effect of framing in this power analysis because it is the variable we were most interested in conceptually. We did not incorporate age into our power analysis because the age effects we found in Study 1 were not consistent across dependent variables, and we therefore did not have predictions about age for Study 2a. The power analysis revealed that a sample size of 54 provided adequate power to detect an effect of framing (84.2%, CI: (81.79, 86.41)). We thus chose a target sample of $N = 60$ children to meet this threshold and allow for adequate counterbalancing across age-groups.

Procedure, Stimuli, & Dependent Measures

The procedure and stimuli used for this portion of Study 2 were identical to those used in Study 1. As in Study 1, we asked both manipulation and comprehension checks throughout the procedure, and excluded trials in which children failed either a manipulation or comprehension checks. There were six trials where children failed manipulation checks, and four trials where

children failed comprehension checks. One of the failed manipulation checks was the same trials as one of the failed comprehension checks. Additionally, one subject only completed two of their four trials. As such, 11 out of 244 trials were excluded from analysis (< 5%).

All the measures for this study were identical to those used in Study 1, with the exception that we did not include the measures assessing smartness as this was a variable that was not of primary concern. We also excluded the *"Why?"* justification question to reduce the overall session length since it did not yield meaningful insights in Study 1. In Study 2a, we focused on the four measures that were central to testing our question about socio-moral reasoning: *Endorsement*, *Action Rating, Friendship Quality,* and *Friend Choice*

Analysis

Our analysis approach was identical to in Study 1, including our pre-registration with age and gender as exploratory variables (https://aspredicted.org/4P8_SRY). See the Appendix A for the regression tables for each of the analysis below.

Results & Discussion

Endorsement of Behavior

We created a generalized linear mixed model to determine whether severity and/or framing impacted children's endorsement of protective behaviors (Figure 3A). The predictors in this model are specified above, and *Endorsement* (yes or no) was the binary dependent variable. Results showed a significant difference between the full model and the null model (χ^2 (5) = 70.45, p < .001), so we proceed with model comparisons. As in Study 1, there was a main effect of severity, such that children were more likely to endorse the protective behavior in the high severity compared to the low severity condition, χ^2 (2) = 68.35, p < .001. Nearly all children endorsed the behavior in the high severity condition, whereas only a little over a quarter of

children endorsed it in the low severity condition. There was no effect of framing, gender, age, or an interaction between framing and severity on endorsement. However, there was a marginal interaction between severity and age, similar to Study 1: with age, children endorsed less in the low severity condition, χ^2 (1) = 3.77, p = .052.

Thus, Study 2a replicated the effects found in Study 1 and demonstrated that in this higher-powered sample, children show similar levels of endorsement across framing conditions but endorse much higher when the protective behavior prevents harm than when it only prevents inconvenience. In fact, our model predicted nearly ceiling levels of endorsement in the high severity condition, suggesting that children find these behaviors prudent when they prevent harm regardless of whether that harm is directed toward the self or others.

Socio-Moral Evaluations

Action Rating. We built a linear mixed model to examine how children differentially evaluate the follower's and violator's decisions, using the difference score for this measure as the continuous outcome measure (Figure 3B). There was a significant difference between the full and null model, χ^2 (5) = 57.61, p < .001. As in Study 1, there was both a main effect of severity (χ^2 (2) = 49.84, p < .001) and framing (χ^2 (2) = 10.22, p = .006). In both the high severity and other-oriented framing conditions, children showed higher positive difference scores, rating the follower more positively and the violator more negatively, whereas in the low severity and self-oriented conditions, children had difference scores closer to zero, reflecting more even evaluations of the follower and violator. There was no effect of gender or age, nor an interaction between framing and severity. However, there was an interaction between age and severity: with age, children showed more differential ratings of the follower and violator in the high severity condition, and more equal ratings in the low severity condition, χ^2 (1) = 6.92, p = .009. Overall,

the primary effects of Study 1 replicated, with children showing higher ratings of the follower's action and lower ratings of the violator's action when the behavior prevents harm or protects others, and children showing more similar ratings of the followers' and violators' actions when the behavior prevents inconvenience or protects the self.

Friendship Quality. We constructed a linear mixed model to examine whether severity or framing predicted differences in children's rating of how good or bad of a friend they view the violator and the follower, using the difference score for this measure as the continuous outcome variable (Figure 3C). There was a significant difference between the full and null model, χ^2 (5) = 33.44, $p < .001$. As in Study 1, we found main effects of severity (χ^2 (2) = 24.74, $p < .001$) and of framing (χ^2 (2) = 9.63, $p = .008$). In both the high severity and other-oriented framing conditions, children showed higher positive difference scores, rating the follower as a better friend and the violator as a worse friend, whereas in the low severity and self-oriented conditions, children had difference scores closer to zero, reflecting more even evaluations of the follower's and violator's friendship quality. Unlike in Study 1, there was no effect of gender. There were also no effects of age or an interaction between framing and severity. Thus, the primary effects of Study 1 replicated, with children rating the followers as better friends and the violators as worse friends when the protective behaviors prevented greater over minor harm and when it protected others over the self. The same pattern can be seen in both the difference score measures, suggesting that children judge the violator and follower aliens similarly on multiple social-moral dimensions.

Friend Choice. The binary measure of which alien is a better friend mirrored the effects found using the difference score measure (Figure 2D). After constructing a generalized linear mixed model, the full model significantly differed from the null model, X^2 (5) = 53.52, $p < .001$. As in Study 1, there was a main effect of severity (X^2 (2) = 41.12, $p < .001$) and framing (X^2 (2) =

7.84, $p = .020$), with stronger evidence for framing than in Study 1 and an overall similar pattern of results. An overwhelming majority of children chose the follower as the better friend in both the high severity and other-oriented conditions, whereas just over half of the children chose the follower in the low severity and self-oriented conditions. There was also a marginal main effect of gender ($X^2 (1) = 3.78$, $p = .052$)—as in Study 1, girls preferred the follower overall. One effect that emerged in Study 2 that was not seen in Study 1 was an effect of age: in this sample, younger children showed a preference for the follower across conditions, whereas older children showed a preference for the violator, $X^2 (1) = 4.39$, $p = .036$. This may be explained by older children being more willing to choose the violator as a better friend in the low severity and other-directed conditions than younger children, who may be less willing to choose the violator as a better friend regardless of context. Overall, we see the main effects from Study 1 replicate, and see stronger evidence that framing protective behaviors as other-oriented yields higher rates of children choosing the follower as the better friend.

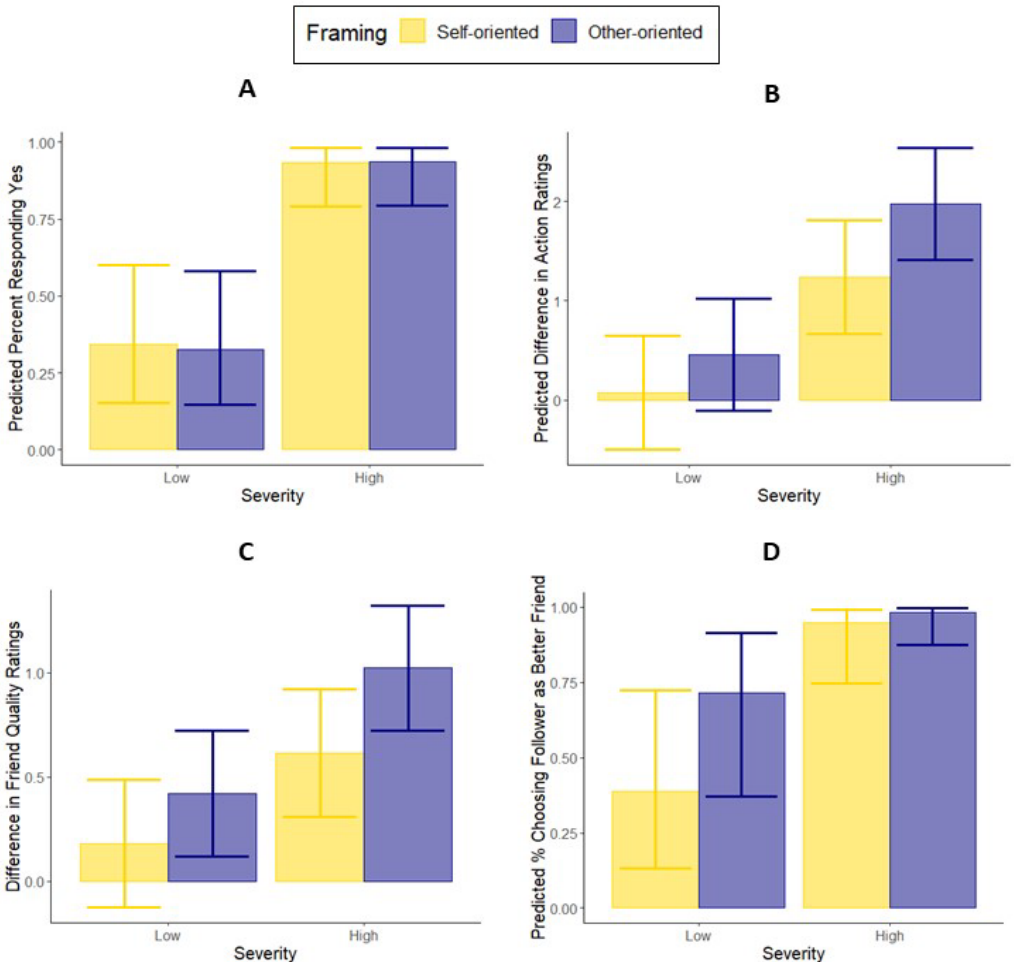


Figure 3.3. Bar charts of model predicted values for Study 2a by Framing (Self-oriented vs. Other-oriented) and Severity (Low vs. High). The dependent variables are *Endorsement* (Fig. 3A), *Action* (Fig. 3B), *Friendship Quality* (Fig. 3C), and *Better Friend Choice* (Fig. 3D). Error bars represent 95% confidence intervals. Note that the y-axis for Figures B and C are difference scores calculated by subtracting the violator rating from the follower rating.

In summary, all the primary effects found in Study 1 replicated in our larger sample, suggesting that those effects are indeed robust and not Type 1 errors. We demonstrate even stronger evidence that children readily endorse protective behaviors as long as they prevent harm, but do not differentially endorse protective behaviors when they are framed as self-oriented versus other-oriented. We find that framing protective behaviors as other-oriented produces more moral thinking, with children showing more positive socio-moral evaluations of followers over violators. For a visual summary of the results found across Study 1 and Study 2a, see Table 2.

Table 3.2. S*ummary of results from Studies 1 and 2a, broken down by dependent variable and listing all significant effects.*

Dependent Variable	Study 1	Study 2a
Endorsement	• Severity • Age X Severity	• Severity
Action Rating	• Framing • Severity • Gender	• Framing • Severity • Age X Severity
Friendship Quality Rating	• Framing • Severity • Gender	• Framing • Severity
Friend Choice	• Severity • Gender	• Framing • Severity • Age
Smartness Rating	• Severity • Gender	
Smarter Alien Choice	• Severity	

Study 2b

The aims of Study 2b were to further investigate how other-oriented framing induces socio-moral reasoning. We hypothesized that children would rate violators less positively and as worse friends when violations were committed intentionally in the high severity condition. Violators who intentionally fail to protect others will be judged as more wrong than those who intend to protect others but forget, especially when there is a potential for harm. Studying 5- to 10-year-olds enabled us to investigate possible changes in children's moral judgements, so we included age as an exploratory variable to further investigate. Since intention-based reasoning is a critical aspect of children's developing moral judgment (Killen & Smetana, 2015), our central focus was whether intentionality and the severity of harm would influence children's moral evaluations of those who do not follow other-oriented framed protective measures.

Methods

Participants

Study 2b was run directly after Study 2a with the same children. One child dropped out of Study 2a early and thus did not complete Study 2b; thus, the final sample for Study 2b was *N* = 60. There were equal numbers of children across three age groups (5-6, 7-8, 9-10), i.e., 20 participants per age group.

Stimuli

Study 2b used the same type of stimuli as the Study 2a and builds off of the stories presented to children. One of the four types of aliens (i.e., Furpees, Blickets, Zibs, and Ollers) corresponded to each severity condition (i.e., one high severity and one low severity alien). An example would be the Furpees with their spikes would poke and hurt others (high severity). Within each alien type, participants saw two different colored aliens representing the intention conditions. Thus, the participant could see a green Furpee who accidentally forgot to do the target behavior (accidental) and a yellow Furpee who decided not to do the target behavior on purpose (intentional).

Design

We employed a 2x2 design with the variables severity (high vs. low) and intention (intentional vs. accidental) tested within subjects. Therefore, each child saw four different aliens representing the four different combinations of manipulations (high severity intentional, high severity accidental, low severity intentional, low severity accidental). We counterbalanced the order and combinations of the conditions and the aliens, to create 16 unique sequences that were randomly assigned to children within each of three age-groups (5-6, 7-8, 9-10) created for counterbalancing purposes.

Procedure

Participants from Study 2a then immediately participated in Study 2b. We re-introduced children to a specific alien type (e.g. Furpees with spikes) that was assigned to either the high severity or low severity condition in Study 2a. Two comprehension check questions were included to ensure the children remembered the severity manipulation and the discomfort of the behavior from Study 2a. Children were then told a story about either the intentional or accidental alien. Following the introduction of the alien, we asked a manipulation check question to assess whether children understood the intention. We employed the same method of evaluating failed comprehension or manipulation checks as in Study 1. Of the 300 trials (5 per child, 60 children), twelve trials were excluded due to a failed comprehension or manipulation check (4%). Following each vignette, we asked several questions about each vignette (see Appendix A for a walkthrough of the vignettes and images shown to children). Once children finished answering questions for all four aliens, the study concluded, and participants' parents were emailed a debriefing letter and the Amazon gift code.

Dependent Measures

To measure children's moral judgments of the violator, following the story of the accidental/intentional alien, children evaluated the morality of the intentional and accidental aliens' actions (*Morality Rating*) on a 5-point Likert scale (really right, a little right, just OK, a little wrong, really wrong). Then, to measure how children perceive the violator as a friend, children indicated for both the intentional and accidental alien how good or bad of a friend the alien is (*Friendship Quality*) on a 4-point Likert scale (very good, a little good, a little bad, very bad). Following the friendship rating, children were asked to choose, between the accidental and intentional alien, which they rather prefer as a friend (*Friend Choice*).

Analysis

Our analysis approach was similar to in Study 1. We used generalized linear mixed models for the binary dependent variable (*Friend Choice*), and linear mixed effects models for the two continuous dependent variables (*Morality Rating* and *Friendship Quality*). For each model, the fixed effects were trial, gender, age, intention, severity, and the interaction between intention and severity. Subject ID was included as a random effect to account for within-subjects testing. Age and gender were pre-registered as exploratory analyses (Study2b: https://aspredicted.org/NVJ_7XN). The regression table for the final models can be found in Appendix A.

Results

Morality Rating

We built a linear mixed model to examine how children morally evaluate the violator's action. There was a significant difference between the full and null model, $\chi^2(5) = 82.61$, $p < .001$. There was both a main effect of severity ($\chi^2(2) = 16.89$, $p < .001$) and intention ($\chi^2(2) = 70.45$, $p < .001$). Children rated intentional violators and high severity violators as more morally wrong. There was a significant effect of the intention and severity interaction, $\chi^2(1) = 9.42$, $p = .002$. In high harm situations, children rated intentional norm-violators as more wrong (Figure 4A). There was a significant interaction between age and severity, $\chi^2(1) = 4.42$ $p = 0.035$. In the high severity condition, older children tended to rate all transgressors more neutrally compared to younger children. In the low severity conditions, across all ages, children tended to rate all transgressors as a little bit wrong. There was no effect of gender. However, there was a marginal main effect of age, $\chi^2(1) = 3.59$ $p = .058$, with a trend of younger children rating all transgressors as slightly worse compared to older children (Figure 4B). These differences were most apparent in the high severity and intentional condition, but amongst the rest of the conditions, children

across all ages tended to rate all violators' actions as more neutral. Overall, both intention and severity appear to be important for children's rating of the alien's actions as good or bad.

Friendship Quality

We constructed a linear mixed model to examine whether severity or intention predicted differences in children's rating of how good or bad of a friend they view the violators. There was a significant difference between the full and null model, χ^2 (5) = 60.73, $p < .001$. We found main effects of severity (χ^2 (2) = 11.36, $p = .003$) and of intention (χ^2 (2) = 54.98, $p < .001$). In both the high severity and intentional conditions, children rated the violators as worse friends (Figure 4C). There was a marginal interaction effect of severity and intention, χ^2 (1) = 3.72, $p = .054$. Children tended to rate intentional violators as worse friends than accidental violators, especially when the behavior prevents severe harm. There was no significant effect of the children's age or gender on their friendship ratings.

Friend Choice

Overall, children were more likely to choose the accidental violator ($M = 0.86$, $SD = 0.35$) as a friend, t (107) = 10.80, $p < .001$. We created a generalized linear mixed model to determine whether severity impacted children's choice of the accidental or intentional friend. Results showed a significant difference between the full model and the null model, χ^2 (3)=10.86, $p = 0.013$. There was a main effect of severity, such that children were less likely to choose the intentional violator as a friend (χ^2 (1) = 7.78, $p = .005$) when the behavior prevents severe harm to others (Figure 4D). There was no significant effect of the children's age or gender on their choice of friend.

A visual summary of the effects found in Study 2 can be found in Table 3.

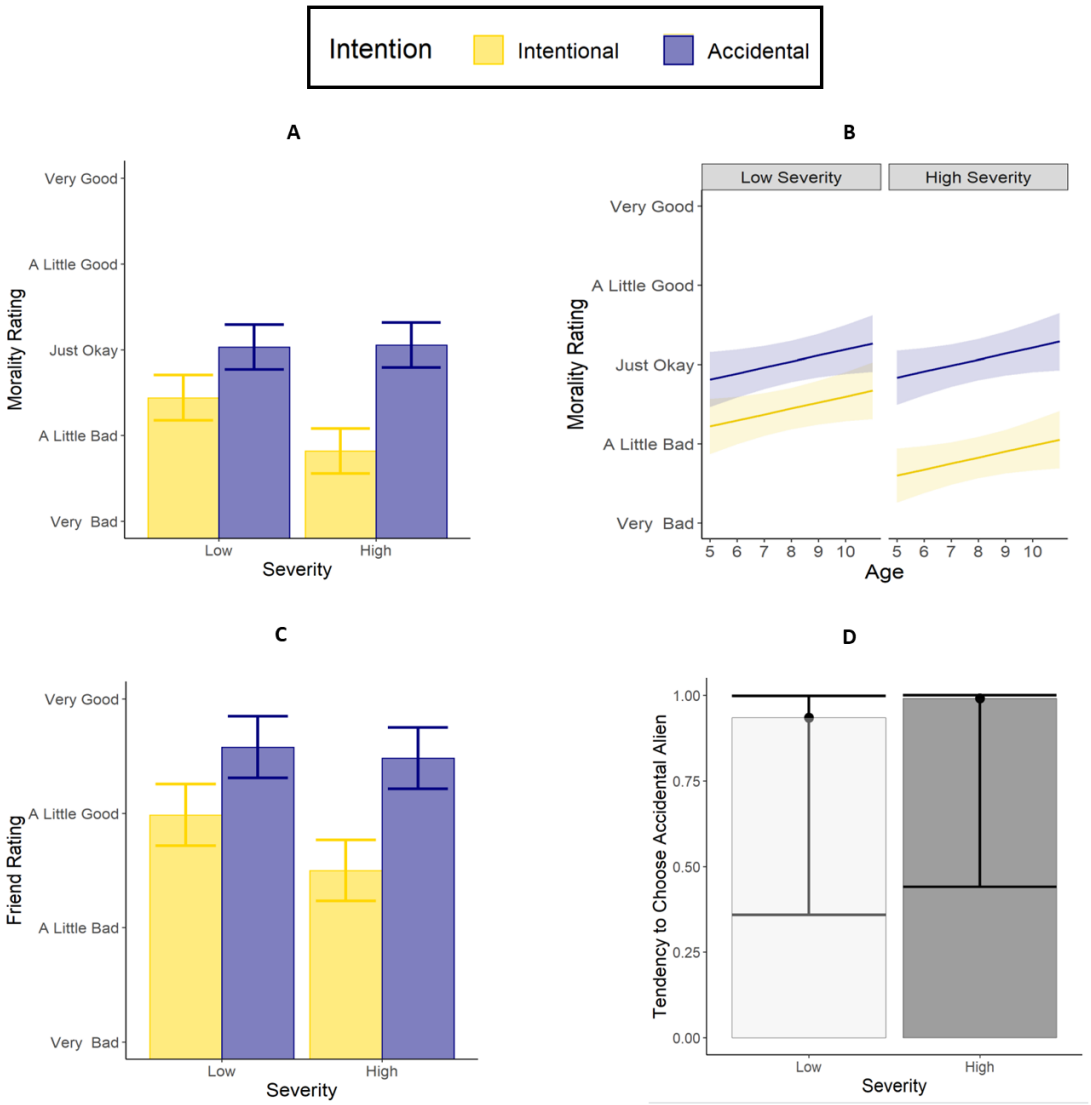


Figure 3.4. Charts of model predicted values for each of the Study 2b dependent variables. Error bars represent 95% confidence intervals.

Table 3.3. S*ummary of results from Study 2b, broken down by dependent variable and listing all significant effects.*

Dependent Variable	Study 2b
Morality Rating	• Intention • Severity • Intention X Severity • Age X Severity
Friendship Quality Rating	• Intention • Severity
Friend Choice	• Intention • Severity

Discussion

The aim of Study 2b was to examine how intention and severity of harm impact children's social-moral evaluations of those who do not follow novel protective measures. Overall, children tended to rate the violators neutrally and saw them as at least good friends regardless of their behaviors. However, children rated the intentional violator's actions more negatively than accidental transgressions when the behavior could have prevented severe harm. In terms of children's evaluations of the violators as friends, children rated violators in low severity and accidental conditions as better friends. Altogether, children tended to evaluate most violators as good friends. Since there was an apparent ceiling effect for the friend rating question, this rating scale contained limitations in finding potential differences between variables because of the lack of variance. In the forced choice friend question, children in high severity situations preferred the accidental aliens over intentional aliens as friends. Similar to prior work on moral transgressions, children appear to be aware of the circumstances surrounding a transgression (i.e., the intention of the actions, the severity of harm caused) (Grueneich, 1982).

When analyzing children's evaluations, children rated intentional violators and high severity violators as more morally wrong and worse friends. Thus, children as young as five years old are attending to intention in their moral judgements. Recent research suggests that four year old children considered intention in their evaluations, but still less so than older children's judgments that closely resembled adults (Nobes et al., 2017). Although, our paradigm required verbal communication from the children to communicate their evaluations, there has been an increasingly number of studies researching intention using non-verbal responses, suggesting that children younger than 4-years-old could be sensitive to intention in their evaluations of others (Hamlin et al., 2013, Behne et al., 2005, Kuhlmeier, et al., 2003). When manipulating, the simplicity of the task, Margoni and Surian found 3-year-olds were successful in expressing intent-based judgment (2020). Children's sensitivity to intention on tasks can be more poignant on tasks with reduced processing demands. Considering this evidence, the trend of children's use of intention in their judgments may occur earlier than previously studied but could be limited by the cognitive ability needed to complete morality tasks.

Children's judgments may be mediated by how harmful the moral transgression of spreading illnesses is believed. Accordingly, our evidence illustrates that when there was no harm caused, children were more likely to judge both the accidental and intentional violators' actions as okay. For this reason, how harmful children view an illness could impact how severely they evaluate those who do not follow preventative health measures. Our finding that intention and severity impact children's social-moral evaluations, has implications for children's judgments and their adherence to public health rules. When wearing protective measures is framed as preventing harm to others, children prefer being friends with someone who at least intends to follow protective measures and tries to protect others from harm. Therefore, framing

public health measures in terms of being a good friend and protecting others could be an effective way in children's adherence to public health measures.

In summary, children consider both the amount of harm caused and the intent of the action when they are asked to evaluate transgressors morally and whom they would choose as friends. Children see those who refuse high severity protective measures on purpose as more morally wrong and as worse friends.

General Discussion

Our findings suggest that framing novel protective behaviors as self- versus other-oriented impacts children's moral reasoning but does not impact children's explicit endorsement of these behaviors. Namely, when novel protective behaviors are framed as other-oriented, children show evidence of moral reasoning by a) rating violators more negatively and followers more positively on sociomoral measures, and b) showing sensitivity to the intention of violators. These results therefore show that focusing on the prosocial aspects of an act helps activate children's moral reasoning. Other-oriented frames tend to emphasize the harm done to others, and as such children may adopt a moral lens when situations are framed in such a way.

In addition to the effect of framing, the severity of harm that the protective behavior would prevent was important to children, having a large effect on all of our variables. When protective behaviors prevent more severe harm, children readily endorse them and rate violators more negatively and followers more positively. This is not the case when the behaviors only prevent a minor inconvenience.

Our findings on severity and framing were robust, remaining consistent across two studies. Additionally, Study 2b expanded these findings by demonstrating that in the other-oriented condition, children reason about intentionality in morality-based ways. This provides

further evidence that other-oriented frames induce moral-thinking, and that this moral-thinking looks similar to other instances of moral reasoning that have been studied in the past.

To our knowledge, this is the first set of studies to explore the effect of framing on children's reasoning about novel public health measures. Our results extend the findings from the adult literature. Similar to Luttrell and Petty (2021) with adults, we found other-oriented frames to be more impactful than self-oriented frames when it comes to children's moralization of novel public health measures. This may suggest that the mechanism leading to this moralization in adults may already be present in middle childhood.

While some of the adult literature suggests framing protective measures as other-oriented is influential in decisions about these measures (e.g., Ceylan & Haran, 2021; Jordan et al., 2020), we did not find an effect of framing on endorsement. One possible explanation is that the harm is less ambiguous in our study than in the adult studies directly addressing COVID-19 prevention measures. In our study, the level of severity was manipulated and clearly communicated, whereas in the COVID-19 studies, participants may have interpreted the severity of the pandemic differently. In our high severity condition, children showed nearly ceiling levels of endorsement, so it may be that when severe harm is apparent, this overrides the effect of framing. This hypothesis is further supported by the fact that Jordan et al. (2020) did not find this framing effect in their studies taking place later in the pandemic, when participants likely had a better understanding of the severity of the pandemic.

Our studies have implications both for the literature on children's morality, as well as for public policy. First, our findings suggest that manipulating framing to focus on the effects of an action for others can induce moral reasoning in children. This indicates context specificity in children's moral thinking, such that a simple manipulation of focus can affect whether moral

thinking is activated. Moreover, children's sensitivity to intentionality–well established in other domains of moral research–extends to our novel public health context.

While our study did not directly ask participants about COVID-19 protective measures, our results suggest some potential implications for effectively communicating novel protective measures to children. First, emphasizing the severity of the prevented harm is crucial. Children both endorse and moralize novel public health measures when the measures prevent harm rather than inconvenience. Emphasizing the consequences for others, rather than the self, also has moralizing effects. Thinking of the measures in moral terms may lead children to value compliance with said measures more–thus, both emphasizing the severity of harm as well as the effects for others are promising ways to communicate novel protective measures to children.

Our study had a few limitations that could be addressed with future research. First, we chose to use hypothetical rather than real-world situations as we wanted to get an unbiased look at children's evaluations that did not depend on their preexisting ideas about COVID-19 measures. This decision allowed us to examine children's reasoning under ideal and controlled circumstances but limits our ability to predict how children might react in real-world contexts such as the COVID-19 pandemic. Additionally, our sample demographics were not representative of the larger US context. Children's demographics, such as their parents' political ideation or the voting behavior of the county they live in impact their views on COVID-19 protective measures (Gollwitzer et al., 2022), so it is possible that children from different backgrounds might respond differently in our paradigm. Our data suggested there may also be some gender-related differences as well, though more research is needed on that front as most of our gender differences did not replicate from Study 1 to Study 2a. Finally, we did not power our

studies specifically to look for age effects, so it is possible that we were underpowered to detect more complex interactions with age.

The findings of our study offer opportunities for future research. First, future studies could assess how children reason about other types of harm, such as psychological harm or disease transmission, that are more causally opaque than physical harm. Prior research shows that harming others is a particularly salient moral violation for children (e.g., Smetana & Ball, 2019). We chose to use physical harm in our paradigm for this reason: so that we could examine whether an effect would be present in obvious instances of harm. However, paradigms in which the harm is more vague would map more closely onto real-world contexts such as the COVID-19 pandemic.

Additionally, future research can recruit more diverse samples and examine whether there are any effects of political or demographic background on these hypothetical situations. By doing so, researchers could address whether any observed effects based on sociodemographic factors is due to explicit communication about COVID-19 protective measures or because of differences in reasoning based on ideology or context.

Finally, while our study focused on one type of framing as self- versus other-oriented, future research could examine how other types of framing could impact these behaviors. A well-known area of framing research is gain-loss framing, such as the Tversky and Kahneman (1981) study in which participants saw language describing the number of people who were saved versus people who died. A recent study employed gain-loss framing, along with additional contextual manipulations, on adults' willingness to take the COVID-19 vaccine (Huang & Liu, 2022). Future research can examine the effects of gain-loss framing on children's COVID-19

protective behaviors as well, such as by emphasizing the risk of not performing the behaviors versus the protection offered by the behaviors.

Our studies were the first to examine children's evaluations of novel protective behaviors similar to those introduced by the COVID-19 pandemic. Our findings expand on the adult literature looking at other- and self-oriented frames for novel protective behaviors by demonstrating that children consider these frames in their social-moral evaluations but not in their endorsements of the behaviors. Specifically, children reason in moral terms when novel protective behaviors are framed as other-oriented rather than self-oriented. We also found that children show higher levels of endorsement in addition to moral thinking when the severity of harm prevented by novel public health measures is high. Overall, the findings from the present set of studies help shed some light on how children reason about novel public health measures, which can help to inform communications with children should novel public health measures be introduced again in the future.

References

Bates, D., Mächler, M., Bolker, B., Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software, 67(1*), 1–48. Doi: 10.18637/jss.v067.i01.

Behne, T., Carpenter, M., Call, J., & Tomasello, M. (2005). Unwilling Versus Unable: Infants' Understanding of Intentional Action*. Developmental Psychology, 41(2),* 328–337. https://doi.org/10.1037/0012-1649.41.2.328

Bray, L., Blake, L., Protheroe, J., Nafria, B., de Avila, M. A. G., Ångström-Brännström, C., … Carter, B. (2021). Children's pictures of COVID-19 and measures to mitigate its spread: An international qualitative study*. Health Education Journal, 80(7*), 811–832. https://doi.org/10.1177/00178969211019459

Ceylan, M., & Hayran, C. (2021). Message Framing Effects on Individuals' Social Distancing and Helping Behavior During the COVID-19 Pandemic. *Frontiers in Psychology, 12(March),* 1–14. https://doi.org/10.3389/fpsyg.2021.579164

Chong, D., & Druckman, J. N. (2007). Framing theory. *Annual Review of Political Science, 10,* 103–126. https://doi.org/10.1146/annurev.polisci.10.072805.103054

Costanzo, P. R., Coie, J. D., Grumet, J. F., & Farnill, D. (1973). A Reexamination of the Effects of Intent and Consequence on Children's Moral Judgments. *Child Development, 44(1),* 154–161.

Cushman, F., Sheketoff, R., Wharton, S., & Carey, S. (2013). The development of intent-based moral judgment*. Cognition, 127(1),* 6–21. https://doi.org/10.1016/j.cognition.2012.11.008

Donovan, C., Rose, C., Lewis, K. N., Vang, K., Stanley, N., Motley, M., … Cima, M. (2022). Morbidity and Mortality Weekly Report. *Morbidity and Mortality Weekly Report, 71,* 384–389. https://doi.org/http://dx.doi.org/10.15585/mmwr.mm7110e1

Forstmeier, W., & Schielzeth, H. (2011). Cryptic multiple hypotheses testing in linear models: Overestimated effect sizes and the winner's curse. *Behavioral Ecology and Sociobiology, 65(1),* 47–55. https://doi.org/10.1007/s00265-010-1038-5

Fu, G., Heyman, G. D., Chen, G., Liu, P., & Lee, K. (2015). Children trust people who lie to benefit others. *Journal of Experimental Child Psychology, 129,* 127–139. https://doi-org.proxy.lib.umich.edu/10.1016/j.jecp.2014.09.006

Gandhi, M., Beyrer, C., & Goosby, E. (2020). Masks Do More Than Protect Others During COVID-19: Reducing the Inoculum of SARS-CoV-2 to Protect the Wearer. *Journal of General Internal Medicine, 35(10),* 3063–3066. https://doi.org/10.1007/s11606-020-06067-8

Gillman, A. S., Iles, I. A., Klein, W. M. P., & Ferrer, R. A. (2022). Increasing Receptivity to COVID-19 Public Health Messages with Self-Affirmation and Self vs. Other Framing. *Health Communication, 00(00),* 1–12. https://doi.org/10.1080/10410236.2022.2043024

Gollwitzer, A., Marshall, J., Lee, Y., Deutchman, P., Warneken, F., & McAuliffe, K. (n.d.). Parent and Community Political Partisanship Predict Children's Preventative COVID-19 Responding. *Under Review.*

Grant, A. M., & Hofmann, D. A. (2011). It's not all about me: Motivating hand hygiene among health care professionals by focusing on patients. *Psychological Science, 22(12),* 1494–1499. https://doi.org/10.1177/0956797611419172

Greene, J. (2014). Moral tribes: Emotion, reason, and the gap between us and them. Penguin.

Grueneich, R. (1982). The Development of Children ' s Integration Rules for Making Moral Judgments. *Child Development, 53(4),* 887–894.

Hamlin, J. K. (2013). Moral Judgment and Action in Preverbal Infants and Toddlers: Evidence for an Innate Moral Core. *Current Directions in Psychological Science, 22(3),* 186–193. https://doi.org/10.1177/0963721412470687

Hebble, P. W. (1971). The Development of Elementary School Children ' s Judgment of Intent. Child Development, 42(4), 1203–1215.

Heyman, G. D., Chiu Loke, I., & Lee, K. (2016). Children spontaneously police adults' transgressions. *Journal of Experimental Child Psychology, 150*, 155–164. https://doi.org/10.1016/j.jecp.2016.05.012

Howe, M. M., Feldman, E. C. H., Lampert, S. L., Kenney, A. E., Davies, W. H., & Greenley, R. N. (2021). Caregiver Perceptions of Importance of COVID-19 Preventative Health Guidelines and Difficulty Following Guidelines Are Associated With Child Adherence Rates. *Families, Systems and Health, 39(4),* 632–637. https://doi.org/10.1037/fsh0000641

Huang, Y., & Liu, W. (2022). Promoting COVID-19 Vaccination: The Interplay of Message Framing, Psychological Uncertainty, and Public Agency as a Message Source. *Science Communication, 44(1)*, 3–29. https://doi.org/10.1177/10755470211048192

Jordan, J. J., Yoeli, E., & Rand, D. G. (2021). Don't get it or don't spread it: comparing self-interested versus prosocial motivations for COVID-19 prevention behaviors. *Scientific Reports, 11(1)*, 1–17. https://doi.org/10.1038/s41598-021-97617-5

Kahn, P. H. (1992). Children's Obligatory and Discretionary Moral Judgments. *Child Development, 63(2),* 416–430. https://doi.org/10.1111/j.1467-8624.1992.tb01637.x

Killen, M., & Smetana, J. G. (2015). Origins and development of morality. In M. E. Lamb & R. M. Lerner (Eds.), *Handbook of child psychology and developmental science: Socioemotional processes., Vol. 3, 7th ed.* (pp. 701–749). John Wiley & Sons, Inc. https://doi-org.proxy.lib.umich.edu/10.1002/9781118963418.childpsy317

Killen, M., & Smetana, J.G. (Eds.). (2022). *Handbook of Moral Development* (3rd ed.). Routledge. https://doi.org/10.4324/9781003047247

Kuhlmeier, V., Wynn, K., & Bloom, P. (2003). Attribution of Dispositional States by 12-Month-Olds. *Psychological Science, 14(5),* 402–408. https://doi.org/10.1111/1467-9280.01454

Luttrell, A., & Petty, R. E. (2021). Evaluations of Self-Focused Versus Other-Focused Arguments for Social Distancing: An Extension of Moral Matching Effects. *Social Psychological and Personality Science, 12(6)*, 946–954. https://doi.org/10.1177/1948550620947853

Margoni, F., & Surian, L. (2020). Conceptual continuity in the development of intent-based moral judgment. *Journal of Experimental Child Psychology, 194*. doi:10.1016/j.jecp.2020.104812

McAuliffe, K., Raihani, N. J., & Dunham, Y. (2017). Children are sensitive to norms of giving. *Cognition, 167*, 151–159. https://doi.org/10.1016/j.cognition.2017.01.006

Mook, D. G. (1983). In defense of external invalidity. *American Psychologist, 38(4),* 379–387. https://doi.org/10.1037/0003-066X.38.4.379

Nobes, G., Panagiotaki, G., & Engelhardt, P. E. (2017). The development of intention-based morality: The influence of intention salience and recency, negligence, and outcome on children's and adults' judgments. *Developmental Psychology, 53(10),* 1895–1911. https://doi.org/10.1037/dev0000380

Piaget, J. (1932). *The moral judgment of the child.* Harcourt, Brace.

Piaget, J. (1965). *The moral judgment of the child*. Free Press.

Rottman, J., & Kelemen, D. (2012). Aliens behaving badly: Children's acquisition of novel purity-based morals. *Cognition, 124(3),* 356–360. https://doi.org/10.1016/j.cognition.2012.06.001

Sarkadi, A., Sahlin Torp, L., Pérez-Aronsson, A., & Warner, G. (2021). Children's Expressions of Worry during the COVID-19 Pandemic in Sweden. *Journal of Pediatric Psychology, 46(8)*, 939–949. https://doi.org/10.1093/jpepsy/jsab060

Schlottmann, A., & Tring, J. (2005). How children reason about gains and losses: Framing effects in judgement and choice. *Swiss Journal of Psychology, 64(3),* 153–171. https://doi.org/10.1024/1421-0185.64.3.153

Shaikh, A. A., & Likhite, A. (2020). Awareness, Perception and Safety Practices about COVID-19 in School Children of 6-16 Years using COVID-19 Quiz Atiya A Shaikh, Apoorva Likhite. *International Journal of Health Sciences and Research, 10(8),* 42. Retrieved from www.ijhsr.org

Smetana, J. G., & Ball, C. L. (2019). Heterogeneity in children's developing moral judgments about different types of harm. *Developmental Psychology, 55(6),* 1150–1163. https://doi.org/10.1037/dev0000718

Thompson, J., Spencer, G., & Curtis, P. (2021). Children's perspectives and experiences of the COVID-19 pandemic and UK public health measures. *Health Expectations, 24(6),* 2057–2064. https://doi.org/10.1111/hex.13350

Tisak, M. S. (1993). Preschool Children ' s Judgments of Moral and Personal Events Involving Physical Harm and Property Damage. *Merill-Palmer Quarterly, 39(3),* 375–390.

Tversky, A., & Kahneman, D. (1981). The Framing of Decisions and the Psychology of Choice. *Science, 211(4481),* 453–458.

Vaish, A., Missana, M., & Tomasello, M. (2011). Three-year-old children intervene in third-party moral transgressions. *British Journal of Developmental Psychology, 29(1),* 124–130. https://doi.org/10.1348/026151010X532888

Weltzien, S., Marsh, L. E., & Hood, B. (2018). Thinking of me: Self-focus reduces sharing and helping in seven- to eight-year-olds. *PLoS ONE, 13(1),* 1–15. https://doi.org/10.1371/journal.pone.0189752

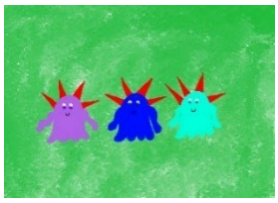
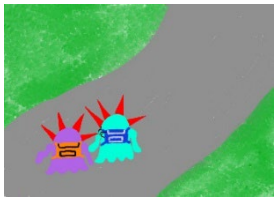
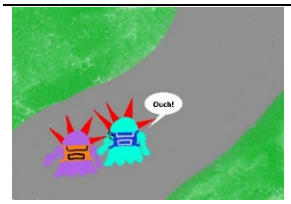
Wyllie, J., Baxter, S., & Kulczynski, A. (2015). Healthy kids: Examining the effect of message framing and polarity on children's attitudes and behavioral intentions. *Journal of Advertising, 44(2),* 140–150. https://doi.org/10.1080/00913367.2015.1018462

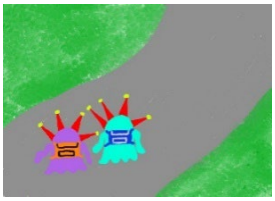
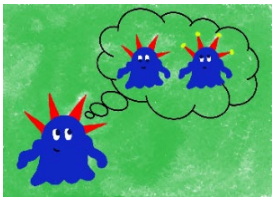
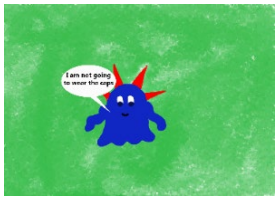
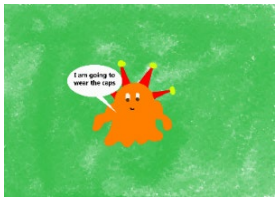
Xue, Q., Xie, X., Liu, Q., Zhou, Y., Zhu, K., Wu, H., … Song, R. (2021). Knowledge, attitudes, and practices towards COVID-19 among primary school students in Hubei Province, China. *Children and Youth Services Review, 120.* https://doi.org/10.1016/j.childyouth.2020.105735

Yuill, N., & Perner, J. (1988). Intentionality and Knowledge in Children's Judgments of Actor's Responsibility and Recipient's Emotional Reaction. *Developmental Psychology, 24(3),* 358–365. https://doi.org/10.1037/0012-1649.24.3.358

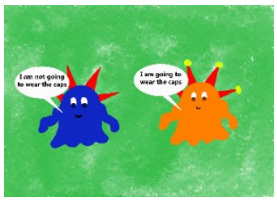
Appendix A: Supplemental Material for Chapter 3

Table 3.A1. Visual and narrative stimuli and dependent measures as presented to participants in Study 1 and Study 2a, using the Furpee alien and the Other-oriented, High severity condition as an example. Alien type and order of conditions are counterbalanced between subjects.

Image	Narrative	Dependent Measure *Question* & [answer format]
	On the planet of Toma, there is an alien called a Furpee. The Furpees have red spikes on their bodies.	
	Sometimes the Furpees' spikes poke other Furpees. This purple Furpee poked the blue Furpee with their spikes when walking to school.	
	Ouch! The blue Furpee is hurt because the spikes are sharp and pokey. The purple Furpee is not hurt, but the blue Furpee is hurt.	**Manipulation Checks** *Who does the Furpee poke?* [themselves/other Furpees] *Does it hurt when the Furpee pokes other Furpees?* [yes/no]
	The Furpees can cover up their spikes with caps so that they don't poke other Furpees. These caps are really heavy. That makes the Furpee feel uncomfortable and sore. This Furpee covered up their spikes with caps.	**Comprehension Check** *How do you think they feel?* [comfortable/uncomfortable]
	They say the caps on their spikes make them feel uncomfortable and sore.	

	When the Furpee covers up their spikes, they don't poke other Furpees anymore. This purple Furpee covered up their spikes with caps, so now they don't poke the blue Furpee anymore when walking to school. The purple Furpee feels uncomfortable, but now the blue Furpee doesn't get poked.	
	This blue Furpee is getting ready to walk to school and deciding what to do. On the one hand, covering up their spikes with caps keeps them from poking other Furpees. On the other hand, they really don't like wearing the caps.	**Endorsement:** *What do you think? Should the Furpee cover up their spikes with caps?* [yes/no] *Why?**
	This blue Furpee decided to NOT wear the caps.	**Rating of Aliens' Action***: Do you think what the blue Furpee did was good, bad, or just OK?* [If good/bad] *Was it a little good/bad, or very good/bad?* **Rating of Aliens' Friendship Quality:** *Do you think the blue Furpee is a good or bad friend? A little good/bad, or very good/bad?* **Rating of Aliens' Smartness:** *Do you think the blue Furpee is smart or not smart? A little smart/not smart, or very smart/not smart?**
	This orange Furpee decided to wear the caps.	**Rating of Aliens' Action***: Do you think what the orange Furpee did was good, bad, or just OK?* [If good/bad] *Was it a little good/bad, or very good/bad?* **Rating of Aliens' Friendship Quality:** *Do you think the orange Furpee is a good or bad friend? A little good/bad, or very good/bad?*

Rating of Aliens' Smartness: *Do you think the orange Furpee is smart or not smart? A little smart/not smart, or very smart/not smart?**

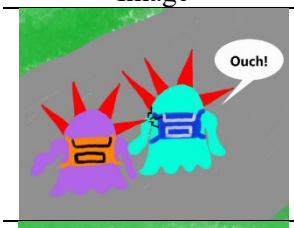
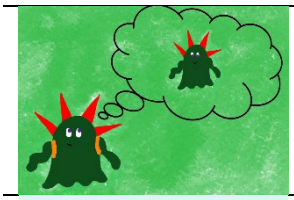
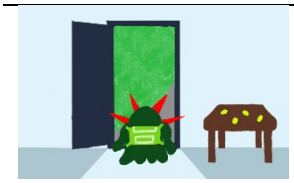
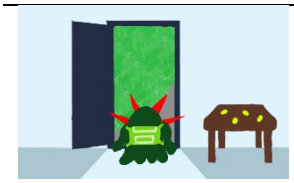


Friend Choice: *Which of the two Furpees would you rather be friends with?* [Blue/Orange]

Smarter Choice*: Which of the two Furpees is smarter?* [Blue/Orange]*

*****Denotes questions that were asked in Study 1 but dropped for Study 2a

Table 3.A2. Visual and narrative stimuli and dependent measures as presented to participants in Study 2b, using the Furpee alien and the other-oriented, high severity condition as an example. Alien type and order of conditions are counterbalanced between subjects.

Image	Narrative	Measures
	Remember the Furpees? These are the aliens with the pokey spikes on their bodies that hurt other Furpees.	**Comprehension Check 1** *When this Furpee is not wearing caps, who does the Furpee poke?* [theirself / other Furpees]
	They can cover up their spikes with caps then they don't hurt other Furpees but the caps are heavy and make them feel uncomfortable.	**Comprehension Check 2** *Does it hurt when the Furpee pokes other Furpees?* [yes, no]
	Intention: Intentional	
	This green Furpee decided to not wear the caps.	
	The green Furpee was in a rush getting ready to go to school. The green Furpee chose not to wear the caps then walked out of the door leaving the caps on the table.	
		**Manipulation Check** *Did the green Furpee decide to not wear the caps on purpose, or did the green Furpee forget to put the caps on by accident?* [on purpose, by accident]
		**Morality Rating** *Do you think the green Furpee did something that was right or wrong or just okay?* [really wrong, a little wrong, just okay, a little right, really right] **Friend Rating**

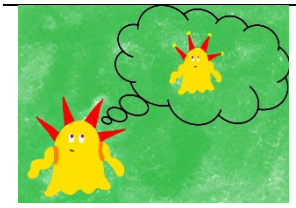
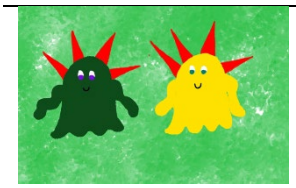
		Is the Green Furpee a good or bad friend? [really bad, a little bad, a little good, really good]
	Intention: Accidental	
	This yellow Furpee decided to wear the caps.	
	This yellow Furpee was in a rush getting ready to go to school. The yellow Furpee forgot about putting the caps on then walked out of the door leaving the caps on the table.	
		**Manipulation Check** *Did the yellow Furpee decide to not wear the caps on purpose, or did the yellow Furpee forget to put the caps on by accident?* [on purpose, by accident]
		**Morality Rating** *Do you think the yellow Furpee did something that was right or wrong or just okay?* [really wrong, a little wrong, just okay, a little right, really right] **Friend Rating** *Is the yellow Furpee a good or bad friend?* [really bad, a little bad, a little good, really good]
	Remember that this green Furpee decided to not wear the caps on purpose and this yellow Furpee forgot to put the caps on by accident.	**Friend Forced Choice** *Would you rather be friends with the green Furpee or yellow Furpee?* [green Furpee, yellow Furpee]

Table 3.A3. Estimates and standard errors (s.e.) of fixed effects in LMMs/GLMMs for each dependent variable in Study 1. Age is mean-centered. Baselines were set as the following: Framing = Self-Oriented; Severity = Low; Gender = Female. Coding was as follows: Endorsement: 0=no, 1=yes; Friend Choice/Smarter Alien Choice: 0=Violator, 1=Follower

	Endorsement	**Action Rating**	**Friendship Quality**	**Friend Choice**	**Smartness**	**Smarter Choice**
(Intercept)	-2.81 (1.98)	0.43 (0.39)	0.44 (0.25)	0.41 (0.97)	0.33 (0.33)	3.78 (2.41)
Trial	-0.40 (0.41)	-0.05 (0.09)	-0.09 (0.06)	-0.28 (0.25)	-0.05 (0.07)	-0.88 (0.43)*
Framing	1.25 (0.92)	0.61 (0.22)**	0.85 (0.15)***	1.40 (0.60)*	0.42 (0.19)*	0.44 (0.83)
Severity	11.54 (3.24)***	1.77 (0.22)***	0.78 (0.15)***	4.02 (0.78)***	1.44 (0.19)***	5.39 (1.34)***
Severity*Age	4.20 (1.56)**					
Gender		-1.17 (0.40)**	-0.51 (0.25)*	-2.21 (0.96)*	-0.82 (0.35)*	
Log Likelihood	-63.12	-326.91	-258.14	-71.17	-299.11	-62.79
Num. obs.	177	177	177	177	177	177
Num. groups: subject	48	48	48	48	48	48
Var: subject (Intercept)	121.40	1.50	0.51	5.50	1.11	38.80
Var: Residual		1.55	0.74		1.11	

Table 3.A4. Estimates and standard errors (s.e.) of fixed effects in LMMs/GLMMs for each dependent variable in Study 2a. Age is mean-centered. Baselines were set as the following: Framing = Self-Oriented; Severity = Low; Gender = Female. Coding was as follows: Endorsement: 0=no, 1=yes; Friend Choice/Smarter Alien Choice: 0=Violator, 1=Follower

	Endorsement	**Action Rating**	**Friendship Quality**	**Friend Choice**
(Intercept)	-0.61 (0.60)	0.03 (0.29)	0.23 (0.16)	0.65 (0.93)
Trial	0.06 (0.18)	0.02 (0.08)	-0.03 (0.05)	0.28 (0.21)
Framing	-0.03 (0.39)	0.56 (0.18)**	0.31 (0.10)**	1.30 (0.50)**
Severity	3.40 (0.59)***	1.34 (0.18)***	0.53 (0.10)***	3.26 (0.72)***
Age	-0.45 (0.22)*	-0.16 (0.11)		-0.56 (0.30)
Severity*Age	0.53 (0.27)	0.28 (0.11)**		
Gender				-1.77 (0.99)
Log Likelihood	-111.96	-445.32	-312.89	-95.70
Num. obs.	233	233	233	233
Num. groups: subject	61	61	61	61
Var: subject (Intercept)	3.70	1.26	0.30	7.79
Var: Residual		1.86	0.63	

Table 3.A5. Estimates and standard errors (s.e.) of fixed effects in LMMs/GLMMs for each dependent variable in Study 2b. Age is mean-centered. Baselines were set as the following: Framing = Self-Oriented; Severity = Low; Gender = Female. Coding was as follows: Endorsement: 0=no, 1=yes; Friend Choice/Smarter Alien Choice: 0=Violator, 1=Follower

	Morality Rating	**Friendship Rating**	**Friend Choice**
(Intercept)	2.56 (0.19)***	2.83 (0.19)***	10.07 (4.11)*
Trial	-0.02 (0.11)	0.12 (0.10)	-0.67 (2.39)
Age	0.15 (0.05)**		
Severity	-0.61 (0.15)***	-0.48 (0.15)***	8.49 (1.38)***
Intention	0.59 (0.15)***	0.59 (0.14)***	
Age*Severity	-0.14 (0.06)*		
Severity*Intention	0.64 (0.21)**	0.39 (0.20)	
Log Likelihood	-273.31	-269.72	-32.93
Num. obs.	218	218	108
Num. groups: subject	60	60	60
Var: subject (Intercept)	0.12	0.14	372.03
Var: Residual	0.58	0.56	

***p < 0.001; **p < 0.01; *p < 0.05

Chapter 4
Children's Socio-Moral Reasoning about Vaccine-Like Behaviors

(Probst & Warneken, Submitted for publication)

Vaccination is an important tool to prevent transmission of illness. Most recently, vaccines have been a major factor in combating the COVID-19 pandemic in the US and other parts of the world. However, since the pandemic, uptake of the COVID-19 vaccine in the United States has been stalled—only 17% percent of eligible people have received the most recent booster shot (CDC, 2024a). Low uptake results in more transmission of the disease, more strain on healthcare resources, and a higher mortality rate (Hoxha et al., 2023). COVID-19 vaccination is particularly low among children, with only 7.5% of children in the United States currently up to date with the vaccine (CDC, 2024b).

Research shows that in adults, public health messages that emphasize consequences for other people can increase uptake (e.g., Ceylan and Hayran, 2021; Jordan et al., 2021). Beyond this, responses to public-health measures can impact people's perceptions of others: COVID-19 measures such as masking and vaccination contributed to political polarization across the United States, and people who moralize these measures condemn those who disagree with them and exhibit prejudiced behaviors (Bor et al., 2023). Thus, the messaging surrounding public-health measures can have major effects on adults' decision making and perception of others.

Little attention has focused on the effects of such messaging on children. While children do not have the ability to decide for themselves whether to get vaccinated, a growing movement among parents centers children's bodily autonomy, and some legal scholars push for children to

be able to override their parents' vaccination decisions (Johnson, 2022; Fahlquist, 2023). Moreover, recent work demonstrates that parents take their children's opinion into account when making vaccination decisions, sometimes allowing children to decide independently (Nickerson et al., 2023). As with adults, socio-moral reasoning is an important factor in children's decision-making and perceptions of others from early on in childhood across many contexts (Killen and Smetana, 2023). Thus, it seems plausible that messaging about public-health measures may influence children's own judgment about vaccines, although research in this domain is still outstanding.

Framing, Morality, and Public Health Measures

When considering what kind of messaging proves most effective, it is helpful to introduce the concept of "framing effects". This refers to the process by which people's thinking and decision-making is affected by the way information is presented to them (Chong and Druckman, 2007). While there are many types of framing effects, one type that is particularly relevant to the public-health context is highlighting the effects of a behavior on the self or someone else, referred to here as self-oriented and other-oriented framing, respectively. For example, Grant and Hoffman (2011) posted signs in a hospital emphasizing the benefits of hand-washing for the self or for hospital patients, and they found that healthcare workers washed their hands more when signs reminded them of the benefits for others.

Other-oriented frames are also more effective in a COVID-19 prevention behavior context: people find other-oriented frames more persuasive and exhibit higher prevention intentions early in a pandemic than when exposed to self-oriented frames (Ceylan and Hayran, 2021; Gillman et al., 2022; Jordan et al., 2021). One reason for this effect is that emphasizing the consequences for other people is seen as a moral argument (Luttrell and Petty, 2021). Thus,

when messages tap into people's sense of morality and care for others, they are more compelled to act.

While other-oriented frames tend to be more effective when it comes to prevention behaviors such as masking and social-distancing, the results are more mixed for vaccination. Emphasizing the prosocial effects of vaccination is a key strategy for promoting uptake (Böhm and Betsch, 2022). People who see vaccines as a collective responsibility have higher vaccination intentions and uptake (Davisson and Hoyle, 2023). Li et al. (2016) found that participants who received prosocial messages about the influenza vaccine expressed greater intentions to vaccinate than participants in a control group. Moreover, people who contributed more to a public goods game were more likely to voluntarily receive their COVID-19 vaccination, suggesting that vaccination behavior is associated with prosociality (Reddinger et al., 2022).

On the other hand, Ashworth et al. (2021)found that while prosocial messages increased vaccination intentions, messages emphasizing personal benefits were the most effective, suggesting that self-oriented frames may be optimal in this context. Additionally, some studies find that moralizing vaccination actually has negative effects for uptake, which may indicate a potential backfiring effect (Delporte et al., 2023; Rosenfeld and Tomiyama, 2022). Finally, Canevello et al. (2023) examined both COVID-19 vaccination and other prevention behaviors and found that prosocial orientation predicted other protective behaviors, but not vaccination.

Taken together, these findings indicate that in contrast to prevention behaviors such as hand washing and masking, vaccination is a more complex issue. Masking and vaccination both include the goal to prevent disease transmission and benefits for both the self and others. However, there are key differences between them: behaviors such as masking are more publicly

visible and more immediate than vaccines, which take time to take effect and therefore protect at a future time. Additionally, vaccination can be seen as more invasive since it involves a shot, whereas a mask can be removed at any time. As suggested by Canevello (2023), the COVID-19 vaccine may also be seen as ineffective, preventing framing from having an impact. Finally, debates in the US surrounding vaccinations against various diseases have a long history (Wolfe & Sharpe, 2002), while mask wearing is a more recent phenomenon. Some of these differences help explain why self- and other-oriented frames may function differently depending on the protective behavior.

Framing, Morality, and Public-Health Measures in Children

Findings on other- and self-oriented framing and vaccination raise the question of how these frames might impact children's reasoning. Decades of research on moral development demonstrate that children have strong beliefs about what is moral and are especially motivated to prevent harm (Killen and Smetana, 2023). If children see vaccination as a moral issue, they may be more likely to ask their parents to be vaccinated. Additionally, children condemn and punish those who violate moral norms; they avoid interacting with transgressors from very young ages (e.g. Marshall & McAuliffe, 2022). Therefore, different frames might lead to children avoiding those who do not vaccinate in their communities and perceiving them negatively. Given the potential for prejudice to develop (Bor et al., 2022), it is important to understand how the types of messages children are exposed to can influence their perceptions and treatment of others.

A recent study experimentally manipulated novel, hypothetical mask-like behaviors as benefitting either the self or others (Probst et al., 2023). Children endorsed these behaviors at high rates provided they prevented harm as opposed to inconvenience. In addition, they showed more moral reasoning about others when the behaviors were framed as other-oriented as

compared to self-oriented. This suggests that there is potential for moralization of public-health measures based on framing in a masking context, and that children generally approve of these kinds of behaviors.

Few studies look at children's reasoning about vaccination. One study examined children's perceptions of mandatory laws and found that children applied moral principles to vaccination laws and considered both benefits and risks to the self and others (Helwig and Jasiobedzka, 2001). Other studies on vaccination focused on parental decision-making (e.g., Szilagyi et al., 2021; Tang et al., 2016), but not on children's reasoning. We are not aware of any study that has tested whether self- and other-oriented framing influences children's thinking about vaccines.

Current Study

The current study addresses this gap in the literature by framing a novel vaccine-like behavior as benefitting the self or other to 5–10-year-old children and examining the effects of this framing on their endorsement and moral reasoning about the behavior. To avoid preconceived biases about vaccination as well as other confounding variables, we employ a tightly controlled experimental design using hypothetical scenarios with vignettes that parallel vaccination, adapted from Probst et al., 2023. Using hypothetical scenarios follows a long tradition in studies of socio-moral reasoning in adults and children to assess the underlying reasoning rather than pre-existing answers to familiar topics (Cushman & Greene, 2012; Turiel, 2015). We manipulate the frame as self-oriented or other-oriented, and also manipulate severity by describing how the behaviors can prevent physical harm or mere inconvenience. Specifically, we use novel aliens that have spiky extremities that can poke (high severity) or brush against (low severity) themselves or others.

In Study 1 (preregistration: https://aspredicted.org/LCD_TX9) the aliens' extremities emerge at random intervals without their control, and we introduce a "special medicine" that makes the alien feel sick but prevents their extremities from emerging. We chose this approach to make the potential for harm more difficult to predict, as is the case with disease transmission, but also to retain the physical harm element of the original paradigm to make the harm more salient to our young participants. We then ask children whether the alien should take the medicine and include a series of moral evaluation questions about aliens who take or do not take the medicine.

Based on the results of Probst et al. (2023) examining these manipulations in a masking context, we predict that children's social-moral evaluations of others will be influenced both by framing and severity, with more positive evaluations of those who perform the behavior than those who do not in the other-oriented and high severity conditions. We also predict that children will endorse these behaviors at high rates in the high severity condition, and that their endorsement will not be influenced by framing as this measure captures practicality in addition to social-moral reasoning.

Study 1

Method

Participants

The final sample were $N = 60$ children aged 5-10 years old ($M = 8.03$, $SD = 1.77$, 46% girls, 54% boys). As per our pre-registered exclusion criteria, one additional participant was excluded because of incorrect responses on all comprehension check questions. Families living predominantly in the U.S. were recruited from a research participant database and online, with

18% Asian, 3% Black/African American, 5% Hispanic/Latino, 56% White/Caucasian, 2% Middle Eastern/North African, and 16% Multiple Race/Ethnicities.

Design

In a 2 x 2 within-subjects design, we manipulated Framing (i.e., whether an alien's spikey extremities affect the *self* or *other*) and Severity (i.e., whether the alien's spikey extremities hurt (*high severity*) or not (*low severity*) as the two independent variables. Each child saw four different aliens corresponding to the four possible condition combinations in several unique counterbalanced sequences distributed evenly across the three age-groups created for counterbalancing purposes (5-6, 7-8, 9-10).

Procedure

The study was conducted online via Zoom, using a Qualtrics form to present stimuli and record children's verbal responses. Parental consent was obtained prior to the session and children's assent was confirmed at the test session. We video-recorded all children whose parents consented to recording (88%).

The experimenter presented alien vignettes on a shared screen and read the study scripts and questions aloud to the participant. Each trial consisted of a vignette with an alien character representing one of the combinations of conditions. In each trial, children answered two manipulation checks and one comprehension check (see below). As per our pre-registration, we excluded trials in which the participant failed a manipulation or comprehension check question (4 trials) or stopped participating (3 trials), resulting in 233 (out of 240) valid trials for the final data set.

The stimuli were adapted from Probst et al. (2023). We used the same four alien types: each alien had a spikey body part that either poked (high severity) or brushed against (low

severity) either themselves (self-oriented) or another alien (other-oriented). Unique to the current study, the aliens' spikey appendages would emerge from their body at unknown intervals outside of the aliens' control (see Appendix B).

Each vignette opened with an introduction to the type of alien, including the consequence of this spikey appendage. We manipulated the Severity by explaining that the appendage poked and therefore hurt the alien (high severity) or only brushed against the alien without hurting them (low severity). In addition, we manipulated the Framing by varying whether the appendage affected the self or the other (see Figure 1). Visual depictions accompanied each description, with speech bubbles in addition emphasizing the severity ("ouch" in the high severity condition, and "oh" in the low severity condition). The child then answered two manipulation check questions: 1. *Who does the [alien] [poke/brush against]?* and 2. *Does it hurt?*' If the child answered incorrectly, the question was repeated. If the child failed again, the trial was excluded from analysis.

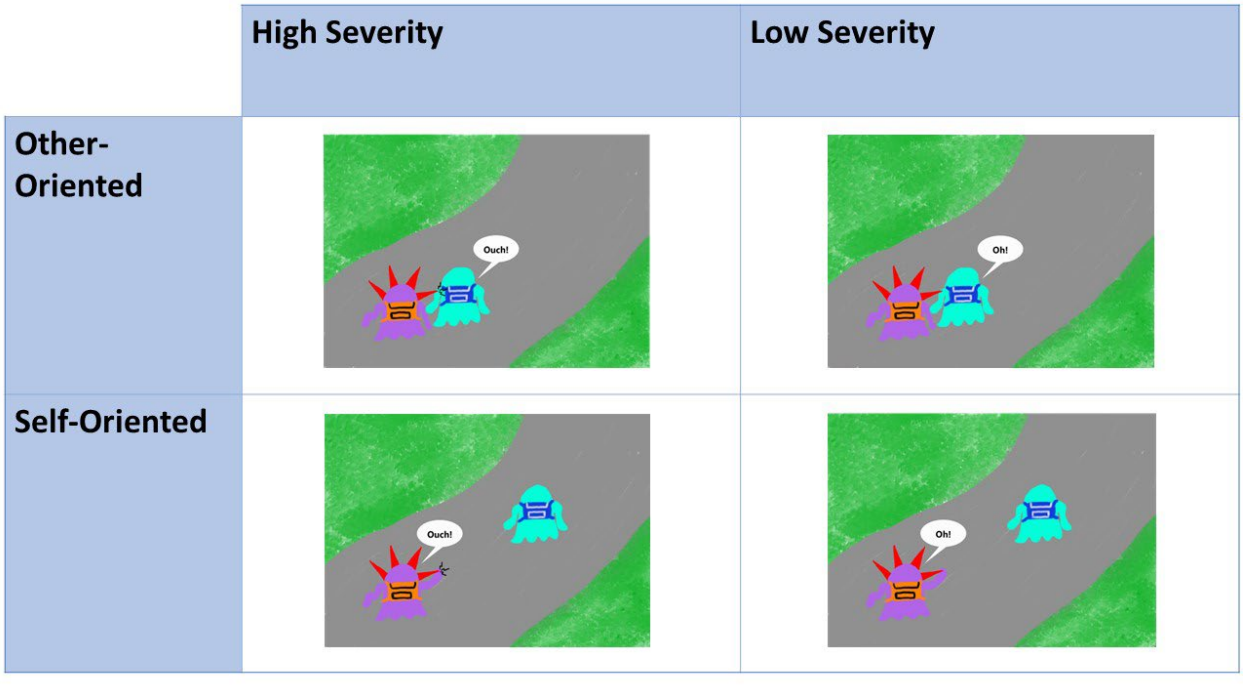


Figure 4.1. Depiction of each combination of conditions, using the Furpee as an example.

Next, the researcher described the protective behavior dilemma: the alien can take a special medicine that prevents the spikes from coming out, but the medicine makes the alien feel yucky and they have to stay in bed for one whole day. The images depicted an alien holding a cup with medicine, and then showed the alien laying in bed next to the empty cup. This protective behavior is intended to be functionally similar to vaccination while having a clear cost for the alien. Children responded to the comprehension question of "*How do you think they feel? Yucky or not yucky*?". As with the manipulation check questions, if children answered incorrectly, we repeated it once and excluded trials with two incorrect answers from analysis.

At the end of the vignette, children saw the result of taking the medicine–the alien no longer poked or brushed against themselves or another alien. They then saw a new alien of the same alien type, weighing the pros and cons and debating whether to take the medicine. We asked, *"What do you think? Should the [alien] take the medicine?"* with the binary answer option of (Yes/No), followed by a free-response justification question (*"Why?")* to keep their attention.

Next, children saw an alien either taking the medicine (Follower) or not taking the medicine (Violator), with the order counterbalanced across the different alien types. The Follower and Violator aliens were the same alien type but differentiated by different colors. The children then answered a series of questions about the Follower or Violator.

First, they were asked to rate the alien's Action: *"Do you think what the [alien] did was good, bad, or just OK?"* If the child selected "good" or "bad", they received additional options of "very good/bad" or "a little good/bad" to create a 5-point Likert scale.

Next, children rated the alien's Friendship Quality: *"Do you think the [alien] is a good or bad friend?"*, with additional prompts of "very good/bad" or "a little good/bad" to create a 4-point Likert scale.

The same set of questions were then repeated for another alien with a different color who made the opposite choice as the previous alien: each child rated both a Follower and a Violator (order counterbalanced). Finally, children saw the Follower and Violator aliens side by side and chose which alien they would rather be friends with (Friend Choice).

Children saw four alien vignettes with different aliens and combinations of conditions (see Appendix B). We also included two variables assessing the smartness of the aliens as a control, but because these were not central to our hypothesis, we include descriptions and results for these variables in Appendix B.

At the end of the session, the experimenter thanked the child and emailed their parent a $5 Amazon gift code as well as a debrief form.

Coding and statistical analyses

The dependent variables were: Endorsement (binary: yes or no); Action Rating (5-point Likert scale, difference score); Friendship Rating (4-point Likert scale, difference score); and Friend Choice (binary: Follower or Violator). For the continuous dependent variables (Action Rating and Friendship Rating), we calculated difference scores by subtracting children's ratings of the Violator from their ratings of the Follower. Higher difference scores therefore reflect more positive ratings of the Follower than the Violator, difference scores near zero reflected similar ratings of each alien, and negative difference scores reflected more positive ratings of the Violator than the Follower.

Our statistical analysis approach was as follows. For the binary dependent variables,we used generalized linear mixed models. For the continuous dependent variables, we performed linear mixed effects models. We performed all our analyses in R version 3.6.3 using the package lme4 (Bates et al., 2014). Each model had the same fixed and random effects: The fixed effects were trial, gender, age, framing, severity, and the interaction between framing and severity; subject ID was included as a random effect to account for the fact that variables were compared within subjects.

For each dependent variable, we performed a set of model comparisons to test the effect of each predictor. First, to reduce Type 1 error for multiple testing, we compared the full model with all predictors to a null model only containing trial and subject to test whether the predictors combined had an effect on the dependent variable (Forstmeier and Schielzeth, 2011). If the full-null model comparison proved significant, we conducted hypothesis-driven model comparisons to assess the unique effect of each predictor on the DV using likelihood ratio tests. For all analyses reported below, these full-null model comparisons were significant at $p < .05$.

Since we did not have specific hypotheses about the effect of gender or age, we included them as exploratory variables. We tested for potential gender effects by comparing the full model to model with the gender term removed. Since there was no effect of gender on any of our variables, we did not include gender for any further model comparisons. For age, we tested for interactions between age as a continuous predictor and our variables of interest (framing and severity) after testing our main model. Where age proved significant, we also ran post-hoc analyses separately by age group (5-6, 7-8, 9-10) to see if effects were significant in any individual age group.

Here we report the results from our hypothesis-driven model comparisons; for the regression tables of the final model for each analysis, please see Appendix B. The final models represent the main variables of interest (framing and severity), plus any exploratory variables that had a significant effect. Plots depicting model estimates are based on the full models.

Results

Endorsement

We first tested whether our manipulation of severity and framing was predictive of whether children thought the alien should take the medicine. Overall, 67% of children endorsed taking the medicine. As described above, we ran a generalized linear model with trial, age, framing, severity, and the interaction between framing and severity as fixed effects, subject ID as a random effect, and endorsement as the binary outcome variable (yes or no). There was a significant effect of severity: children were more likely to endorse taking the medicine in the high than the low severity condition (X^2 (2) = 52.13, $p < .001$). There was also a main effect of age, with younger children generally endorsing the medicine more than older children (X^2 (1) = 7.11, $p = .008$), as well as a significant interaction of age and severity: younger children endorsed the behavior at high rates regardless of severity, while older children were more likely to endorse the behavior in the high over the low severity condition (X^2 (1) = 18.68, $p < .001$, see Figure 2A). We found no effect of framing nor an interaction between framing and severity.

Action Rating

We next assessed whether our predictors were related to children's ratings of the aliens' decisions to take (Follower) or not take (Violator) the medicine, using our difference score as DV, with more positive values reflecting higher ratings of the Follower over the Violator.

Overall, children's responses tended positive with a mean difference score of 1.18, suggesting that children generally rate followers higher than violators.

We ran a linear mixed effects model with the same predictors as our previous model and the difference score of action ratings as the continuous outcome variable. We found a main effect of severity (X^2 (2) = 38.71, $p < .001$), a main effect of age, (X^2 (1) = 5.79, $p = .02$), as well as a significant interaction between severity and age: While at younger ages, children did not show sensitivity to severity, with increasing age, children showed more positive ratings of Followers over Violators in the High over the Low Severity condition, (X^2 (1) = 9.38, $p = .009$, see Figure 2B). There was no effect of framing, and no interaction between framing and severity.

Friendship Rating

Next, we examined how children judged the Follower and Violator in terms of being a good or bad friend. As with their ratings of the aliens' actions, children rated the Follower's friendship quality higher than the Violator's, with a mean difference score of .69. We next ran linear mixed effects models with the same predictors as before and Friendship Rating difference score as the continuous outcome variable. We found a main effect of severity (X^2 (2) = 10.48, $p = .005$), no effect of framing and no interaction of severity and framing (see Figure 2C). There was also no effect of age.

Friend Choice

We tested whether framing and severity would impact which alien the child would rather be friends with (Follower or Violator). Overall, 72% of children chose the Follower, suggesting that children generally favor aliens that take the medicine regardless of our manipulations. Next, we ran a generalized linear mixed method model with the same predictors as our previous models, and the binary variable of Friend Choice as the dependent variable. There was a main

effect of severity (X^2 (2) = 35.04, p < .001), a main effect of age (X^2 (1) = 8.66, p = .003) and an interaction of age and severity (X^2 (1) = 10.48, p = .001, see Figure 2D): At younger ages, children virtually always chose the Follower regardless of condition, while with increasing age, children became more differentiating, choosing the Follower in the High severity scenarios, but increasingly choosing the Violator in the Low severity scenarios. There was no effect of framing or an interaction between framing and severity.

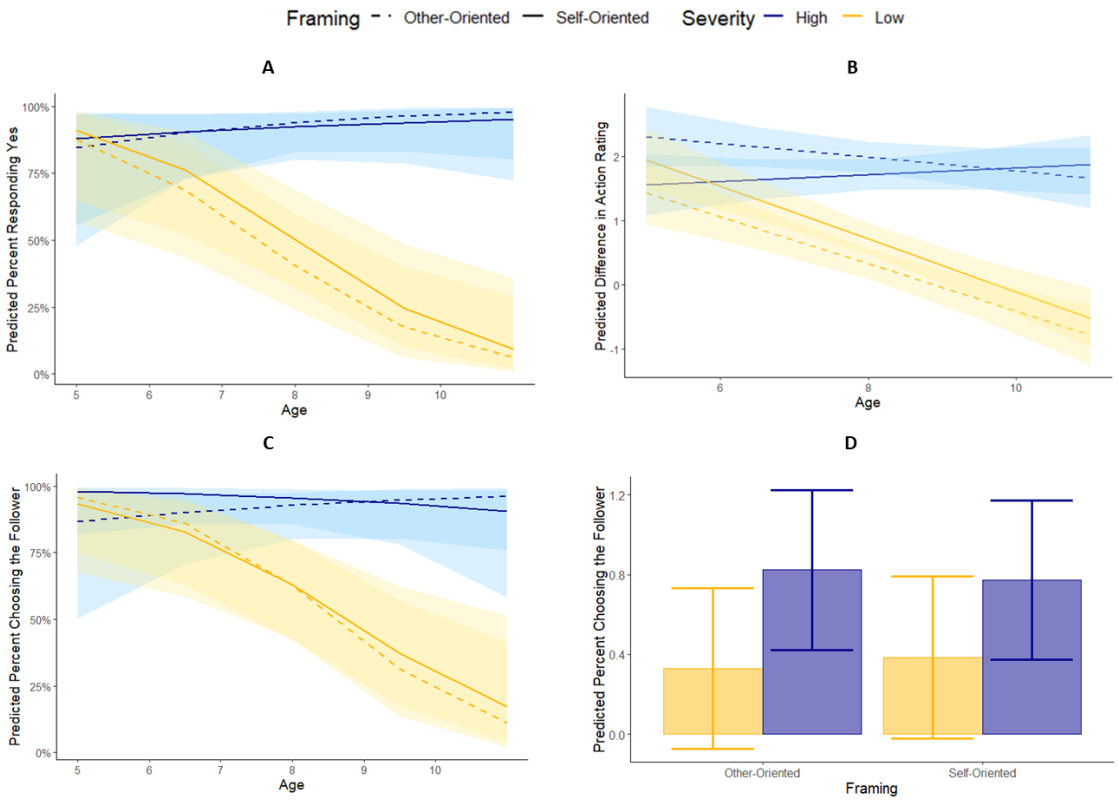


Figure 4.2. Regression plots for the dependent variables in Study 1. Shading (A-C) and error bars (D) denote 95% confidence intervals.

Discussion

We found that across all variables, children attended to severity: They were more likely to endorse taking the medicine and rate individuals who took the medicine more positively when it prevented harm as opposed to reducing a mere inconvenience. This pattern emerged with age,

with younger children rating taking the medicine more positively throughout while older children considering the degree of severity. We found little evidence of an effect of framing on any of our variables, suggesting that children find these vaccination-like behaviors imperative regardless of whether they protect the self or others.

Our results from Study 1 shed light on children's consideration of a novel vaccine-like behavior, but leave open some additional questions. First, we found consistent evidence for age effects, specifically with regard to the degree of severity. This may suggest that in this vaccination context, consideration of the severity of harm that a vaccination prevents emerges later in development. However, it is also possible that this interaction between severity and age is due to a general assumption by younger children that the term "medicine" might be interpreted as an indication that an already existing ailment needs to be treated, not quite capturing the prophylactic nature of vaccines. Perhaps younger children are prone to think that any medicine should be taken by default, without deeper considerations about the reasons, while older children better understand medicine is not always needed. To address these potential concerns and provide a more specific measure of children's reasoning about hypothetical vaccination, in the vignettes of Study 2 we use "liquid" rather than "medicine" as a more neutral term.

We also consider the possibility that children's high levels of endorsement regardless of framing may be due in part to the nature of our stimuli. In Study 1, aliens had spikey extremities emerge from their body, which might be perceived as alarming by the children. Children might find it imperative to prevent this from occurring regardless of condition, masking any potential effects of framing. This could also potentially explain why Probst et al. (2023) found an effect of framing in scenarios where aliens could put caps on their spikes to prevent harm, as opposed to the current study with no framing effect for a medicine preventing the emergence of these

extremities in the first place. To address this issue, in Study 2 we modified the paradigm such that the aliens' spikey extremities already existed, and drinking the liquid could prevent them from getting larger. This also mirrors how body parts can swell with illness, making it a more familiar action than in Study 1.

Additionally, all four aliens had spikey extremities that could poke or brush against others. We wanted to include an additional type of alien issue that more closely maps onto disease transmission to make our results less context-specific. To this end, in Study 2 we introduced two new types of aliens who emitted a gas, which drinking the liquid could prevent from increasing in volume and causing the self or another alien to cough (high severity) or get a dry mouth (low severity). We counterbalanced these alongside the aliens with spiky extremities and compared the two alien types in preliminary analysis to ensure that results could be generalized across both types of aliens.

Finally, we hoped to get more insight into children's thought processes regarding their decision-making about vaccine-like behaviors. We introduced free-response questions for coding and analysis. We asked children Justification questions after their evaluations of the Follower and Violator aliens in each condition, and added a Persuasion measure where children explain how one alien should convince their friend to get or not get the vaccine.

Study 2

In Study 2 (preregistration: https://aspredicted.org/NFB_LWF), we aimed to modify the methods of Study 1 and test children's endorsement and reasoning about vaccine-like behaviors based on framing in a more robust paradigm. To summarize we made the following changes: : (1) We replaced the phrase "taking the medicine" with "drinking the liquid" to avoid preconceived biases about the importance of medicine, particularly among younger children; (2)

We modified the stimuli so that the vaccine-like behavior prevents spikey extremities from getting larger rather than from emerging from the body at all in order to make the potential harm less jarring for young children; (3) We included a new alien type that emits a gas that can make the self or others cough or get a dry mouth, which can be prevented with the vaccine-like behavior. This allows us to generalize to another type of alien whose issue more closely resembles disease transmission; and (4) We introduced two more free-response measures, Justification and Persuasion, to gain additional exploratory insight into children's reasoning.

If the results of Study 1 are due to details of our procedure, such as the term "medicine" and the strangeness of having extremities emerge from the body, we predict that, based a previous study using these methods in a masking context (Probst et al., 2023) we will find that framing triggers children's socio-moral reasoning about the vaccine-like behaviors in the other-oriented condition. This would indicate that children reason similarly about vaccine-like and mask-like prevention behaviors based on framing, but that our design in Study 1 failed to capture these effects.

However, it may be the case that children's reasoning about vaccine-like prevention behaviors are similar regardless of who the behaviors protect; in this case, we expect to find similar results to Study 1, but may gain additional insight into how children think about these behaviors based on our added free response measures.

Method

Participants

Our final sample were $N = 60$ children between the ages of 5 and 10 years old ($M = 7.92$, $SD = 1.65$, 52% girls), recruited with the same methods as in Study 1. All participants could be

included. The racial/ethnic breakdown was: 17% Asian, 7% Black or African American, 2% Hispanic or Latino, 78% White or Caucasian, and 10% multiple race/ethnicities.

Design

As in Study 1, we employed a 2 x 2 within-subjects design manipulating Framing (self-oriented, other-oriented) and Severity (high, low), with condition order counterbalanced across participants.

Procedure

The overall procedure was the same as in Study 1, using Zoom and Qualtrics for online testing. Parents completed a consent form prior to the study, and the experimenter verbally confirmed the parent's consent and the child's assent at the beginning of the testing session.

Children saw four vignettes with different aliens, each representing a different combination of conditions. We used two of the same aliens from Study 1 (with spikes on their bodies), along with two new aliens whose dilemmas involved gas that came out of their bodies (see Appendix B for details).

We used the same exclusion criteria as in Study 1. Only one child had to be excluded and be replaced with a new participant. In our final sample, four trials were excluded due to failed manipulation or comprehension checks. Thus, we had 236 out of 240 valid trials.

Children were first introduced to the aliens and learned what events can sometimes occur. For the spike-type aliens, the aliens have small spikes that can sometimes grow large. When the spikes grow large, they can either poke (high severity) or brush against (low severity) themselves or others. For the gas-type aliens, the aliens have some gas that comes out of their bodies. If a large amount of gas is released, it can either make the self or others get a dry throat (low

severity) or cough (high severity). The manipulation check questions asked children who got poked or brushed against, and whether it hurt.

Next, children learned that the alien can drink a liquid that prevents the spikes from becoming large or a large amount of gas being released. However, the liquid makes the alien feel yucky and they have to stay in bed for a whole day. The comprehension check question asked children how the alien feels when they drink the liquid.

Finally, children saw that when the alien drinks the liquid, the spikes do not become big or the gas amount does not increase, which means that the aliens no longer poke or brush against themselves or others, or no longer make themselves or others get a dry throat or cough. At the end of the vignette, the child saw a new alien (denoted by a different color) debating whether or not to drink the liquid and the condition was summarized in their deliberation.

We then moved on to presenting the dependent variables, as in Study 1.We asked the Endorsement question of whether or not the alien should drink the liquid, then introduced the Follower or Violator alien (counterbalanced) and asked children to provide the Action Rating. New to Study 2, we then asked a Justification question: “Why was what the alien did good/bad/just OK?” to gain new insight into the reasoning behind their Action Rating.

Subsequently, we assessed the Friendship Rating, then introduced the other alien (Violator or Follower, depending on what came first) and had children answer the same questions. We then asked them to select which alien (Follower or Violator) they would rather be friends with (Friend Choice).

We then included a new free-response question at the end of each alien condition, asking children what advice one alien would give to another alien who was unsure what to do. This Persuasion item had two parts. First, the alien performed the act that aligned with what the child

had opted for after the Endorsement question (e.g., if the child said "yes", then the alien drank the liquid). Then, the alien talked to a new alien who was unsure what to do. We then asked the child: "What should the [alien] say to the [friend alien] to get them to drink/not drink the liquid?"

After viewing all four alien vignettes, the study concluded with the experimenter thanking the child and sending their parent a debriefing form and Amazon gift code (see Appendix B for more details).

Coding and statistical analysis plan

We used the same analysis approach as in Study 1: We constructed generalized linear mixed models for the binary dependent variables and we constructed linear mixed effects models for the continuous dependent variables. To reiterate, since Action Rating and Friendship Rating are both difference scores, positive values reflected higher ratings of the Follower, neutral values reflected similar ratings of the two aliens, and negative values reflected higher ratings of the Violator.

As in Study 1, the fixed effects for each model were trial, gender, age, framing, severity, and the interaction between framing and severity, and the random effect for each model was subject ID. We used model comparisons to test the effect of each predictor variable. For all of the results below, the full-null comparisons were significant at $p < .05$. Since there was no effect of gender on any variables, we removed it from our full model. Age was also exploratory, and we examined interactions between age and our key variables (framing and severity). See the Appendix B for the regression tables of the final models of each analysis.

Free Response Variables. Our added free-response variables were exploratory and thus we did not have an a priori analysis plan. A research assistant transcribed children's responses

from the video recordings (or live if there was no video consent). Next, we developed a coding schema to categorize children's responses (see Appendix B for details). There was no limit on how many codes could be applied to each response; most had 1-3 codes. To assess inter-rater reliability, a research assistant independently coded the data. Interrater reliability was high for all categories, with Cohen's Kappa ranging from .80 to .97. Discrepancies were resolved through discussion between the two coders.

Preliminary analyses. Before our main analysis, we first checked for any item effect of alien type (spikes versus gas), by running each of the full models with alien type as additional predictor for each dependent variable aggregated across trials to reduce model complexity. Alien type had no effect in any of these analyses, so we collapsed across alien types for all further analyses.

Results

Endorsement

First, we tested whether our framing and severity manipulations affected children's endorsement of the vaccine-like behavior. As with all other analyses, we constructed a generalized linear mixed model with the fixed effect predictors of trial, age, severity, framing, and the interaction between severity and framing, and subject ID as a random effect. Endorsement was the binary dependent variable. We found a significant main effect of severity ($X^2(2) = 36.80$, $p < .001$). A large majority of children (88%) endorse drinking over not drinking the liquid in the high severity condition, whereas a smaller majority (63%) endorse in the low severity (See Figure 3A). No other predictors were significant, including framing.

Action Rating

Next, we examined children's ratings of the aliens' choices to drink or not drink the liquid. We calculated difference scores by subtracting the Violator evaluation from the Follower evaluation. Children's scores were generally neutral or positive ($M = 1.34$), suggesting that regardless of condition, they rated the follower's action higher than the violator's action.

To assess whether framing and severity influenced children's evaluations, and whether this changed with age, we constructed a linear mixed effects model with the aforementioned predictors and the Action Rating difference score as the dependent variable. We found a significant main effect of severity, $X^2(2) = 34.15$, $p < .001$, and an interaction of framing and age, with older children rating followers more positively and violators more negatively in the other-oriented condition ($X^2(1) = 5.05$, $p = .02$, see Figure 3B). Post-hoc analysis testing each age group showed that the effect of framing was significant for 9-10 year olds only ($X^2(2) = 11.80$, $p = .003$). No other predictors were significant.

Friendship Rating

We next examined children's evaluations of how good or bad a friend the Follower and Violator were. Children's ratings tended to be either neutral or positive ($M = .84$), suggesting they thought the follower was the better friend or to see both aliens as equally good.

To assess whether our predictors affected children's evaluations of how good or bad a friend the Follower and Violator were, we constructed a linear mixed effects model with the aforementioned predictors and the Friendship Rating difference score as the dependent variable. We found a significant main effect of severity, $X^2(2) = 26.74$, $p < .001$, and a significant interaction between framing and age ($X^2(1) = 11.18$, $p < .001$, see Figure 3C). Post-hoc analyses analyzing each age group separately again revealed that the effect of framing was only significant in the 9-10 year old age group ($X^2(2) = 21.61$, $p < .001$). Older children thus had more

disparate friendship ratings of Followers and Violators when the liquid benefited others rather than the self.

Friend Choice

We next assessed children's decisions about who was the better friend: the Follower or the Violator. The majority of children (82%) chose the follower as the better friend regardless of condition. To test whether our predictors affected children's decisions about which alien was the better friend, we constructed a generalized linear mixed model with the aforementioned predictors and the binary variable of Friend Choice as the dependent variable. There was a significant effect of severity, $X^2(2) = 7.70$, $p = .02$, and a marginal interaction between framing and age, $X^2(1) = 3.90$, $p = .05$, with older children choosing the Violator less in the self-oriented condition than in the other-oriented condition and younger children showing no effect of framing (see Figure 3D). Post-hoc analyses did not find a significant effect of framing in any individual age group, suggesting that this effect was not as strong as with the previous two variables. None of the other predictors were significant.

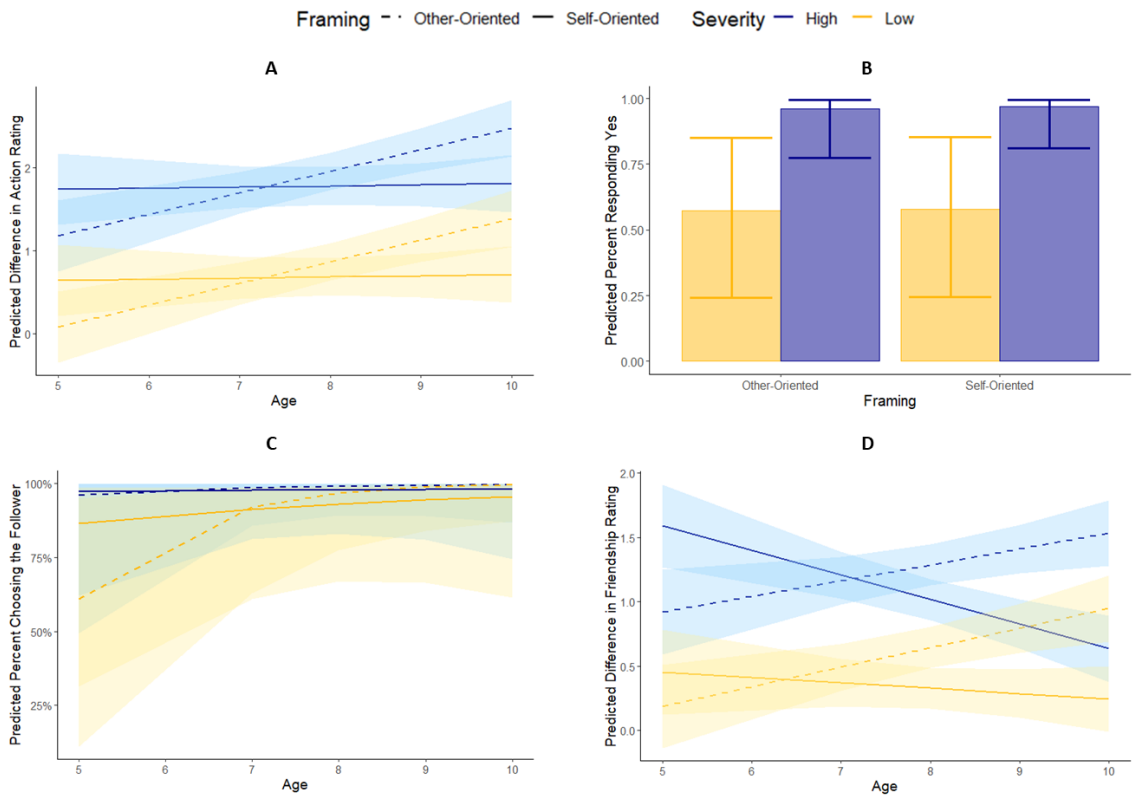


Figure 4.3. Regression plots for the dependent variables in Study 1. Shading (A, C, D) and error bars (B) denote 95% confidence intervals.

Free-Response Data

Justifications. After each Action Rating question for the Follower and Violator, respectively we asked for a justification of their rating. See Appendix B for explanations of each coding category. As seen in Table 1, the largest number of responses mentioned harm for others or the self as justifications for their ratings of the Followers and Violators. A sizable portion of responses engaged in a cost-benefit analysis to inform their ratings. Many justifications also discussed implications for the aliens' relationships and their bodily autonomy. Many children were unable to give any rationale at all or simplistically reiterated parts of the vignette.

We created contingency tables and ran chi-squared tests for each coding category to examine patterns in children's responses based on condition. For both the Followers and the

Violators, children talked about harm to others more in the other-oriented condition than in the self-oriented condition (F: $X^2(1) = 68.50$, $p < .001$; V: $X^2(1) = 44.10$, $p < .001$). Likewise, responses mentioned harm to the self more in the self-oriented condition than in the other-oriented condition (F: $X^2(1) = 78.14$, $p < .001$; V: $X^2(1) = 42.63$, $p < .001$). Justifications that discussed the implications of drinking or not drinking the liquid for the alien's relationships were more likely in the other-oriented than in the self-oriented condition (F: $X^2(1) = 9.5$, $p = .002$; V: $X^2(1) = 6.61$, $p = .01$). There were no other consistent differences found between conditions.

We also ran a series of logistic regressions to examine effects of age on each of our variables. We compared regressions with predictors of age and subject ID (as a random effect to account for the within-subjects nature of the data) to regressions with only subject ID as the predictor in order to isolate the effect of age, then created regression plots for any significant effects in order to visualize the direction of the effect (see Appendix B for these plots).

With increasing age, children were more likely to mention harm to others (F: $X^2(1) = 11.56$, $p < .001$; V: $X^2(1) = 6.20$, $p = .01$) and engage in cost-benefit analysis (F: $X^2(1) = 4.16$, $p = .04$; V: $X^2(1) = 9.19$, $p = .002$) when justifying their ratings of Followers and Violators. For Followers, they were more likely to cite the implications of the alien's relationships ($X^2(1) = 4.79$, $p = .03$), and for Violators, they were marginally more likely to discuss bodily autonomy ($X^2(1) = 3.08$, $p = .08$). Additionally, with age children were less likely to give no response/rationale (F: $X^2(1) = 7.28$, $p = .008$; V: $X^2(1) = 8.87$, $p = .003$), suggesting that younger children had a harder time articulating their responses.

Persuasion. At the end of each condition, children were asked what an alien should say to their friend to convince them to drink or not drink the liquid (depending on how the child responded to the Endorsement question), and we used the same coding scheme as the

Justification questions. As seen in Table 1, children's responses fell into the coding categories at similar rates as the Justification question with the exception of Bodily Autonomy, which was rarely cited for this question.

Again, we were interested in whether persuasion responses differed by condition. Children cited harm to others in their responses more in the other-oriented than the self-oriented condition ($X^2(1) = 44.12$, $p < .001$), and they cited harm to the self in their responses more in the self-oriented than the other-oriented condition ($X^2(1) = 48.94$, $p < .001$). The only other category that varied by condition was children's citing of the implications for the alien's relationships, which was more common in the other-oriented condition ($X^2(1) = 4.82$, $p = .03$).

As with our Justification responses, we ran logistic regressions to examine age-related changes in children's Persuasion responses. With age, children were more likely to discuss the personal cost of the liquid, $X^2(1) = 9.93$, $p = .002$, the harm to others, $X^2(1) = 13.20$, $p < .001$, the self, $X^2(1) = 6.63$, $p = .01$, and the cost-benefit analysis of drinking the liquid ($X^2(1) = 13.34$, $p < .001$) when persuading the alien to drink or not drink the liquid. Additionally, with age children are less likely to give no rationale or answer simplistically ($X^2(1) = 27.01$, $p < .001$). These age-related changes suggest that younger children have a harder time thinking of how to persuade others, and fall back on direct-requests or non-responses. Older children, on the other hand, are attuned to contextual factors and provide more thoughtful persuasive responses that cite implications of the self and others.

Table 4.1
Overall percentages for the Justification and Persuasion free-response questions. Percentages represent the total number of times a response fell into a given category over the total number of responses.

	Question Item		
Category	**Justification - Followers**	**Justification - Violators**	**Persuasion**
Personal cost of the liquid	18%	17%	25%
Harm to others	33%	28%	22%
Harm to self	31%	30%	24%
Cost-benefit analysis	15%	12%	14%
Relationships	13%	8%	10%
Bodily Autonomy	9%	15%	2%
No / Simplistic Justification	21%	22%	36%

Discussion

In Study 2, we found that children endorse taking the liquid at high rates, and we continue to see severity impacting their endorsement and evaluation of others. These effects are thus robust across two studies. Unlike in Study 1, the severity effect was constant across age. It thus appears that the modifications we made helped younger children to better think through the scenarios. Namely, removing the term “medicine” and making the spikes less jarring in nature allowed younger children to better take severity of harm into account in their judgements.

Another key change from Study 1 was that a framing effect emerged with age on the socio-moral variables. Older children in Study 2 showed more moral judgment in the other-oriented condition, suggesting that emphasizing the effects of the vaccine-like behaviors for others is important later on in development. Our refined paradigm thus helped us to detect age-related changes in children's moral reasoning as a result of self- and other-oriented frames.

Finally, our added Justification and Persuasion questions helped us gain additional insight into children's decision-making. Children in both framing conditions were concerned about harm, and cited that in their justifications for the Follower and Violator ratings. Additionally, children cited the cost of the liquid and bodily autonomy in their reasoning regardless of condition, suggesting that they respect the alien's right to choose for themselves and avoid personal consequences. Finally, children were more likely to discuss implications for the aliens' friendships in the other-oriented condition, suggesting that children consider the social implications of vaccination-like behaviors when the behaviors are framed as benefiting others.

Our free-response questions also helped us gain insight into the age-related changes we found in our quantitative data. We found that younger children had a harder time articulating their reasoning and persuading others to drink or not drink the medicine. This is in line with our findings that younger children are less attentive to contextual factors when evaluating vaccine-like behaviors. Older children, on the other hand, engaged in more sophisticated reasoning, reasoning about cost-benefit analysis and bodily autonomy. This may partly explain why framing effects impact older children's moral reasoning–they are more likely to think through the various implications and whether it is worth it to engage in the behavior.

General Discussion

Across both studies, children highly endorsed vaccine-like behaviors, especially when they prevented harm as opposed to mere inconvenience. In addition, we found evidence for age-related changes in children's perceptions of vaccine-like behaviors: younger children seemed to believe these behaviors were important no matter what, while older children considered the consequences of the behavior, such as the severity of harm and the self or others as victims. This finding was corroborated by children's free-response questions: younger children were more likely to give simplistic answers or struggle to articulate their reasoning, whereas older children discussed the various contextual factors and implications for the self and others.

We hypothesized that framing vaccine-like behaviors as protecting others versus protecting the self would influence children's social-moral reasoning, but that their endorsement would only be affected by the severity of harm prevented. We found support for this hypothesis among our older participants, as the effect of framing emerged over age from 5 to 10 years of age. For younger children, framing vaccine-like behavior as benefiting the self versus others did not influence their social-moral evaluations of others, while older children were more likely to view vaccination as a socio-moral issue when presented with a other-oriented frame. Specifically, older children rated Followers of the behavior more positively and Violators more negatively when the behavior protected others. Taken together, we see developmental change in how self- and other-oriented frames impact children's moralization of vaccine-like behaviors across the 5–10-year-old age-range.

We also find that children consider severity of harm in their sociomoral evaluations. When vaccine-like behaviors prevented more severe harm, children considered them to be important regardless of who the behavior benefitted: children in the high severity condition

endorsed the behaviors at high rates, and rated Followers more positively and Violators more negatively. Previous studies demonstrate that preventing harm is a salient moral principle for children (Smetana and Ball, 2019). Additionally, children are often advised to be safe and not get hurt, so it might be that for young children, preventing harm to the self is perceived as a moral issue as much as preventing harm to others. As children get older, they may see preventing the harm to the self as less of a moral violation as they take into account other foundations of morality such as liberty (Iyer et al., 2012). This is supported by their verbal justifications, with older children thinking more about issues such as bodily autonomy and engaging in more cost-benefit analysis than their younger counterparts.

Interpretation

Our results extend previous literature with adults that finds vaccination behaviors less susceptible to framing effects than other prevention measures such as masking (e.g., Canevello et al., 2023). There were consistent framing effects on social-moral measures for 5–10-year-olds in Probst et al. (2023), yet there were no main effects of framing in our studies with the same age group. One possible reason for this pattern of results is that vaccination-like behaviors are seen as more effective in these hypothetical paradigms and thus imperative to engage in when they prevent severe harm, no matter who is protected. Indeed, adult literature suggests that perceived effectiveness is an important factor in vaccination decisions (Canevello et al., 2023).

Another possibility is that due to the higher personal cost of taking the vaccine portrayed in our vignettes, children–especially younger children–are more hesitant to negatively judge those who refuse to drink the liquid. The frequent mention of the cost of the liquid, cost-benefit analysis, and bodily autonomy in children's justifications suggest that children may not be comfortable condemning Violators and instead can see the justification for their actions.

Although we did not find framing effects in Study 1, our improved paradigm in Study 2 found evidence for an effect of framing on social-moral reasoning emerging with age. This developmental pattern suggests that as children age, framing vaccine-like behaviors as benefiting others can lead them to think about these behaviors as socio-moral issues. This is in line with adult literature that suggests that moral appeals for vaccination have resulted in vaccinated individuals viewing unvaccinated individuals as moral transgressors (Bor et al., 2022). Our findings thus shed light on the mixed adult literature regarding other-oriented framing and vaccination: many of these studies focused on uptake or intentions as their dependent measure, rather than effects on social-moral cognition (e.g., Li et al.; Ashworth et al.). Our framing effects on social-moral cognition in older children suggest that these differential approaches to messaging about public-health behaviors still have an impact on people's perceptions of others, even if their own vaccination intentions are similar for self- and other-oriented approaches.

Implications

Our studies have several implications for how vaccination messages could be presented to children, and how children might be impacted by real-world messaging about vaccination. Children are exposed to pro-vaccine and anti-vaccine messaging, which can emphasize personal protection or protecting others. Our results suggest that for older children, this type of framing can influence how they see others. When the impact on others is emphasized, older children see vaccination as a moral issue.

Children of all ages differentially evaluated others on social-moral measures when harm is more severe. Thus, messages emphasizing the potential harm of COVID-19 or other diseases might be particularly salient in children's judgment about vaccination and those who choose to get vaccinated or not. Their verbal justifications indicate that when severity is low, they do not

see the vaccine-like behaviors as worth the personal cost they incur, and at times even seem to think negatively about those who perform them. Therefore, if the severity of diseases is downplayed, it may make children more resistant to vaccination.

Limitations and future directions

Finally, we consider the limitations of our study and how they can help inform future research. One deliberate decision was to use hypothetical scenarios, due to the fact that there are such strong opinions about vaccination which children may already be biased by, and we wanted to examine their reasoning without eliciting such preconceived notions. On the other hand, this analytic approach raises the question of how children's reasoning translates into real-world settings. This question is complicated by the fact that beyond individual reasoning, a multitude of other factors could be relevant, such as family or community political leanings or the perceived effectiveness of a vaccines, all factors known to influence adults' decision-making about vaccination (Roccato et al., 2019; Canevello et al., 2023). A future direction could be to examine associations between children's responses in our hypothetical paradigm with their actual beliefs about vaccination and other demographic factors.

Another limitation is our focus on middle childhood alone. While the main goals were to select an age window that reflects a major period of socio-moral reasoning in childhood and to be able to interpret children's thinking about vaccine-like behaviors in relation to results about masking-like behaviors in Probst et al. (2023), it is an open question how the found effects play out in older children, especially adolescence, when children have an increasing influence on their own behavior. A future direction could be to examine these questions across adolescence and into adulthood, when children mature and get more involved in medical decision-making.

In summary, across two experiments, we find that US children endorse vaccine-like behaviors at a high rate and showed evidence of moral reasoning about such behaviors when they prevented severe harm, regardless of whether the self or other was protected. Older children are more likely than younger children to think positively about those who perform vaccine-like behaviors and more negatively about those who do not when the behaviors protect others rather than the self. We thus conclude that emphasizing the severity of harm is an important factor in children's sociomoral-thinking about vaccination, and that emphasizing the benefits for others is increasingly important as children get older.

References

Ashworth, M., Thunström, L., Cherry, T. L., Newbold, S. C., & Finnoff, D. C. (2021). Emphasize personal health benefits to boost COVID-19 vaccination rates. *PNAS, 118* (32), 1–3. https://doi.org/10.1073/pnas.2108225118

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software, 67(1), 1–48. Doi: 10.18637/jss.v067.i01.

Böhm, R. & Betsch, C. (2022). Prosocial vaccination. *Current Opinion in Psychology, 43*, 307–311. https://doi.org/10.1016/j.copsyc.2021.08.010

Bor, A., Jørgensen, F., & Petersen, M. B. (2023). Discriminatory attitudes against unvaccinated people during the pandemic. *Nature, 613*(7945), 704–711. 10.1038/s41586-022-05607-y

Canevello, A., Jiang, T., Magid, K., Perry, J., & Crocker, J. (2023). Prosocial orientation and COVID-19 vaccine willingness in the U.S. *Social and Personality Psychology Compass, 17*(9), 1–11. DOI: 10.1111/spc3.12809

CDC (2024a). COVID-19 Vaccinations in the United States. Available at: https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-people-booster-percent-pop5 (Accessed 14 February 2024).

CDC (2024b) COVID-19 Vaccination Coverage and Vaccine Confidence in Children. Available at: https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/interactive/children.html (Accessed 14 February 2024).

Ceylan, M., & Hayran, C. (2021). Message Framing Effects on Individuals' Social Distancing and Helping Behavior During the COVID-19 Pandemic. Frontiers in Psychology, 12(March), 1–14. https://doi.org/10.3389/fpsyg.2021.579164

Chong, D., & Druckman, J. N. (2007). Framing theory. Annual Review of Political Science, 10, 103–126. https://doi.org/10.1146/annurev.polisci.10.072805.103054

Cushman, F., & Greene, J. D. (2012). Finding faults: how moral dilemmas illuminate cognitive structure. *Soc Neurosci, 7*(3), 269-79. doi: 10.1080/17470919.2011.614000

Davisson, E. K., & Hoyle, R. H. (2023). Collective views of vaccination predict vaccine hesitancy and willingness to receive a COVID-19 vaccine. *Social and Personality Psychology Compass* 17(8): 1–8. doi: 10.1111/spc3.12768

Delporte, M., Luyts, M., Molenberghs, G., Verbeke, G., Demarest, S., & Hoorens, V. (2023). Do Optimism and Moralization Predict Vaccination? A Five-Wave Longitudinal Study. *Health Psychology, 42*(8), 603–614. doi: 10.1037/hea0001272

Fahlquist, J. N. (2023). Taking Risks to Protect Others - Pediatric Vaccination and Moral Responsibility. *Public Health Ethics, 16*(2), 127–138. doi: 10.1093/phe/phad005

Forstmeier, W., & Schielzeth, H. (2011). Cryptic multiple hypotheses testing in linear models: Overestimated effect sizes and the winner's curse. *Behavioral Ecology and Sociobiology, 65(1),* 47–55. https://doi.org/10.1007/s00265-010-1038-5

Gillman, A. S., Iles, I. A., Klein, W. M. P., & Ferrer, R. A. (2022). Increasing Receptivity to COVID-19 Public Health Messages with Self-Affirmation and Self vs. Other Framing. *Health Communication, 00(00),* 1–12. https://doi.org/10.1080/10410236.2022.2043024

Grant, A. M., & Hofmann, D. A. (2011). It's not all about me: Motivating hand hygiene among health care professionals by focusing on patients. *Psychological Science*, *22*(12), 1494–1499. https://doi.org/10.1177/0956797611419172

Helwig, C. C., & Jasiobedzka, U. (2001). The Relation between Law and Morality: Children's Reasoning about Socially Beneficial and Unjust Laws. *Child Development, 72*(5), 1382–1393.

Hoxha, I., Agahi, R., Bimbashi, A., Aliu, M., Raka, L., Bajraktari, I., Beqiri, P., & Adams, L. (2023). Higher COVID-19 Vaccination Rates Are Associated with Lower COVID-19 Mortality: A Global Analysis. *Vaccines, 11*(1), 1–11. doi: 10.3390/vaccines11010074

Iyer, R., Koleva, S., Graham, J., Ditto, P., & Haidt, J. (2012) Understanding libertarian morality: The psychological dispositions of self-identified libertarians. *PLoS ONE, 7*(8). doi: 10.1371/journal.pone.0042366

Johnson, L. (2022). My Body, Your Choice: The Conflict Between Children's Bodily Autonomy and Parental Rights in the Age of Vaccine Resistance. *The University of Chicago Law Review, 89*(6), 1605–1654.

Jordan, J. J., Yoeli, E., & Rand, D. G. (2021). Don't get it or don't spread it: comparing self-interested versus prosocial motivations for COVID-19 prevention behaviors. *Scientific Reports*, *11*(1), 1–17. https://doi.org/10.1038/s41598-021-97617-5

Killen, M., & Smetana, J.G. (Eds.). (2022). *Handbook of Moral Development* (3rd ed.). Routledge. https://doi.org/10.4324/9781003047247

Li, M., Taylor, E. G., Atkins, K. E., Chapmin, G. B., & Galvani, A. P. (2016). Stimulating Influenza Vaccination via Prosocial Motives. *PLoS ONE, 11*(7). doi:10.1371/journal.pone.0159780 1–15.

Luttrell, A., & Petty, R. E. (2021). Evaluations of Self-Focused Versus Other-Focused Arguments for Social Distancing: An Extension of Moral Matching Effects. *Social*

Psychological and Personality Science, 12(6), 946–954. https://doi.org/10.1177/1948550620947853

Marshall, J. & McAuliffe, K. (2022). Children as assessors and agents of third-party punishment. *Nature Reviews Psychology, 1*(6), 334-344.

Nickerson, A., Gutierrez-Mock, L., Buback, L.,Welty, S., Anicete, L. M., Sanchez, S., Enanoria, W. T. A. & Reid, M. (2023). Factors Influencing Parent and Guardian Decisions on Vaccinating Their Children Against SARS-CoV-2: A Qualitative Study. *Inquiry, 60*. doi: 10.1177/00469580231159742

Probst, S., Nowack, A., & Wamrneken, F. (2023). Children's moral reasoning about self- versus other-benefiting public health measures. *Journal of Experimental Child Psychology, 229*. https://doi.org/10.1016/j.jecp.2022.105623

Reddinger, J. L., Charness, G. & Levine, D. (2022) Prosocial motivation for vaccination. *medRxiv*. doi: 2022.04.21.22274110.

Roccato, M., & Russo, S. (2023). A new look on politicized reticence to vaccination: populism and COVID-19 vaccine refusal. *Psychological Medicine, 53*, 3769–3770. https://doi.org/10.1017/S0033291721004736

Rosenfeld, D. L. & Tomiyama, A. J. (2022). Jab my arm , not my morality : Perceived moral reproach as a barrier to COVID-19 vaccine uptake. *Social Science & Medicine, 294.* https://doi.org/10.1016/j.socscimed.2022.114699

Smetana, J. G., & Ball, C. L. (2019). Heterogeneity in children's developing moral judgments about different types of harm. *Developmental Psychology, 55(6),* 1150–1163. https://doi.org/10.1037/dev0000718

Szilagyi, P. G., Shah, M. D., Delgado, J. R., Thomas, K., Visueta, N., Cui, Y., Vangala, S., Shetgiri, R., & Kapteyn, A. (2021). Parents' intentions and perceptions about COVID-19 vaccination for their children: Results from a national survey. *Pediatrics, 148*(4). doi: 10.1542/peds.2021-052335

Tang, M. Y., Shahab, L., Robb, K. A., & Gardener, B. (2016). Are parents more willing to vaccinate their children than themselves? *Journal of Health Psychology, 21*(5), 781–787. doi: 10.1177/1359105314539527

Turiel, E. (2015). Moral development. In: Lerner RM et al. (eds) *Handbook of child psychology and developmental science*, *7th edition.* Wiley, pp. 484-522.

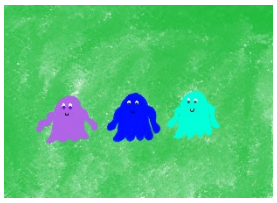
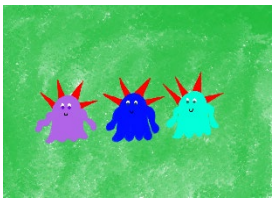
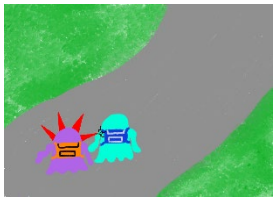
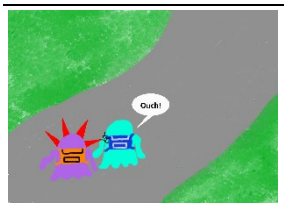
Wolfe, R.M. & Sharp, L. K. (2002). Anti-vaccinationists past and present. *BMJ, 325*(7361), 430-2. doi: 10.1136/bmj.325.7361.430

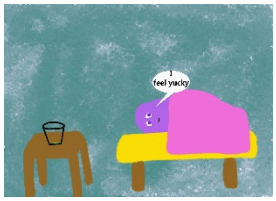
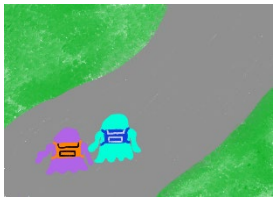
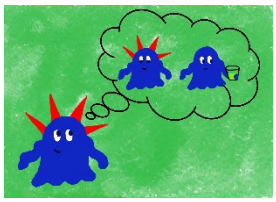
Appendix B: Supplemental Material for Chapter 4

Figure 4.A1. The four alien types for Study 1. The top row represents the initial state of each alien, and the bottom row represents the aliens once their spikey extremities have emerged.

Table 4.A1

Visual and narrative stimuli and dependent measures as presented to participants in Study 1, using the Furpee alien type, other-oriented framing, and high severity as an illustrative example. Alien type and order of conditions are counterbalanced between subjects.

Image	**Narrative**	**Dependent Measure** *Question* & [answer format]
	On the planet of Toma, there is an alien called a Furpee.	
	The Furpees have red spikes that come out of their bodies sometimes. They do not know when the red spikes will come out, and they can't control them.	
	Sometimes when the Furpees' spikes come out, they poke other Furpees. This purple Furpee poked the blue Furpee when their spikes came out while they were walking to school.	
	Ouch! The blue Furpee is hurt because the spikes are sharp and pokey. The purple Furpee is not hurt, but the blue Furpee is hurt.	**Manipulation Checks** *Who does the Furpee poke?* [themselves/other Furpees] *Does it hurt when the Furpee pokes other Furpees?* [yes/no]
	There is a special medicine the Furpees can take. The special medicine makes it so that their spikes don't come out anymore.	

	But when the Furpees take the medicine it makes them feel yucky and they have to stay in bed for one whole day. The purple Furpee took the special medicine.	**Comprehension Check** *How do you think they feel?* [yucky/ not yucky]
	The purple Furpee says they feel yucky.	
	When the Furpee takes the special medicine, their spikes don't come out anymore, and they don't poke other Furpees. The purple Furpee took the special medicine, so now their spikes don't come out and they don't poke the blue Furpee anymore when walking to school. The purple Furpee felt yucky, but now the blue Furpee doesn't get poked.	
	This blue Furpee is deciding what to do. On the one hand, taking the special medicine keeps their spikes from coming out and poking other Furpees. On the other hand, the medicine makes them feel yucky.	**Endorsement:** *What do you think? Should the Furpee take the medicine?* [yes/no]
	This blue Furpee decided NOT to take the medicine.	**Rating of Aliens' Action***: Do you think what the blue Furpee did was good, bad, or just OK?* [If good/bad] *Was it a little good/bad, or very good/bad?* **Rating of Aliens' Friendship Quality:** *Do you think the blue Furpee is a good or bad friend? A little good/bad, or very good/bad?* **Rating of Aliens' Smartness:** *Do you think the blue Furpee is smart or not smart? A little*

		smart/not smart, or very smart/not smart?
	This orange Furpee decided to take the medicine.	**Rating of Aliens' Action***: Do you think what the orange Furpee did was good, bad, or just OK?* [If good/bad] *Was it a little good/bad, or very good/bad?* **Rating of Aliens' Friendship Quality:** *Do you think the orange Furpee is a good or bad friend? A little good/bad, or very good/bad?* **Rating of Aliens' Smartness:** *Do you think the orange Furpee is smart or not smart? A little smart/not smart, or very smart/not smart?*
		**Friend Choice:** *Which of the two Furpees would you rather be friends with?* [Blue/Orange] **Smarter Choice***: Which of the two Furpees is smarter?* [Blue/Orange]

Study 1 Smartness Variables

Two of our dependent variables for Study 1 assessed alien smartness, originally intended as a check to see if children responded differently to these measures of competence than the social-moral measures. Because these variables were not central to our aims and hypotheses, we removed their description and results from the main text of the manuscript, yet include them here for transparency.

Method

A 4-point Likert scale assessed how children perceived the alien's Smartness: *"Do you think the [alien] is smart or not smart? A little smart/not smart, or very smart/not smart?"*. As with the Action Rating and Friendship variables, we calculated a difference score by subtracting the Violator rating from the Follower rating.

After seeing the Follower and Violator side by side and choosing which alien the children would rather be friends with (Friend Choice), we also asked children to choose which alien was smarter (Smarter Choice).

Results

Smartness Rating. We aimed to see how our predictors would influence the difference in children's ratings of how smart the Follower and Violator aliens were. Children rated the Follower and Violator on a 4-point Likert scale from not very smart to very smart, and we computed a difference score by subtracting the Violator score from the Follower score. Results showed that children rated the Follower slightly higher, with a mean difference score of .71, and most children only utilized the response options of "a little smart" and "very smart" in their ratings. After building a linear mixed effects model with the same predictors as the other variables and the difference score in smartness ratings as the dependent variable, the full model

differed from the null model (X^2 (5) = 29.53 p < .001). We found a significant main effect of severity (X^2 (2) = 27.47, p < .001) and an interaction between age and severity: younger children rated the Follower as smarter than the Violator regardless of condition, but with age children rated the aliens more similarly in the low severity condition (X^2 (1) = 12.96, p < .001). There was no effect of framing nor an interaction between severity and framing.

Smarter Choice. We were interested in whether severity and framing impacted children's choice of which alien was smarter. Overall, 75% of children chose the Follower as the smarter alien, suggesting that regardless of condition, children think it is smart to take the medicine. We built a generalized linear mixed model to test whether our predictors influenced children's binary choice of which alien (Follower, Violator) was smarter. The full model differed from the null model, so we proceeded with model comparisons (X^2 (5) = 69.15, p < .001). We found a significant main effect of severity, (X^2 (2) = 56.79, p < .001), a main effect of age(X^2 (1) = 11.17, p < .001), and an interaction between age and severity: Older children tended to choose the Follower alien less than younger children overall, and especially in the low severity condition (X^2 (1) = 4.20, p = .04). There was no effect of framing, and no interaction between framing and severity.

Table 4.A2

Estimates and standard errors (s.e.) of fixed effects in LMMs/GLMMs for each dependent variable in Study 1. Baselines were set as the following: Framing = Self-Oriented; Severity = Low.

	Endorsement	**Action Rating**	**Friendship Quality**	**Friend Choice**
(Intercept)	0.06 (2.28)	2.90 (1.11)**	0.82 (0.20)***	-0.78 (2.20)
Trial	-0.03 (0.54)	-0.17 (0.30)	0.07 (0.19)	-0.03 (0.57)
Severity	-5.84 (2.83)*	0.42 (1.41)	-0.50 (0.19)*	-6.70 (2.87)*
Age	-0.34 (0.30)	-0.11 (0.13)		-0.23 (0.27)
Framing	-1.19 (2.79)	-1.55 (1.39)	-0.05 (0.19)	-4.56 (3.01)
Severity*Age	1.12 (0.38)**	-0.26 (0.17)		1.09 (0.36)**
Severity*Framing	0.93 (3.72)	2.28 (2.00)	0.11 (0.27)	5.86 (4.01)
Severity*Age*Framing	-0.20 (0.47)	-0.20 (0.24)		-0.67 (0.48)
Log Likelihood	-107.94	-465.59	-376.52	-104.58
Num. obs.	233	233	233	232
Num. groups: subject	60	60	60	60

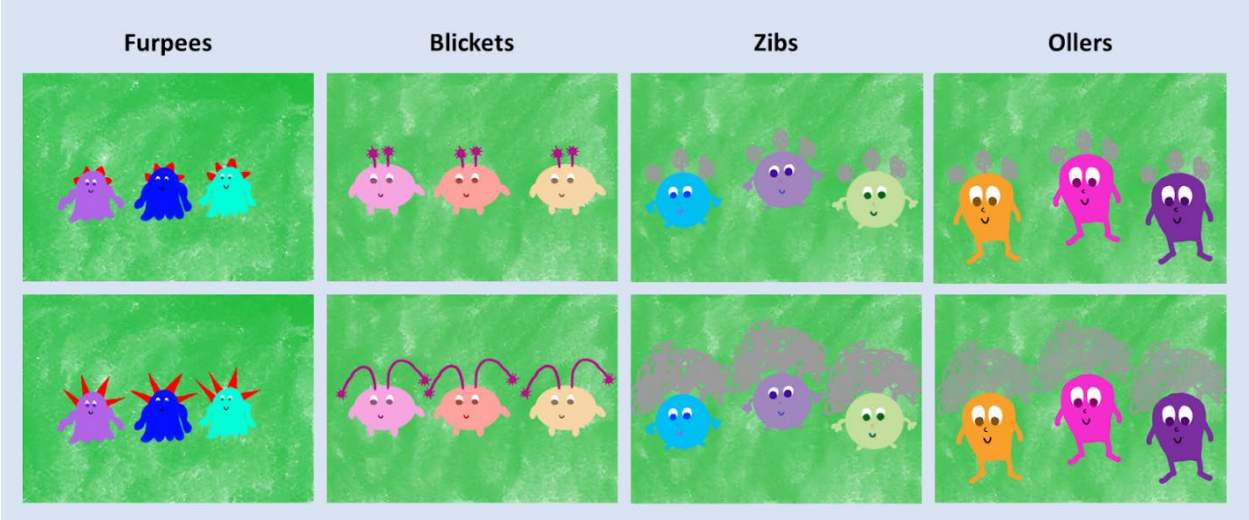
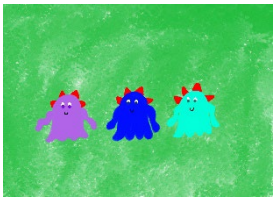
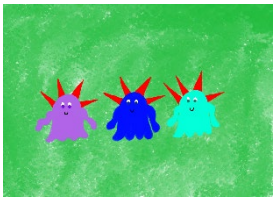
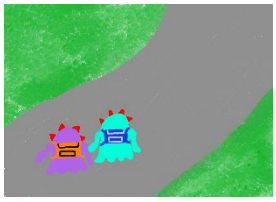
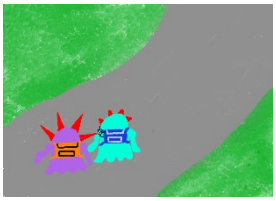
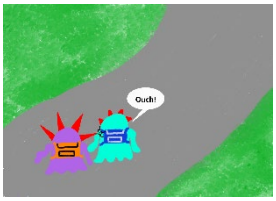
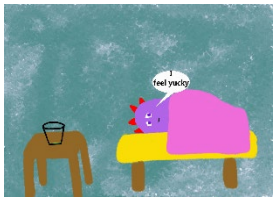
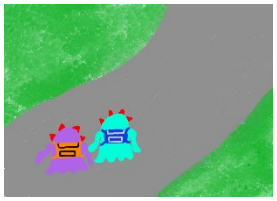
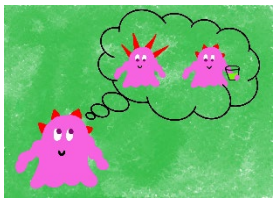
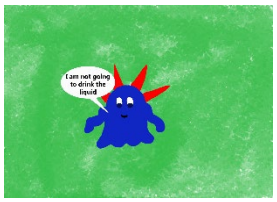


Figure 4.A2. The four alien types for Study 2. The top row represents the initial state of each alien, and the bottom row represents the aliens once their spikey extremities/extra gas have emerged.

Table 4.A3

Visual and narrative stimuli and dependent measures as presented to participants in Study 2 using the Furpee alien type, other-oriented condition, and high severity condition as an illustrative example. Alien type and order of conditions were counterbalanced between subjects.

Image	Narrative	Dependent Measure *Question* & [answer format]
	On the planet of Toma, there is an alien called a Furpee. The Furpees have small red spikes on their bodies.	
	Sometimes, the spikes on the Furpees' bodies get bigger. The Furpees do not know when this will happen, and cannot control it.	
	Sometimes when the Furpees' spikes get bigger, they poke other Furpees. This purple Furpee poked the blue Furpee when their spikes got bigger while they were walking to school.	
		
	Ouch! The blue Furpee is hurt because the spikes are sharp and pokey. The purple Furpee is not hurt, but the blue Furpee is hurt.	**Manipulation Checks** *Who does the Furpee poke?* [themselves/other Furpees] *Does it hurt when the Furpee pokes other Furpees?* [yes/no]
	There is a green liquid the Furpees can drink. The green liquid makes it so that their spikes don't get bigger anymore.	

	But when the Furpees drink the green liquid, it makes them feel yucky and they have to stay in bed for one whole day. The purple Furpee drank the green liquid.	**Comprehension Check** *How do you think they feel?* [yucky/ not yucky]
	The purple Furpee says they feel yucky.	
	When the Furpee drinks the green liquid, their spikes don't get bigger anymore, and they don't poke other Furpees. The purple Furpee drank the green liquid, so now their spikes don't get bigger and they don't poke the blue Furpee anymore when walking to school. The purple Furpee felt yucky, but now the blue Furpee doesn't get poked.	
	This pink Furpee is deciding what to do. On the one hand, drinking the green liquid keeps their spikes from getting bigger and poking other Furpees. On the other hand, the liquid makes them feel yucky.	**Endorsement:** *What do you think? Should the Furpee drink the green liquid?* [yes/no]
	This blue Furpee decided NOT to drink the liquid.	**Rating of Aliens' Action***: Do you think what the blue Furpee did was good, bad, or just OK?* [If good/bad] *Was it a little good/bad, or very good/bad?* **Justification:** *Why do you think what the blue Furpee did was good/bad/just OK?* **Rating of Aliens' Friendship Quality:** *Do you think the blue Furpee is a good or bad friend? A little good/bad, or very good/bad?*

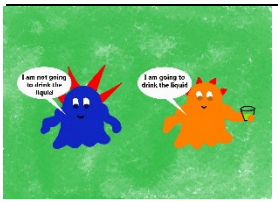
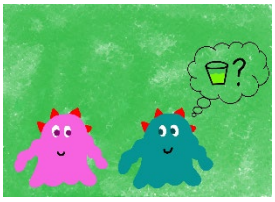
	This orange Furpee decided to drink the green liquid.	**Rating of Aliens' Action***: Do you think what the orange Furpee did was good, bad, or just OK?* [If good/bad] *Was it a little good/bad, or very good/bad?* **Justification:** *Why do you think what the orange Furpee did was good/bad/just OK?* **Rating of Aliens' Friendship Quality:** *Do you think the orange Furpee is a good or bad friend? A little good/bad, or very good/bad?*
		**Friend Choice:** *Which of the two Furpees would you rather be friends with?* [Blue/Orange]
	The pink Furpee drank / did not drink the green liquid. Their friend is also deciding what to do, and the pink Furpee wants them to drink / not drink the green liquid too.	**Persuasion**: *What do you think the pink Furpee will say to their friend to convince them to drink/ not to drink the green liquid?*

Table 4.A4

Estimates and standard errors (s.e.) of fixed effects in LMMs/GLMMs for each dependent variable in Study 2. Baselines were set as the following: Framing = Self-Oriented; Severity = Low.

	Endorsement	**Action Rating**	**Frienship Quality**	**Friend Choice**
(Intercept)	-3.27 (0.94)***	-0.57 (1.02)	0.16 (0.80)	-0.05 (3.97)
Trial	-0.90 (0.68)	0.63 (0.26)*	0.18 (0.18)	-1.11 (0.71)
Framing	-0.10 (0.46)	1.79 (0.90)*	2.23 (0.88)*	-2.64 (4.18)
Severity	3.01 (0.67)***	-1.09 (0.18)***	-0.88 (0.88)	5.20 (4.00)
Age		0.26 (0.12)*	0.12 (0.10)	-0.52 (0.53)
Framing*Age		-0.25 (0.11)*	-0.31 (0.11)**	0.44 (0.54)
Severity*Framing			-1.01 (1.26)	-2.57 (5.16)
Severity*Age*Framing			0.12 (0.15)	0.31 (0.66)
Log Likelihood	-99.37	-456.65	-368.55	-86.56
Num. obs.	236	236	236	236
Num. groups: subject	60	60	60	60

Table 4.A5

Coding categories with descriptions and examples for the free-response questions (Justification and Persuasion) in Study 2.

Category	**Description**	**Example**
Personal cost of the liquid	Focuses on the cost of the liquid for the alien drinking it (they will feel yucky, have to stay in bed, miss school)	"Because they are going to be yucky and stay in bed for a whole day"
Harm to others	Focuses on the harm to others prevented by drinking the liquid	"Because then they won't poke other Furpees"
Harm to self	Focuses on the harm to the self prevented by drinking the liquid	"Because it can poke themselves and it will hurt"
Cost-benefit analysis	Explicitly weighs the benefits and costs of taking the liquid, or implies this through use of phrases such as "worth it"	"Because it's just one day and you can catch up in school and when the smoke is a lot it hurts so you should drink the liquid."
Relationships	Invokes relationships, either by discussing the effect on the alien's friends or how the alien's friends will react to their decisions	"He'll say that if he doesn't drink the orange liquid no one will be friends with him because they'll just get hurt and cough"
Bodily Autonomy	Discusses the alien's right to choose for themselves	"Because it's your antennas and you get to decide what to do with it"
No/ Simplistic Response	Does not provide a rationale, either by giving no explanation at all, by simplistically restating part of the prompt, or (for Persuasion questions) directly telling the alien what to do	"I don't know" ;"Because he drank the liquid"; "Drink the liquid, now!"

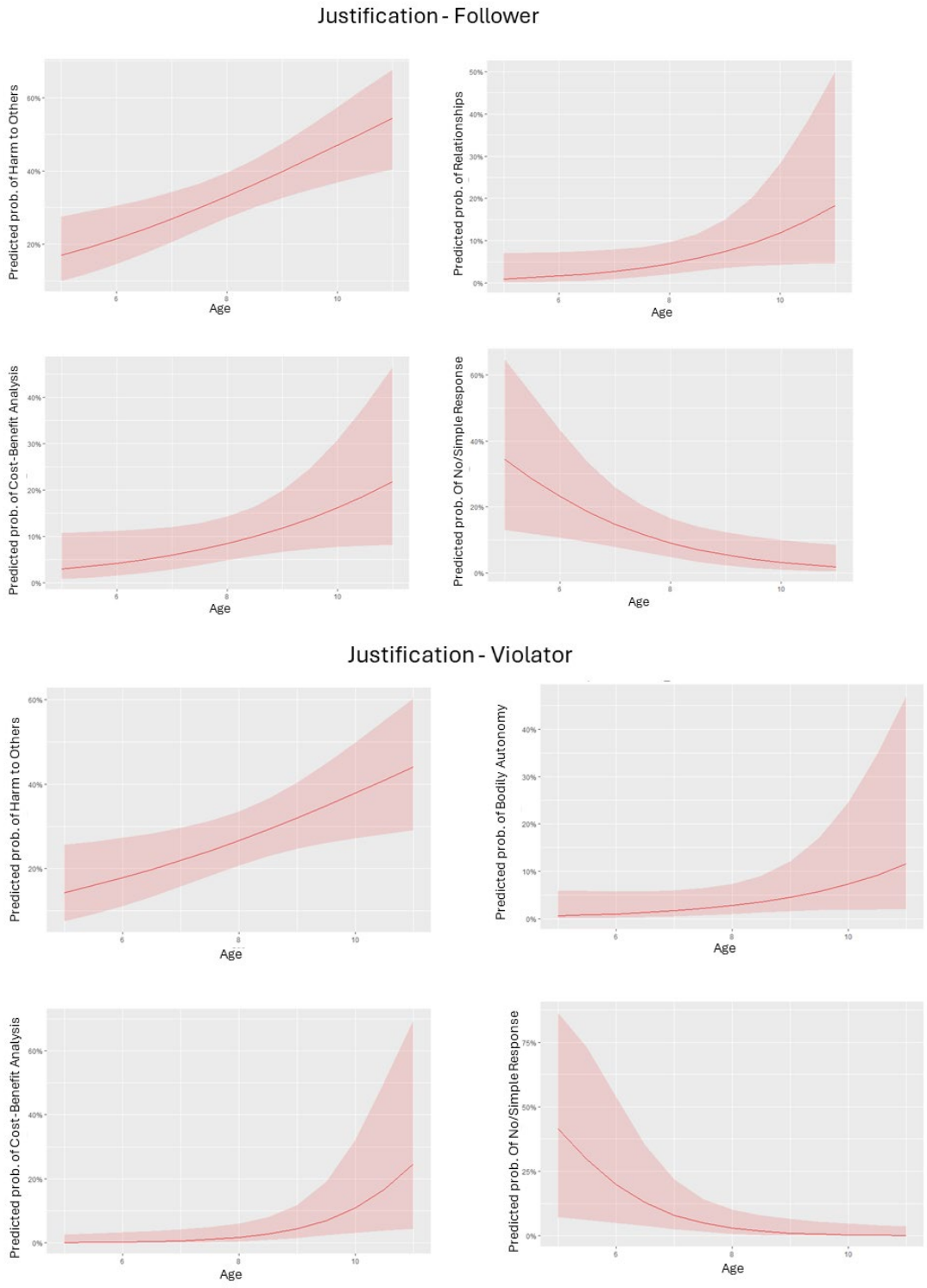


Figure 4.A3. Regression plots for each of the coding categories that were significant for the Justification question.

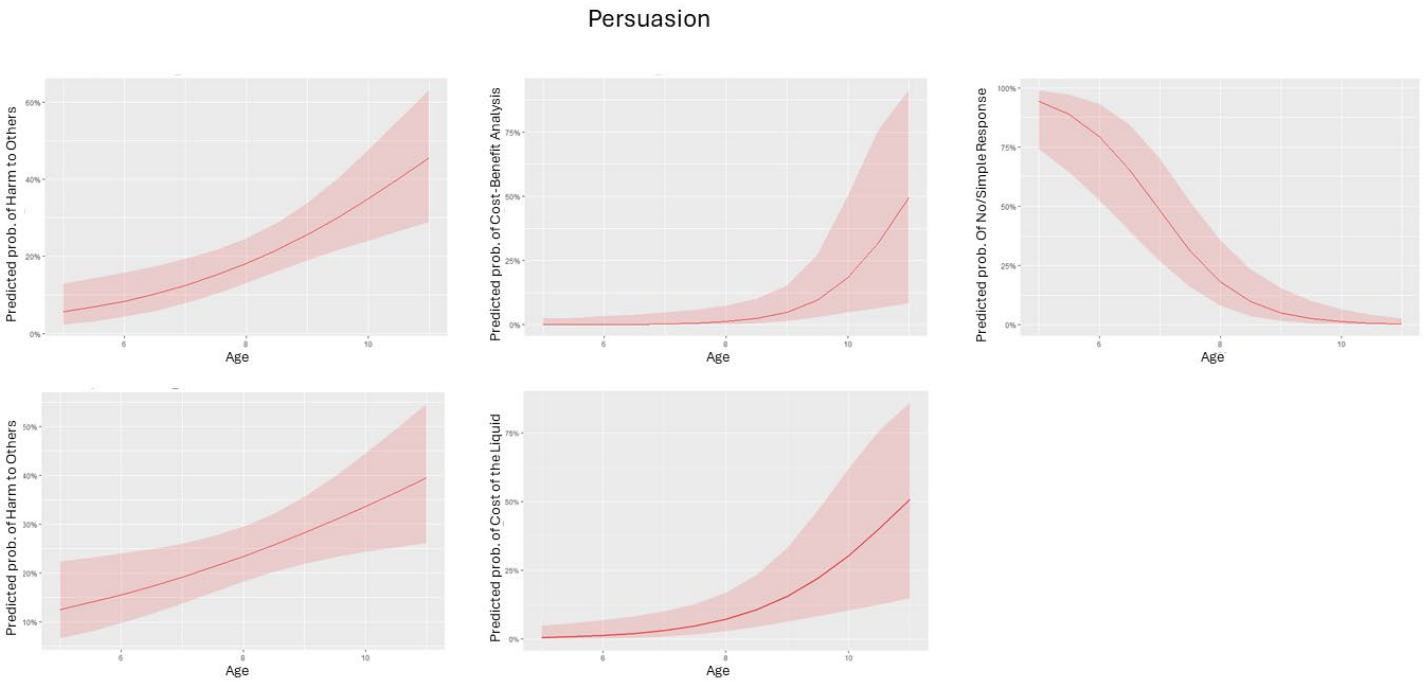


Figure 4.A4. Regression plots for each of the coding categories that were significant for the Persuasion.

Chapter 5: Conclusion

Through this dissertation, I have demonstrated that a) young infants can help when given a motorically appropriate way to do so, and that b) tapping into children's prosocial inclinations can have important implications for their reasoning about public health measures such as masking and vaccination. I have contributed to the research field by developing a novel way to study infant helping and shedding some light on the origins of helping behavior, and by applying prosocial and moral research with children to a novel public-health context. These projects showcase the breadth of methodology and subject matter I have explored during my doctoral experience.

In *Chapter 2*, I presented my studies on infant helping behavior. In the first of these studies, we found that infants removed a barrier more when that barrier blocked an agent's goal than when it blocked a non-goal object. This constitutes initial support for the predisposition hypothesis: infants helped a character in a novel situation they had never seen before, making it impossible for socialization to have had an effect. However, one might argue that this behavior was not genuine helping but instead due to infants looking at the button that was in the area of the screen they had already been looking at.

We ran our second study with the aim to rule out this alternative hypothesis: we designed a new version with only one button and conditions that varied whether the goal object was in front of or behind the wall. We found no difference between our conditions, making it difficult to rule out this alternative hypothesis. However, in our attempt to control for one issue, we may

have introduced another by making the conditions too similar and too engaging for the infants. Further research is thus needed to clarify the nature of our results.

While we had mixed findings in Chapter 2, our initial evidence suggests that infants may be motivated to help others. More importantly, my development and successful implementation of this novel way to study infant cognition and behavior provides the field with the necessary tools to further investigate this and other questions. Future studies can not only continue to parse the nature of infant prosocial behavior, but can also use this complex type of gaze-contingency paradigm to investigate other outstanding issues of infant cognition. Thus, in addition to my theoretical contributions, I make significant methodological contributions as well.

In *Chapter 3*, I presented my studies on framing and mask-like behaviors. Across these studies, I demonstrated the utility of hypothetical alien vignettes for investigating children's reasoning about novel public-health measures without the influence of their preexisting beliefs. We found that children endorsed these novel mask-like behaviors at high rates when they protected either the self or others from more severe harm. We further found that children reasoned about followers and violators of this behavior in moral terms when the behavior was framed as protecting others.

The studies in Chapter 3 were the first to examine how children's prosocial and moral tendencies could be applied in a public-health context. As these studies were conducted during the COVID-19 pandemic, understanding how children thought about protective health behaviors was a temporally relevant question. I contributed both to the literature on public-health measures as well as to the literature on children's socio-moral cognition by demonstrating the moralizing effects of other-oriented framing on children's reasoning about public-health measures.

In *Chapter 4*, I examined these same questions in the context of vaccination. Across two studies, we demonstrated that children highly endorsed vaccine-like behaviors when they protected the self or others from severe harm. We also found age effects, with the younger children in our sample attending less to severity and framing and the older children taking these contexts into account in their evaluations of others. Specifically, older children think of these behaviors in moral terms when they are framed as protecting others.

As in Chapter 3, the studies in Chapter 4 apply our understanding of children's socio-moral reasoning and prosocial propensity to a public-health context, this time focusing on the relevant issue of vaccination. Vaccination is an issue that has been in the public eye for a long time, with childhood vaccination often being a source of controversy. Yet, few studies investigate children's own reasoning about vaccination. These studies are thus a timely contribution and help us better understand how messaging emphasizing the benefits of vaccination for the self or others can cause older children to think about vaccination as a moral issue.

To conclude, across these studies I made contributions to our understanding of the prosociality of infants and children, and also to the methods we use to study these concepts. I shed light on the origins of prosocial behavior by demonstrating initial evidence of helping in young infants. I also found evidence that messaging about protective behaviors that emphasizes the effects for others can induce moral thinking among children, demonstrating that children's prosociality can be leveraged in a public-health context.