Journal of Experimental Psychology: General

ISSN: 0096-3445

2024, Vol. 153, No. 7, 1887–1903
https://doi.org/10.1037/xge0001605

Is It Personal or Is It Social? The Interaction of Knowledge Domain and Statistical Evidence in U.S. and Chinese Preschoolers' Social Generalizations

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Children make inferences about the social world by observing human actions. However, human actions can be ambiguous: They can be sources of information about personal, idiosyncratic characteristics of individuals or socially shared knowledge. In two cross-cultural studies ($N = 420$; $M_{age} = 4.05$ years, $SD = 0.77$, 47% female), we ask if U.S. and Chinese children's inferences about whether an action is personal or social vary by domain, statistical evidence, and culture. We did this with a generalization method: Preschoolers learn about one agent's actions and then are asked what they think a new agent will do. Low rates of generalization suggest children inferred something unique to an individual, while high rates suggest that children inferred that the action represented socially shared knowledge. In a mixed between- and within-participant design, children observed agents demonstrate sequences of statistically random (or nonrandom, between participants) actions that were verbally framed as relevant to a particular domain (agent's personal preferences, labels, object functions, or game rules). We found that children's social generalizations about actions were on a continuum: with linguistic conventions (e.g., labels) being the most social, preferences being the most personal, and nonlinguistic conventions (i.e., object functions, game rules) falling somewhere in between. Furthermore, the influence of statistical evidence and cultural variation varied for each domain. These findings highlight how children combine knowledge and evidence to infer social meaning from actions and have implications for rational constructivist accounts of cultural learning.

Public Significance Statement

We show that U.S. and Chinese preschoolers (3- to 5-year-olds) combine prior knowledge with evidence to infer whether an action is representative of an individual's idiosyncratic preferences or of norms and conventions of an entire social group. Specifically, preschoolers do not generalize actions framed as preferences of a single individual to other individuals but have strong prior beliefs that actions framed as labels and object functions will generalize across individuals. Notably, preschoolers' generalizations of actions framed as rules of games fall somewhere in the middle and are moderated by cultural background and statistical evidence.

Keywords: social cognition, cultural differences, social generalizations, statistical inference, rational learning

Supplemental materials: https://doi.org/10.1037/xge0001605.supp

This article was published Online First May 2, 2024.
Rachel Wu served as action editor.
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This research was supported by the National Science Foundation Behavioral and Cognitive Science (BCS) Program (BCS-1823658), the Chenguang Program of the Shanghai Education Development Foundation, and the Shanghai Municipal Education Commission (22CGA28). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the article. We thank Rachel Marciano, Doreen Wu, Aprile Bertomo, and Mathew Lin for their work as undergraduate research assistants. We also thank all the families and the local schools, after-school programs, and museums for participating in this research. We declare no competing interests. Preregistrations, materials, data, and analyses are available on the project's OSF page at https://osf.io/a78xs/ (Flanagan et al., 2024). The data and ideas of Study 1 were presented as a poster at the Cognitive Development Society Conference in 2019. The data and ideas of Studies 1 and 2 were presented as a talk at the Society for Research in Child Development Biennial Meeting in 2021.

Teresa Flanagan served as lead for formal analysis, methodology, writing–original draft, and writing–review and editing and served in a supporting role for conceptualization. Xin (Alice) Zhao served in a supporting role for conceptualization, writing–original draft, and writing–review and editing. Fei Xu and Tamar Kushnir served as lead for conceptualization and served in a supporting role for writing–original draft and writing–review and editing. Teresa Flanagan and Xin (Alice) Zhao contributed equally to investigation. Xin (Alice) Zhao, Fei Xu, and Tamar Kushnir contributed equally to funding acquisition.

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Human actions convey an enormous amount of social meaning for children, and children's learning about the social world involves observing actions and making inferences about agents' intentions and goals (Csibra & Gergely, 2009; Gopnik et al., 1999; Tomasello, 2019). However, there exists a challenge for young learners due to the inherent ambiguity of goal inference: Familiar individuals (such as caregivers) are both a source of rich information about individuals' personal, idiosyncratic characteristics (e.g., preferences, beliefs, personality traits) and a source of sociocultural information that is generalizable across members of a community (e.g., norms, conventions, rules). For example, when a child watches his mother clap her hands when she is happy, it could mean that that is how she expresses herself when she is happy or what she likes to do. It could mean that is how people in her social group express themselves when they are happy or that clapping this way is a rule, norm, or ritual behavior. The problem for young learners, then, goes beyond figuring out which observable actions are meaningful. Young learners also have to figure out what the meaning is—is this person showing me something about their own idiosyncratic preferences? Or are they showing me a useful piece of cultural information—perhaps a norm that the child must also follow, and expect others to follow?

A key challenge of children's social learning, therefore, is to learn which actions are motivated by idiosyncratic, personal characteristics that are unique to an individual and which actions have normative, social, or cultural motives that apply to broader social groups. One solution to this challenge that has been proposed is rational learning (e.g., Fedyk & Xu, 2018; Gopnik & Wellman, 2012; Sobel & Kushnir, 2013; F. Xu, 2019; F. Xu & Kushnir, 2013): Infants and children combine what they know about actions with new evidence to make the best guess about the likelihood that the patterns of actions that they see are individually or socially meaningful. To evoke children's prior knowledge about actions, an important cue is the contextual framing, either verbal or nonverbal (Butler & Markman, 2012; Roberts et al., 2017). Actions can be framed as idiosyncratic preferences, for example, by stating "this is what I like!" or providing positive emotional cues (e.g., Kushnir et al., 2010). Similarly, actions can be framed as various types of social knowledge such as norms, rules, object functions, rituals, or any number of socially shared events (Butler & Markman, 2012; Csibra & Gergely, 2009; Gelman & Heyman, 1999; Rakoczy et al., 2008; Roberts et al., 2017; Vredenburgh et al., 2015).

Within socially meaningful contextual frames, children then incorporate statistical evidence (Garvin & Woodward, 2015; Heck et al., 2021; Kushnir et al., 2010; F. Xu & Kushnir, 2013). For example, Kushnir et al. (2010) found that when 2- to 4-year-old children see an agent sample five similar objects out of a box (framed as "things he likes") in which the objects are the minority (had a low probability of being sampled by random chance), children infer that the agent selected those toys preferentially. Despite similar framing, children did not infer a preference when the object sampled was in the majority (had a high probability of being sampled by random chance). The nonrandom sample was a signal of the agent's intention, but, as discussed above, intent itself does not definitively suggest a particular reason. Instead, the reason is given by the frame. As such, previous research has found that children use nonrandom samples of actions, appropriately framed, to make inferences about a variety of personal and social domains, including preferences (Diesendruck et al., 2015; Garvin & Woodward, 2015; Heck et al., 2021; Kushnir et al., 2010; Ma & Xu, 2011), social status (Eason et al., 2019; Heck et al., 2021), object functions (Waismeyer et al., 2015), and word learning (F. Xu & Tenenbaum, 2007).

It is also important to consider the influence of broader contexts, such as our culture, on our beliefs about personal and social actions. Research in cultural psychology (Hofstede, 1983; Kitayama et al., 2004; Markus & Kitayama, 1991; Miller et al., 2011; Morris & Peng, 1994; Oyserman et al., 2002; Roets et al., 2014; Savani et al., 2010; Triandis, 1995) has identified notable cultural differences between individualistic Western cultures (e.g., United States, Canada) and collectivistic East Asians cultures (e.g., China, Japan). Specifically, adults from Western cultures tend to have an analytic cognitive approach and view the self as independent of one's social relationships and thus are more likely to interpret actions as personally motivated. Adults from East Asian cultures, however, tend to have a holistic cognitive approach and view the self in relation to one's social relationships and thus are more likely to interpret actions as socially motivated (Kitayama et al., 2004; Miller et al., 2011; Nisbett & Miyamoto, 2005; Nisbett et al., 2001; Roets et al., 2014; Savani et al., 2010).

It remains an open question, however, how early such cultural differences influence young children's learning. Prior work has found differences between Western and East Asian cultures in how parents talk to their 3- to 4-year-old children about social roles and events—either focusing on the aspects of an individual thing or on the relationship between things (Senzaki et al., 2016; Wang, 2006; Wang & Fivush, 2005). Similarly, previous work suggests that there is more of an emphasis on personal choice in the United States compared to Asian children when it comes to evaluating one's personal, conventional, or even moral actions (Chernyak et al., 2013; Wente et al., 2016; Zhao & Kushnir, 2019). These literatures suggest there might be an early-emerging cultural bias toward interpretations of one individual's actions as signals of personal preferences and other unique characteristics in the United States, and an opposite bias toward socially shared or normative interpretations of actions in East Asia. These cultural biases may be most prominent in situations of relative ambiguity, such as when either an individual or social interpretation is equally likely.

To date, another question that remains an open question is how children integrate these two types of prior knowledge—knowledge about specific action domains and cultural beliefs about actions—with statistical evidence in their social generalizations. In this project, we look at whether preschoolers from two cultures (the United States and China) generalize an agent's action differently depending on the statistical regularities of the action and the way the action is framed. We focus specifically on comparing actions that are ambiguous with respect to how personal or socially shared they are (e.g., object functions and game rules) to actions that are more clear-cut cases at either end (e.g., personal preferences at one end, language—a conventional system of communicative signals by definition—on the other). Our hypothesis is that even if learners only observe the patterns of actions of one individual, combining the evidence with prior knowledge can suggest whether the actions are more likely to be idiosyncratic and personal or generalizable and social.

Labels (Words) Versus Preferences

As early as infancy, we have an expectation that language is a kind of action that is shared across individual members of the same social/

linguistic group. For example, after watching one person label an object, 9-month-old infants and toddlers expect a new person to use the same label for the same object, even if the person was not present when the object was originally labeled (Buresh & Woodward, 2007; Diesendruck & Markson, 2001; Henderson & Woodward, 2012). In contrast, infants and children most often infer that preferences do not generalize from one individual to another (Buresh & Woodward, 2007; Doan et al., 2021; Henderson & Woodward, 2012; Kalish, 2012; Roberts et al., 2017). This distinction between words and preferences is further supported by findings suggesting that 16-month-old infants do not think labels can change (Koenig & Echols, 2003), but children understand that preferences can change over time (Bélanger et al., 2014; Gelman & Heyman, 1999; Lee & Atance, 2016). Finally, there is evidence that both infants and young children view language as a signal of group membership, inferring that people who use the same language also belong to the same group and share other types of cultural knowledge (Kinzler et al., 2007, 2009; Liberman et al., 2017).

Though the contrast between language as a cultural convention and preferences as idiosyncratic and personal is often clear, there are also exceptions. For example, infants expect people in the same group to share the same food preferences (Liberman et al., 2016), as food is a culturally relevant domain and can be viewed as more similar to language than personal taste. Statistical evidence can also change children's beliefs about shared preferences; preschoolers judge preferences to be socially shared if they see two or more people from the same social group express interest in a statistically rare item (Diesendruck et al., 2015; Roberts et al., 2017). By the age of 9, children begin to view some preferences as an essential quality of a social group (Gelman et al., 2007). These examples suggest that there are some actions that might be interpreted as personal preferences but might also be ambiguous.

Nonlinguistic Conventions

Evidence suggests that children also expect certain nonlinguistic actions to be socially shared (or "social conventions," see Diesendruck & Markson, 2011). One such case that has been extensively studied is object functions. For example, when toddlers and preschool children learn that an object has a particular function, they do not try to see if the object has other functions (Bonawitz et al., 2011), they expect new people they meet to also know the function (Casler & Kelemen, 2005), and they extend the object's function only to other exemplars of the same object category (Childers & Tomasello, 2003). Along these lines, it is reasonable to assume that, once children have established an action as the intended function of an object, they would predict that this action generalizes across individuals.

How then might children establish that nonverbal actions on objects are social conventions, and not arbitrary or idiosyncratic to particular individuals? Research shows that children infer the social nature of object functions by paying attention to how these actions are framed. For example, a few studies show that toddlers notice intentional teaching by adults as a cue that a property of an object is likely to be common knowledge, which influences their subsequent behavior toward the object (Vredenburgh et al., 2015) as well as their expectations about others' behavior (Csibra & Gergely, 2009). By age 3, intentional demonstrations of an object used by one individual can lead children to expect others to use the object in the same way and to prefer those who use the object as demonstrated over those who use it differently (Wohlgelernter et al., 2010). By the time children are in preschool, verbally framing actions using normative or generic language (Butler & Markman, 2012; Gelman & Heyman, 1999; Roberts et al., 2017) or by explicitly stating them to be "rules" (Rakoczy et al., 2008; Schmidt et al., 2016) leads to similar expectations that such actions ought to be widely known and followed.

These results suggest that children expect various nonlinguistic conventions, from object functions to rules, to have social meaning that extends beyond particular individuals. But despite their commonalities, there are also differences. For instance, children allow for the fact that some norms and rules (such as rules of games that do not rely exclusively on the affordances of particular objects) can be followed or not—depending on whether people choose to play or are ignorant of the rules for some reason (e.g., they were asleep when the rules were taught; Schmidt et al., 2016). Another unique property of rules that children appreciate is that they are context-dependent (Rakoczy et al., 2009; Smetana, 1981): Rules can be overturned by authority figures (Laupa & Turiel, 1993) or changed by their peers if their peers are the rule creators (Zhao & Kushnir, 2018).

The flexibility and context-dependence of some nonlinguistic conventions imply that even if children infer from framing that an action might be socially shared knowledge, there is still much ambiguity for young learners to resolve. First, nonlinguistic conventions come in many varieties—the functions of artifacts, social norms, games, family rituals, and school rules—and children must learn the unique social significance of each. Moreover, even when one knows that an action is socially shared knowledge, there are questions about how much choice any given individual has when deciding whether they ought to conform to it (Chernyak et al., 2013, 2019; Zhao & Kushnir, 2019). Furthermore, at least in adults, the inherent ambiguity of such actions leaves them open to the influence of biased interpretations of behavior from broader cultural frameworks (Gelfand et al., 2011; Markus & Kitayama, 1991).

While many of these questions have been studied separately, to the best of our knowledge, there has not yet been a comprehensive comparison of young children's social inferences about actions framed as preferences, rules, functions, and labels using a single, unified methodology.

Overview of Project

In this project, we investigate how U.S. and Chinese preschoolers combine prior knowledge (instantiated in action "frames") with statistical patterns of action (nonrandom or random sampling) to infer whether actions are individual or socially shared. We do this by using a simple, nonverbal third-party generalization measure (e.g., Diesendruck et al., 2015; Henderson & Woodward, 2012; Kalish, 2012). In this method, children were shown one agent's actions framed to indicate what type of action it is—a demonstration of preferences (Studies 1 and 2), a new word (Study 1), an object function (Studies 1 and 2), or a rule (Study 2). Then, children were introduced to a new, unfamiliar agent. Children are then asked to predict the new agent's actions within the same framing. Low rates of generalization would suggest that children inferred that the action represents something unique to an individual (like a preference), whereas high rates

would suggest that children inferred that the action represents socially shared knowledge.[1]

In addition to investigating children's social generalizations, we also measured whether children viewed the first agent's action as restricted to a single object or applicable to many objects. We include this to check the validity of our method against findings from prior work. For example, there is work showing that children view idiosyncratic personal characteristics (e.g., preferences) as restricted to particular individuals, but unrestricted to single objects (Bélanger et al., 2014; Gelman & Heyman, 1999; Lee & Atance, 2016). Other work shows that children believe socially shared knowledge is broadly applicable to many individuals, but perhaps more restricted to single objects (e.g., mutual exclusivity of labels, Markman & Wachtel, 1988). Beyond validation, this secondary measure could also provide insight into how children handle ambiguous actions and potentially identify social actions that can be both broadly applicable and unrestricted.

We predicted that the contextual frames would invoke prior beliefs (e.g., the generalizability of language across individuals or the individual nature of preferences) that would lead to different rates of generalization even with the same observed statistical evidence. In addition, we hoped to replicate statistical learning effects found in prior work (e.g., Kushnir et al., 2010), such that children will be more likely to infer intent from selective over random sampling, but we had no specific predictions about whether these effects would extend beyond the U.S. cultural context.

We also predicted that nonlinguistic conventions such as functions and rules may invoke "mixed" beliefs where both personal and social influences might play a role. In these intermediary cases, we may be more likely to find influences of culture on the generalizability of actions across individuals. For example, considering cross-cultural work with adults (Kitayama et al., 2004; Miller et al., 2011; Nisbett & Miyamoto, 2005; Nisbett et al., 2001; Roets et al., 2014; Savani et al., 2010), we may find that Chinese children are more willing to generalize nonlinguistic conventions across individuals than U.S. children.

Study 1

In the first study, we compared U.S. and Chinese children's learning and generalizations from statistical patterns of evidence across three types of action "frames" (within participants). On one extreme, actions were framed as preferences (what an agent likes). On the other, actions were framed as labels (what an object is called). In between these two, actions were framed as object functions (what makes a toy light up and make sounds). Within each of these frames, children watched a puppet sample of five toys of the same type from a minority (20%) of objects or a majority (80%, between participants). After children watched the selections, children were asked to pick which toy (the selected toy, the alternative toy, or a third, novel toy) the puppet likes, uses to make the toy light up, or is called a toma, depending on the way the actions were framed. Critically, children were then introduced to a new, unfamiliar puppet and were asked the same question again (social generalization). Our main question of interest, therefore, is whether children would generalize their inference from the first puppet to the new puppet. We also asked the children what toy they themselves would pick and what toy the first puppet liked. At the end of the study, we also asked children if the first puppet could use any of the other two toys to perform the same action, as a measure of children's property generalization.

Method

The study was approved by the Cornell University Institutional Review Board (Protocol IRB0000557) and the East China Normal Institutionnal Review Board (Protocol HR554-2019).

Transparency and Openness

A deidentified data set and analysis code for the study are available on the project's Open Science Framework (OSF) page at https://osf.io/a78xs/ (Flanagan et al., 2024). Data were analyzed using R Version 1.1.456 (R Core Team, 2022) and the packages lme4 (Bates et al., 2015) and car (Fox & Weisberg, 2019).

Participants

The final sample consisted of 72 U.S. children (3–5 years old, $M = 4.06$, $SD = 0.73$) and 87 Chinese children (3–5 years old, $M = 4.10$, $SD = 0.79$). There were 78 children in the 20% condition (United States: $N = 35$, $M = 4.06$, $SD = 0.73$; China: $N = 43$, $M = 4.05$, $SD = 0.82$) and 81 children in the 80% condition (United States: $N = 37$, $M = 4.05$, $SD = 0.74$; China: $N = 44$, $M = 4.16$, $SD = 0.78$). U.S. participants were recruited from a lab database, local preschools, and a science museum in Ithaca, New York. Only 40 parents filled out the demographic questionnaire. Of the parents that reported, 82.5% held a bachelor's degree or above, and 77.5% of the families had an income of over 50,000 USD per year. Of the parents that reported their demographic information, 11 of the children were female and 21 were male; 31 were White, two were Black/African American, two were Hispanic/Latino, and four were multiracial. All children spoke English as their native language. Four additional U.S. children participated but were excluded due to either a developmental disability or lack of compliance throughout the entire study. Data collection in the United States was stopped short as a result of the COVID-19 pandemic. Chinese participants were recruited from local preschools in Beijing ($N = 39$, $M = 4.41$, $SD = 8.74$) and Shanghai ($N = 48$, $M = 4.63$, $SD = 8.86$). Fifty of the children were female and 37 were male. Of the parents that reported ($N = 63$), 92.1% held a bachelor's degree or above, and 77.8% of the families had an income of over 200,000 RMB per year. All the children spoke Mandarin Chinese as their native language and were of the Han ethnicity.

[1] As an important caveat, the generalization measure is useful for understanding whether children think actions are individual or social but does not itself shed light on the nature of the social generalization in the latter case. Debates about how to interpret children's generalizations have existed in the literature for a long time (e.g., Casler & Kelemen, 2005; Childers & Tomasello, 2003; Diesendruck & Markson, 2001; Markman, 1989; Sabbagh & Henderson, 2007), with one perspective being that children generalize across agents because they expect all members of a social community to know the same objective facts about the world and the other perspective being that children generalize because they assume social knowledge is a matter of convention and agreement. A third perspective is that the nature of the generalization is domain-dependent, with some domains being more likely to be viewed as objective and some as conventional. Our method is not designed to inform this debate.

Materials

There were three sets of toys, one for each frame (preference, function, label), with three types of toys per set. The preference set contained small fruit toys; green apples and strawberries alternated as the target, and oranges were always the novel toy. For the U.S. sample, the function set contained foam shapes; pink circles and blue flowers alternated as the target, and yellow cylinders were always the novel toy. For the Chinese sample, the function set contained block shapes. The label set contained decorated hardware toys; colorful rubber band hooks (described as "the colorful one") and pink string screws (described as "the pink one") alternated as the target, and blue tape washers (described as "the blue one") were always the novel toy. The three boxes in the 20% condition contained a 10:40 ratio of the target to other toy (e.g., 10 apples and 40 strawberries) and the three boxes in the 80% condition contained a 40:10 ratio of the target to the other toy.

A "blicket detector" was also used in the function frame (Gopnik & Sobel, 2000). The blicket detector was an opaque box that lit up when certain objects were placed on it. A wire was connected to the detector and a switchbox. If the switchbox was pressed, the detector would light up. If the switchbox was not pressed, the detector would not light up. During the experiment, the experimenter controlled the switchbox underneath the table so that the box "turned on" as soon as the object made contact with it and continued to light up as long as the object continued to make contact with it. A black marker and orange chess piece were used with the blicket detector during the familiarization phase of the function frame.

Procedure

Each child sat individually at a table with the experimenter. The child was randomly assigned to one of two sampling conditions (20% condition or 80% condition). In the 20% condition, the box contained 20% of the target toy. In the 80% condition, the box contained 80% of the target toy. The order of the frames (preference, function, label) was counterbalanced. Each trial proceeded in the following order: introduction phase, sampling phase, and test phase.

In the function frame, the experimenter first introduced the blicket detector. The experimenter placed the blicket detector, the marker, and the chess piece on the table, and said, "This is my special toy. Some things make it light up and some things don't make it light up." Then the experimenter placed the chess piece on the blicket detector, and it lit up. The experimenter referenced the light and said, "See this makes the toy light up." Then the experimenter took the chess piece off and placed the marker on the blicket detector, and it did not light up. The experimenter referenced the lack of light and said, "See this does not make the toy light up." The experimenter reminded the child that some things make the toy light up and some things do not, then put the blicket detector, the marker, and the chess piece away.

In the introduction phase, the experimenter placed the three toys on the table and asked the child to label them. If the child could not identify the toys, descriptions were provided (e.g., the pink one, the blue one, the colorful one). The experimenter removed the toys and introduced an animal puppet (Agent A) to the child (animal puppet randomized for each frame) in relation to the frame (see Table 1). After, the experimenter brought out the box and prompted the child to label the toys in the box but made no reference to the quantity or proportion of the different toys in the box.

In the sampling phase, the experimenter told Agent A that it was his turn. Agent A removed a sample of five toys and the actions were specific to each frame (see Table 1). After Agent A removed the fifth toy, the experimenter put Agent A, the population box, and the toys away. In the test phase, the experimenter asked the child four questions in order: first agent, social generalization, self, and like.

For the first agent question, children were asked to give Agent A one of the three toys. Children's responses to this question would indicate whether they viewed Agent A's sampling behavior as intentional in the context of the domain (e.g., as preferential in the preference frame). For the focal social generalization question, the experimenter introduced a new puppet (Agent B) and asked the child to give Agent B one of the three toys. Children's responses to this primary question would indicate that children viewed Agent A's behavior as generalizable to other individuals, thus a socially shared action.

For the self-question, children were told that it was his/her turn and were asked to pick one of the three toys for themselves. Language for each of these questions was specific to the frame (see Table 1). Children's responses to this question are a possible further indication of viewing the behavior as generalizable, thus a socially shared action. For the like question, the experimenter brought out Agent A again and asked the child "which one does he like?" For the action framed as a preference, this question is a near-replication of the first agent question. For the actions framed as an object function and label, this question was added to see if children also viewed Agent A's behavior as based on preferences.

After all the trials were complete, we asked the property generalization question. The experimenter brought out the three toy types that were used for the first agent and social generalization questions one set at a time, reminded the child of his/her pick for Agent A and then asked the child if Agent A could also pick one of the other two toys (as one he "likes," uses to "make the toy go" or calls a "toma," respective to the frame (see Table 1). Children's responses to this question would indicate whether children viewed Agent A's demonstrated action as restrictive to one object only or applicable to other objects.

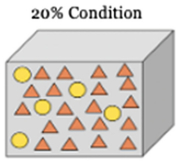
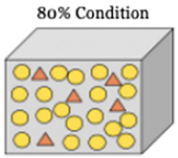
Coding

For the first agent, social generalization, self, and like questions, children's first choice was recorded. If the child picked the target toy, they received a score of 1, if the child picked the alternative or novel toy, they received a score of 0. For the property generalization question, children's yes/no response was recorded. If the child said, "yes"—that Agent A could use the other toys—they received a score of 1. If the child said, "no"—that Agent A could not use the other toys—they received a score of 0. For any of the questions, if the child said, "I don't know," the experimenter told the child that he/she can take a guess and the experimenter repeated the question. If the child continued to say, "I don't know," the experimenter moved on to the next question, and the child's answer was not coded.

Results

We were primarily interested in what information children infer from one agent's actions—what can be inferred about the agent and what can be generalized to another agent. First, we ran separate generalized models for each frame (preference, function, label), looking at

Table 1
Procedure for Study 1

Phase		Frame		
Introduction phase		Preference	Function	Label
Puppet introduction	"This is [Agent A]."	"He's going to show you some things he likes."	"He's going to show you what things make the toy light up."	"He's going to show you what things are called."
Population introduction	"There are [target toys] and [alternative toys]."			
Sample phase				
Test phase	"Remember these toys here."			
First agent question	"Remember [Agent A]."	"Can you give him the one that he likes?"	"Can you give him the one that makes the toy light up?"	"Can you give him the toma?"
Social generalization question	"This is [Agent B]. It's his turn to play."	"Can you give him the one that he likes?"	"Can you give him the one that makes the toy light up?"	"Can you give him the toma?"
Property generalization question (always at the end)	"Remember [Agent A]. You said [Agent A]…"	"…likes [toy picked by child from Agent A question]."	 "…uses [toy picked by child from Agent A question] to make the toy light up."	"…calls [toy picked by child from Agent A question] a toma."
	"Could [Agent A]…"	"…also like the other ones?"	 "…also use the other ones to make the toy light up?"	"…also call the other ones a toma?"

Note. Experimenter referred to the puppet by animal name (e.g., Mr. Monkey), as indicated by the placement of [Agent A] and [Agent B]. The self and like questions were asked after social generalization question but are not shown here. Toys and puppets varied across frames. See the online article for the color version of this table.

the effect of age (in months), sampling condition (20% vs. 80%), and culture (United States vs. China) on children's responses. For each of the models, we started with the full model including all possible two-way interactions and then removed interaction terms that were nonsignificant, running the simplest model with any significant interaction terms (results from the full models are in the online supplemental materials). Second, we ran mixed effects models exploring the difference between frames in children's responses, including the between-participants variables (age, sampling condition, and culture) and participant ID as a random intercept. Follow-up tests with multiple comparisons were conducted with Bonferroni corrections. The analyses for the self, like, and property generalization question can be found in the online supplemental materials, but we report any notable findings from these analyses in the main article.

First Agent Question

For the first agent question, we were interested in what children infer from one agent's sampling behavior. The distributions of children's responses are shown in Figure 1 (see the online supplemental materials for comparisons to chance). For the preference frame, we did not find any significant interactions, $ps \geq .129$, so we removed them from the final model. We found a main effect of age, $\chi^2(1) = 9.17$, $p = .002$, such that older children were more likely to say that the first agent likes the target toy than younger children, $OR = 2.5$, 95% confidence interval (CI) [1.38, 4.52]. We did not find the main effects of culture or sampling condition, $ps \geq .181$. For the function frame, we did not find any significant interactions with culture and the other variables, $ps \geq .199$, so we removed them from the final model. We found a main effect of age, $\chi^2(1) = 9.17$, $p = .002$, and two-way interaction between age and sampling condition, $\chi^2(1) = 4.58$, $p = .03$. We found a significant difference in age for the 20% sampling condition, such that older children were more likely to say that the first agent uses the target toy to perform the function than younger children ($OR = 5.49$, 95% CI [1.87, 16.20], $p = .004$), but not in the 80% sampling condition ($OR = 0.98$, 95% CI [0.31, 3.08], $p = 1.00$). We did not find the main effects of culture or sampling condition ($ps \geq .386$). For the label frame, we did not find any significant main effects or interaction effects ($ps > .465$).

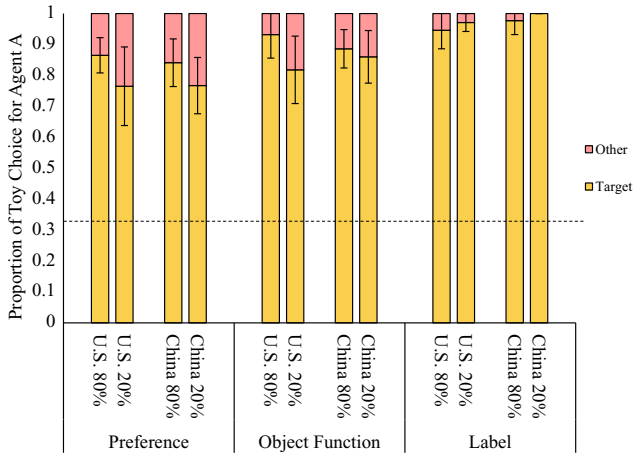
We then compared children's responses between frames, controlling for age, culture, and sampling condition. We found a main effect of the frame, $\chi^2(2) = 17.86$, $p = .0001$. Children were more likely to say that the first agent calls the target toy the label (97.5%, $N = 155/159$) than using the target toy to perform the function (87.2%, $N = 130/149$), $OR = 8.33$, 95% CI [1.79, 38.91], $p = .003$, and more than liking the target toy (81%, $N = 128/158$), $OR = 14.97$, 95% CI [3.20, 70.11], $p = .0001$. Children giving the target toy in the preference frame did not significantly differ from children giving the target toy in the function frame, $p = .354$. Together, these findings demonstrate that all children inferred that the agent's sampling behavior was intentional when labeling objects. The extent to which children inferred that the agent's sampling behavior was preferential, however, increased with age, and in which children inferred that an unlikely sampling behavior was to perform an object function increased by age.

Social Generalization Question

The distribution of children's responses to the social generalization question is shown in Figure 2 (see the online supplemental materials for comparisons to chance). In each fame, we did not find any significant main effects or interaction effects of age, sampling condition, or culture ($ps > .05$). We then compared children's responses between frames, controlling for age, culture, and

Figure 1

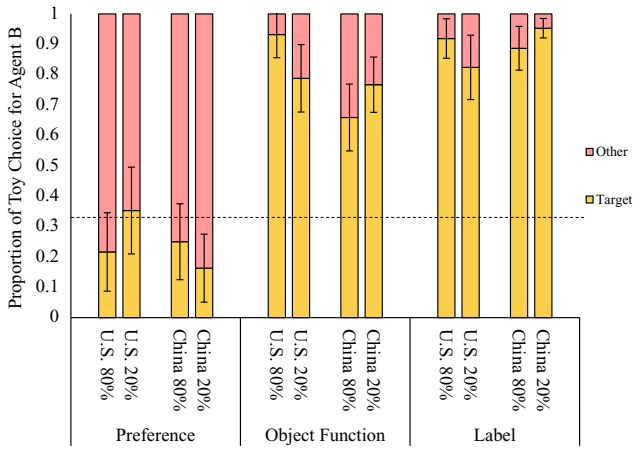
Results of the First Agent Question (Proportion of Children Choosing the Target Toy as the Preference of Agent A, Object That Agent A Uses to "Make the Toy Go," or Object That Agent A Will "Call a [Toma]") Across Frames, Cultures, and Sampling Conditions



Note. Error bars represent ± standard error. Dotted line represents chance (33%). U.S. = United States. See the online article for the color version of this figure.

Figure 2

Results of the Social Generalization Question (Proportion of Children Choosing the Target Toy as the Preference of Agent B, Object That Agent B Uses to "Make the Toy Go," or Object That Agent B Will "Call a [Toma]") Across Frames, Cultures, and Sampling Conditions



Note. Error bars represent ± standard error. Dotted line represents chance (33%). U.S. = United States. See the online article for the color version of this figure.

sampling condition. We found a main effect of frame, $\chi^2(2) = 67.79$, $p < .0001$: Children were more likely to say that the new agent would call the target to the same label (89.9%, $N = 142/158$) than use the target toy to perform the function (77.2%, $N = 115/149$), $OR = 3.25$, 95% CI [1.33, 7.94], $p = .005$. They were also more likely to generalize labels and functions than to generalize the first agent's preference to the new agent (24.1%, $N = 38/158$), function/preference ($OR = 23.78$, 95% CI [8.24, 68.64], $p < .0001$), label/preference ($OR = 77.10$, 95% CI [20.92, 284.08], $p < .0001$). This is further supported by the chance comparison findings, such that U.S. and Chinese children gave the target toy to the new agent in the object function and label frames more than chance, but at or less than a chance for the preference frame (see the online supplemental materials). Taken together, these findings suggest that children's social generalizations were driven by the property, rather than children's age, culture, or the agent's sampling behavior. Particularly, all children were more willing to generalize labels and functions, with label generalizations being higher, compared to preferences.

Property Generalization Question

The full analyses for the property generalization question can be found in the online supplemental materials, but we report two notable findings. First, we found that children were more likely to say that the first agent could prefer other toys (61.5%, $N = 59/96$) than saying the agent could use the other toys for the same function (45.6%, $N = 41/90$), $OR = 3.09$, 95% CI [1.10, 8.66], $p = .026$, and more than saying the agent could call the other objects by the same label (24%, $N = 23/96$), $OR = 19.08$, 95% CI [5.03, 73.00], $p < .0001$. Children were also more likely to say the agent could use the other toys for the same function than saying the agent could call the other objects by the same label ($OR = 6.18$, 95% CI [1.90, 20.09], $p = .0007$).

Second, we found that for the preference frame, U.S. children were more likely to say the first agent could like the other objects (76.2%, $N = 32/42$) than Chinese children (50%, $N = 27/54$), $OR = 3.30$, 95% CI [1.32, 8.20]. We also found this cultural difference in the label frame, but this interacted with age, such that in the United States, older children were less likely to say that the first agent could call the other toys the same label than younger children ($OR = 0.16$, 95% CI [0.05, 0.57], $p = .009$), but there was no difference in age for Chinese children ($OR = 3.63$, 95% CI [0.35, 37.90], $p = .562$).

Discussion

In Study 1, we found that U.S. and Chinese preschoolers' generalizations of the actions of one individual to other individuals depended almost exclusively on the way the action was framed. Building upon prior work (Behrend et al., 2001; Diesendruck & Markson, 2001; Diesendruck et al., 2015; Heyman & Gelman, 2000), we found that preferences and labels stand at opposite ends of children's social generalizations—preferences belong to individual agents and are not restrictive (someone can like more than one thing), but labels are socially shared and restrictive. Children generalized actions framed as functions at rates above chance, a clear contrast with their inferences about preferences, but also significantly lower than generalizations of labels. We also found modest cultural differences: Children in our U.S. sample were generally more flexible about how many objects could be "liked" than children in our Chinese sample and also less restrictive with extending words to new objects at younger ages.

Our findings that object functions were generalized at high rates are open to interpretation. Given that the function used in our study is causal, our results could be explained as children were simply making inferences about an objective fact about the world (a causal property of an object) rather than a social convention regarding how people use the object. While prior studies have supported the latter explanation using other measures (Vredenburgh et al., 2015; Wohlgelernter et al., 2010), it is important to investigate this further.

One way to do this is to compare children's generalization of two actions that are identical and equally causal (e.g., putting a toy on an object to light up), but vary in the framing of the action as either explicitly about causality (e.g., to make the toy light up) or explicitly about a social norm (e.g., the rules of a novel game). In Study 2, we explore this comparison. In doing so, we could control the causal property of the action to explore whether children's generalizations differ between two different types of framing, holding constant all other cues.

Unexpectedly, in Study 1, we did not find any influence of statistical regularities on children's inferences of preferences and word labels, unlike prior work (Kushnir et al., 2010; F. Xu & Tenenbaum, 2007). One possibility is that our preference frames were overly explicit—"-he's going to show you some things he likes"—and prior work has found that reducing preference framing before nonrandom sampling of actions can reduce their preference inferences (Garvin & Woodward, 2015; Heck et al., 2021). In Study 2, we reduced the explicit preference framing by changing the emphasis from showing things he likes to playing—"it's his turn to play"—which is an exact replication of the language used in Kushnir et al. (2010).

While we found that children in both cultures made similar generalizations across individuals, we found that children from the two cultures differed in their generalizations across objects. Specifically, U.S. children were more likely to say that an individual could like other toys or call other toys by the same label than Chinese children. Prior work has found that parent's cultural values play a large role in children's social learning (Reifen Tagar et al., 2014), so there is an open question as to whether this also plays a role in children's generalizations. To investigate this further, in Study 2, we included a survey for the parents to measure their parenting style (authoritarian vs. nonauthoritarian; from Reifen Tagar et al., 2014) and self-construal (independence vs. interdependence; from Singelis, 1994).

Study 2

In Study 2 (conducted over Zoom), we directly compared U.S. and Chinese children's generalizations of two types of social conventions: causal functions and game rules, under two different statistical sampling conditions. Between participants, children were randomly assigned to watch a puppet perform the same set of actions framed either as a causal function ("make the toy light up") or as a game rule ("play the Blicket game"). Also between participants, children watched the puppet sample five toys from the minority (20%) or majority (80%) of toys. Within participants, all children were also in a preference condition, similar to Study 1. We included this comparison condition for two reasons: first to match the procedure of Kushnir et al. (2010) more closely, and second to replicate

the findings of Study 1 in an online format. Our dependent measures were similar to Study 1—we asked children to predict the first agent's actions and to generalize to a new agent's actions. We also investigated the influence on children's culture more extensively by investigating their parents' parenting style and self-construal. Study 2 was preregistered on OSF at https://osf.io/a78xs/ (Flanagan et al., 2024).

Method

The study was approved by the Cornell University Institutional Review Board (Protocol IRB0000557) and the East China Normal Institutionnal Review Board (Protocol HR554-2019).

Transparency and Openness

A deidentified data set, analysis code, study materials, and preregistration for the study are available on the project's OSF page at https://osf.io/a78xs/ (Flanagan et al., 2024). Data were analyzed using R Version 1.1.456 (R Core Team, 2022) and the packages lme4 (Bates et al., 2015) and car (Fox & Weisberg, 2019).

Participants

The final sample consisted of 129 U.S. children (3–5 years old, $M = 4.00$, $SD = 0.78$) and 132 Chinese children (3–5 years old, $M = 4.02$, $SD = 0.78$).[2] The age distributions for the frames and sampling population conditions within each culture are displayed in Table 2. Moreover, U.S. participants were recruited from a lab database in Ithaca, New York, social media advertisements, and the Children Helping Science platform (https://childrenhelpingscience.com/). Of the parents that reported ($N = 128$), 92.1% held a bachelor's degree or above and 93.6% of the families had an income of over 50,000 USD per year. Of those that were reported, 61 children were male and 68 children were female; 94 children were White, one was Black/African American, one was Hispanic/Latino, 11 were Asian, and 21 were multiracial. Seven additional U.S. children participated but were excluded due to either a developmental disability ($N = 3$), lack of compliance throughout the entire study ($N = 2$), or technology issues ($N = 2$). Chinese participants were recruited from social media advertisements. Seventy-one of the children were female and 61 were male. Of the parents that reported ($N = 87$), 94.3% held a bachelor's degree or above, and 72.4% of the families had an income of over 200,000 RMB per year. All children spoke Mandarin Chinese as their native language and were of the Han ethnicity.

Table 2
Age Distribution for the Frames and Sampling Population Conditions Within Each Culture

Frames	Culture	Sampling population (%)	Number	*M* (*SD*)
Function	United States	80	33	3.91 (0.72)
		20	32	4.09 (0.82)
	China	80	34	4.00 (0.74)
		20	32	4.06 (0.82)
Rule	United States	80	32	4.03 (0.82)
		20	32	3.97 (0.78)
	China	80	34	4.11 (0.80)
		20	32	3.97 (0.78)

Materials

The sets of toys for the preference frame and the function frame were the same as in Study 1. The rule frame used the same sets of toys as the function frame. The blicket detector from Study 1 was also used in the function and rule frame.

Procedure

Study 2 was conducted online via Zoom, due to the global COVID-19 pandemic. Each child sat with their guardian on the computer while the experimenter displayed their screen. Children were randomly assigned to one of two sampling conditions (20% condition or 80% condition), similar to Study 1. Children were also randomly assigned to one of two conventional frames (function or game rule) for one trial along with one preference frame trial. The order of the frames (preference, function/rule) was counterbalanced. Each frame proceeded in the same order as Study 1 (introduction phase, sampling phase, and test phase).

In the introduction phase, children saw three toys on the screen and were asked to label them (see Table 3). If the child could not identify the toys, labels were provided. The experimenter then played a video that displayed the three toys and a narrator labeling each one. For the function and rule frames, the video then displayed the blicket detector. For the function frame, the language for the narration and actions displayed was the same as in Study 1. For the rule frame, the language for the narration was the same as Study 1, but the narrator said, "part of the Blicket game," instead of, "make it light up."

For all frames, the video then displayed an animal puppet (Agent A) and the narrator introduced it in relation to the frame. After, the video displayed a table with the target toy and alternative toy on it. The objects were displayed on a table, rather than in a box as in Study 1, to make it easier for children to see over video. The narrator labeled the toys on the table but made no reference to the quantity or proportion of the different toys in the box.

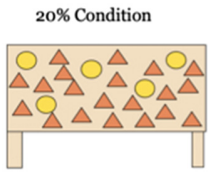
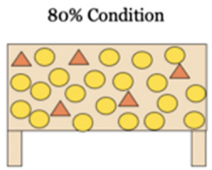
The sampling phase was identical to Study 1 with the exception that Agent A picked the toys from the table rather than out of a box. After Agent A sampled the five toys, the video then displayed the table with toys on it again, with a red box outlining the five toys selected, and the narrator said, "this is what [Agent A] played." A video example of the actions in the function and rule frames is available on OSF at https://osf.io/a78xs/ (Flanagan et al., 2024).

In the test phase, the experimenter showed a picture of the puppet (either Agent A or Agent B) and the three toys. Children were asked the first agent question, the social generalization question, and the property generalization question from Study 1 (see Table 3).

After the child completed the activity, we gave the parent the option to fill out an online survey. The majority of parents filled out the survey (United States: 57%, China: 66%). The survey consisted of questions regarding the parent's parenting style (authoritarian vs. non-authoritarian; from Reifen Tagar et al., 2014) and the parent's self-construal (independent vs. interdependent; from Singelis, 1994). For the parenting style measure, the parent was asked to choose which characteristic is more important for a child to have (e.g.,

[2] In our preregistration, we reported that we would conduct the study with 256 participants, but an additional five participants were included in the study due to scheduling or expressing interest in participating after 256 children had participated.

Table 3
Procedure for Study 2

Phase		Frame		
Introduction phase		Preference	Function	Game rule
Puppet introduction	"This is [Agent A]."	"It's his turn to play."	"It's his turn to show how the toy works."	"It's his turn to show how to play the Blicket game."
Population introduction	"There are [target toys] and [alternative toys]."			
Sample phase				
Test phase	"Remember these toys here."			
First agent question	"Remember [Agent A]."	"Can you give him the one that he likes?"	"Can you give him the one that makes the toy light up?"	"Can you give him the one that's part of the Blicket game?"
Social generalization question	"This is [Agent B]. It's his turn to play."	"Can you give him the one that he likes?"	"Can you give him the one that makes the toy light up?"	"Can you give him the one that's part of the Blicket game?"
Property generalization question				
	"Remember [Agent A]. You said [Agent A] …"	"…likes [toy picked by child from Agent A question]."	"…uses [toy picked by child from Agent A question] to make the toy light up."	"…uses [toy picked by child from Agent A question] to play the Blicket game."
				
	"Could [Agent A]…"	"…also like the other ones?"	"…also use the other ones to make the toy light up?"	"…also use the other ones to play the Blicket game?"

Note. Experimenter referred to the puppet by animal name (e.g., Mr. Monkey), as indicated by the placement of [Agent A] and [Agent B]. Puppets varied across frames. One set of toys was used in the function and rule frames and another set in the preference frame. See the online article for the color version of this table.

good manners or curiosity) in four questions. For the self-construal measure, the parent was asked to rate their level of agreement in a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) with 30 statements about their personal and social values (e.g., "having a lively imagination is important to me," "it is important for me to maintain harmony within my group," etc.). The full list of questions for the parent survey is included in the online supplemental materials.

Coding

Children's responses for the first agent, social generalization, and property generalization questions were the same as in Study 1. For the parenting style measure, an authoritarian response (e.g., preferring a child to have good manners) was coded as 0 and a nonauthoritarian response (e.g., preferring a child to have curiosity) was coded as 1. Parent's responses for all questions were summed to have a total score out of 4 (lower scores indicating authoritarian parenting style and higher scores indicating nonauthoritarian parenting style). For the self-construal measure, parents' responses were coded from 1 to 7, with 1 indicating a *highly interdependent self-construal* and 7 indicating a *highly independent self-construal*. Fifteen of the questions were reverse-coded (see the online supplemental materials for the coding scheme of the parent survey). Parent's responses for the self-construal measure were combined into a single score out of 210 (lower scores indicating an interdependent self-construal and higher scores indicating an independent self-construal).

Results

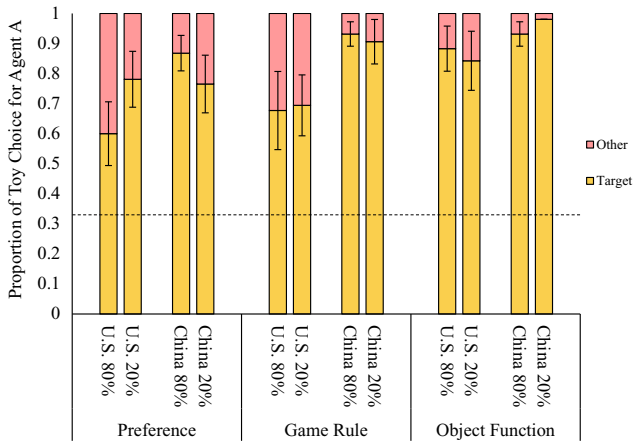
First, we ran separate generalized models for each frame (preference, rule, function), looking at the effect of age (in months), sampling condition (20% vs. 80%), and culture (United States vs. China) on children's responses. For each of the models, we started with a model including all possible two-way interactions and then removed interaction terms that were nonsignificant, running the simplest model with any significant interaction terms (results from the full models are in the online supplemental materials). Next, we ran models comparing the frames to each other (mixed effects model for preference vs. rule and preference vs. function, with participant ID as a random intercept; a generalized linear model for rule vs. function), including the between-participants variables (age, sampling condition, and culture).[3] Follow-up tests with multiple comparisons were conducted with Bonferroni corrections. The analyses for the property generalization question and the parental surveys can be found in the online supplemental materials, but we report any notable findings from these analyses in the main article.

First Agent Question

The distribution of children's responses to the first agent question is shown in Figure 3 (the online supplemental materials contain comparisons to chance). For the preference frame, we did not find any significant interactions with age ($ps \geq .471$), so we removed them from the final model. We found a main effect of age, $\chi^2(1) = 8.41$, $p = .0037$, such that older children were more likely to say that the first agent likes the target toy than younger children ($OR = 1.99$, 95% CI [1.25, 3.18]). We found a main effect of culture, $\chi^2(1) = 4.48$, $p = .034$, such that Chinese children were more likely than U.S. children to infer that the first agent likes the target toy (China: 81.8%, $N = 108/132$; United States: 69%, $N = 89/129$), $OR = 1.98$, 95% CI [1.08, 3.62]. While we did not find a main effect of the sampling condition, $\chi^2(1) = 0.42$, $p = .516$, we found an interaction between culture and sampling condition, $\chi^2(1) = 6.78$, $p = .009$. To explore the interaction, we compared sampling conditions separately within each cultural group. Replicating Kushnir et al. (2010), U.S. children in the 20% sampling condition were more likely to say that the first agent likes the target toy (78.1%, $N = 50/64$) than U.S. children in the 80% sampling condition (60%, $N = 39/65$), $OR = 2.42$, 95% CI [1.10, 5.32], $p = .029$. We did not find a difference in sampling condition for Chinese children (20%: 76.6%, $N = 49/64$; 86.8%, $N = 59/68$), $OR = 0.48$, 95% CI [0.19, 1.21], $p = .120$.

Figure 3

Results of the First Agent Question (Proportion of Children Choosing the Target Toy as the Preference of Agent A, Object That Agent A Uses to Play the "Blicket Game," or Object That Agent A Uses to "Make the Toy Go") Across Frames, Cultures, and Sampling Conditions



Note. Error bars represent ± standard error. Dotted line represents chance (33%). U.S. = United States. See the online article for the color version of this figure.

For the rule frame, we did not find any significant interactions ($ps > .125$), so we removed them from the final model. We found a main effect of culture, $\chi^2(1) = 7.41$, $p = .007$, such that Chinese children were more likely to say that the first agent will use the target toy to play the game (92.4%, $N = 61/66$) than U.S. children (73.4%, $N = 47/64$), $OR = 4.48$, 95% CI [1.52, 13.20]. We did not find the main effects of age or sampling condition ($ps \geq .073$).

In the function frame we did not find any significant interactions ($ps > .348$), so we removed them from the final model. We found a main effect of age, $\chi^2(1) = 5.45$, $p = .020$, such that older children were more likely to say that the first agent will use the target toy to perform the function ($OR = 4.31$, 95% CI [1.26, 14.70]). We

[3] In the preregistration, we originally planned to run one big, generalized model of children's toy choice with frame, sampling condition, culture, and age as the independent variables. However, we decided it would be best to separate the models by frame to account for the differences in the within- and between-participants design.

did not find the main effects of sampling condition or culture in the function frame ($ps \geq .656$).

We then compared children's target choices for Agent A between frames, including age, culture, and sampling condition. First, we did not find a difference between preference and rule frames, within participants, $\chi^2(1) = 0.31$, $p = .580$ (preference: 80.8% $N = 105/130$; rule: 83.1%, $N = 108/130$). We did find a difference between preference and function frames, within participants, $\chi^2(1) = 12.88$, $p = .0003$, such that children were more likely to give the first agent the target toy to perform a function (91.6%, $N = 120/131$) than as his preference (70.2%, $N = 92/131$), $OR = 9.17$, 95% CI [2.72, 30.90]. Finally, comparing rule and function frames between participants) we found a main effect of the frame, $\chi^2(1) = 4.35$, $p = .037$, such that children were more likely to give the first agent the target toy to perform a causal function than to play a game ($OR = 2.36$, 95% CI [1.05, 5.29]). It is important to note that despite these differences, all of the groups of children chose the target toy at rates above chance, regardless of the frame (binomial $ps < .001$, see the online supplemental materials). Taken together, these findings suggest that children inferred that the agent's sampling behavior was selective, but this was especially the case for causal functions.

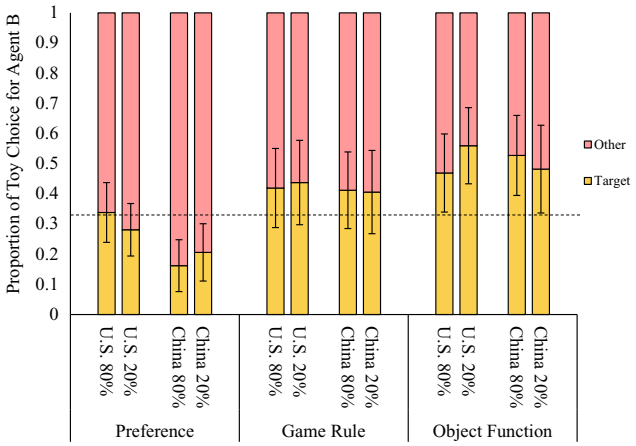
Social Generalization Question

The distribution of children's responses to the social generalization questions is shown in Figure 4 (see the online supplemental materials for comparisons to chance). For the preference frame, we did not find any significant interactions ($ps > .320$), so we removed them from the final model. We found a main effect of culture, $\chi^2(1) = 5.92$, $p = .015$, such that U.S. children were more likely to say the new agent also preferred the target toy (31%, $N = 40/129$) than Chinese children (18.3%, $N = 24/131$), $OR = 2.07$, 95% CI [1.15, 3.70]. We did not find the main effects of age or sampling condition ($ps \geq .064$). For the rule and function frames, we did not find any significant main or interaction effects of age, sampling condition, or culture ($ps > .183$).

We then compared children's social generalizations between frames, controlling for age, culture, and sampling condition. First, comparing preferences and rules, within participants, we found a main effect of the frame, $\chi^2(1) = 13.63$, $p = .0002$, such that children were more likely to say that the new agent would use the same object to play by the rules of the game (41.5%, $N = 54/130$) than like the same object (20%, $N = 26/130$), $OR = 3.31$, 95% CI [1.75, 6.27]. Next, comparing preferences and functions, within participants, we found a main effect of the frame, $\chi^2(1) = 13.02$, $p = .0003$, such that children were more likely to say that the new agent would use the same object to make the toy go (51.1%, $N = 67/130$) than like the same object (29.2%, $N = 38/130$), $OR = 2.90$, 95% CI [1.62, 5.18]. Finally, we did not find a difference between rules and functions between participants, $\chi^2(1) = 2.50$, $p = .114$. Looking at our chance comparisons, however, gives us further information. Replicating Study 1, U.S. and Chinese children gave the new agent the target toy more than chance for the object function frame, but at or less than chance for the preference frame. For the game rule frame, however, the percentage of U.S. and Chinese children giving the new agent the target toy did not differ from chance (see the online supplemental materials). Taken together, these findings demonstrate that all children were most likely to generalize causal functions across agents, then game rules, and least likely to generalize preferences.

Figure 4

Results of the Social Generalization Question (Proportion of Children Choosing the Target Toy as the Preference of Agent B, Object That Agent B Uses to Play the "Blicket Game," or Object That Agent B Uses to "Make the Toy Go") Across Frames, Cultures, and Sampling Conditions



Note. Error bars represent ± standard error. Dotted line represents chance (33%). U.S. = United States. See the online article for the color version of this figure.

Property Generalization Question

The full analyses for the property generalization question can be found in the online supplemental materials, but we report notable cultural differences. Replicating Study 1, we found a cultural difference in the preference frame, such that U.S. children were more likely to say the first agent could like other objects (57.8%, $N = 74/128$) than Chinese children (39.4%, $N = 52/132$), $OR = 2.11$, 95% CI [1.28, 3.47]. This was also the case for game rules, such that U.S. children were more likely to say the first agent could play the game with other objects (73.4%, $N = 47/64$) than Chinese children (48.5%, $N = 32/66$), $OR = 3.02$, 95% CI [1.43, 6.37].

Second, we found that children were more likely to say that the first agent would use other objects to play the game (60.8%, $N = 79/130$) than like the same object (46.5%, $N = 60/129$), $OR = 3.11$, 95% CI [1.45, 6.64] and more than to perform the function (40.5%, $N = 53/131$), $OR = 2.43$, 95% CI [1.44, 4.10]. We did not find a difference between the preference (preference: 50.4%, $N = 66/131$) and function frames.

Parental Measures

The full analyses for the parental measures (parenting style and self-construal) can be found in the online supplemental materials, but we report an overall summary here. We found that U.S. parents had a more nonauthoritarian parenting style ($M = 3.41$, $SD = 0.89$) than Chinese parents ($M = 2.84$, $SD = 0.99$), but parents from both cultures had similar values on independence and interdependence (United States: $M = 120.12$, $SD = 16.65$; China: $M = 118.15$, $SD = 7.45$; higher scores [out of 210] indicate more independent

self-construal). We did not find any relationship between children's social generalization or property generalization and parenting style or parents' self-construal ($ps \geq .51$).

Discussion

In Study 2, we compared U.S. and Chinese children's social inferences of identical actions framed either as causal functions or game rules to each other and to actions framed as an individual's preferences. We found that children's initial inferences about the preferences and rule following of the first agent were influenced by statistical evidence and cultural context. Specifically, children in our U.S. sample, but not our Chinese sample, used evidence of nonrandom sampling to infer that the first agent had stronger preferences for certain objects over others. Children in our Chinese sample inferred stronger object-specific preferences and object-specific rules than children in our U.S. sample and were more likely to restrict their inferences to the demonstrated toy rather than extend them to other toys. This cultural difference was not further influenced by parental values, as originally hypothesized.

Importantly, replicating the overall pattern found in Study 1, generalizations were mostly dependent on the way actions were framed: Children in both cultures thought that both causal functions and rules generalize across agents more than personal preferences. However, children still seemed to distinguish between the two social-conventional frames: Children in both cultures did not expect the new agent to follow the same game rule over and above chance and were more likely to say that the game could be played with other objects, but the majority of children expected the new agent to do the same causal function and thought the causal function was specific to the demonstrated object.

General Discussion

Inferring social meaning from ambiguous actions can be a difficult task but young children do this every day with ease. In this project, we found that preschooler's social generalizations are a result of combining two types of prior knowledge about actions—domain-specific knowledge and cultural knowledge—with statistical evidence. In general, we found that children's social inferences about actions are on a continuum: with linguistic conventions (e.g., labels) being the most social, preferences being the most personal, and nonlinguistic conventions (i.e., object functions, game rules) falling somewhere in between, and open to cultural interpretation. These findings are consistent with rational learning: Children's prior beliefs about the generalizability of an action in a particular domain are combined with new evidence to determine whether the action is individually or socially meaningful.

The predominant influence on children's generalizations in this study was their domain-specific knowledge of action types, invoked by the framing of actions as preferences, labels, functions, or rules. The fact that children's generalizations across the social frames (game rules, object functions, labels) were largely unchanged by the strength of the statistical evidence from the actions of the first agent suggests that children in our studies had relatively strong prior beliefs governing different types of social action. It is unclear, however, whether the nature of children's social generalizations is domain-dependent, with some domains being viewed more as objective and others viewed more as conventional (Casler & Kelemen, 2005; Childers & Tomasello, 2003; Diesendruck & Markson, 2001; Markman, 1989; Sabbagh & Henderson, 2007). For example, it may be that children view some social actions, like game rules, as purely conventional, while children view language and functions as facts about the world. Continuing to compare children's judgments of various social actions would be beneficial in uncovering the prior beliefs incorporated in children's social judgments.

We also found that in our socially framed cases, evidence of nonrandom sampling did not influence children's beliefs about the first agents' actions, or their subsequent generalizations. Unlike prior findings with infants (Gweon et al., 2010), additional information about the intentions of the first agent to select one object over the other when demonstrating its causal function (i.e., in the 20% condition) did not result in stronger inferences that other objects would not. An intriguing possibility consistent with rational learning is that this represents age-related changes in prior beliefs about object functions (German & Defeyter, 2000) based on experience, but this possibility requires further study.

Framing causal actions as "rules of a game" rather than as functions reduced the overall tendency to generalize. While children's social generalizations for the game rule were higher compared to preferences and did not differ from object functions, only half of the children said a new individual would use the same object to play the game as the first agent. Furthermore, children thought the first individual could play the game with either object, more so than object functions and preferences. These two findings are supported by other work demonstrating that while children expect people to follow the rules of the game, they think it is okay for someone to choose to play something else (Schmidt et al., 2016) or even change the rules (Zhao & Kushnir, 2018). Therefore, even though children seem to believe that following the rules of a game is a social action, they also seem to believe that it involves an element of choice. Notably, statistical evidence that the game rule was more selective did not influence children's generalizations. This leaves open questions regarding what types of evidence (if any) would lead children in both cultures to have stronger intuitions that rules must be widely followed.

Both U.S. and Chinese children had similar beliefs about the generalizability of actions across individuals, even in the case of nonlinguistic conventions. While we expected some differences between cultures, the lack of difference is not entirely surprising. For example, we only looked at preschool-aged children's social generalizations, but prior work has found that certain differences in culture become more prevalent with age (Chernyak et al., 2019). It is possible, therefore, that our prior beliefs about personal and social actions are similar at a young age but then change with respect to our cultural values as we develop. This possibility requires further investigation. Furthermore, it is also important to consider the cultural change that has happened in China in recent decades, suggesting a general rise in individualism and a decline in collectivism (Bao et al., 2021; Cai et al., 2020). This change has been found in various aspects of adults' psychology, including values (Y. Xu & Hamamura, 2014; Zeng & Greenfield, 2015), self-concept (Hamamura & Xu, 2015; Yu et al., 2016), self-esteem (Cai et al., 2012; Li et al., 2020), and need for uniqueness (Cai et al., 2018). Notably, these changes have also been observed in parent–child conversations (Chen, 2012; Zhou et al., 2018) and in young children's own beliefs (Chen et al., 2005). In support of this recent work, we found that the parents of Chinese children in our sample were as independent

as the parents of U.S. children. It is possible, therefore, that this cultural change is reflected in young children's social judgments, but, as we did not directly measure cultural change, we caution against any strong conclusions based on our study.

Children's cultural background played a role in how flexible children viewed personal and social actions. Specifically for our case, preschool-age children may already have some culture-specific beliefs about how likely behaviors (especially norms) are to generalize across contexts, and these beliefs may continue to change with age. For example, prior work finds that by age 4 children in the United States and Singapore already have different beliefs about how likely it is for someone to violate norms and conventions just because they "want" to, and this difference grows across middle childhood (Chernyak et al., 2019). We found modest support for this in children's inferences about the first agent—U.S. children were more flexible about how the first agent would play the game, and what object he would use. By the same token, children in different cultures might have different beliefs about how rigid or flexible one can be about language use in ambiguous cases (Chan & Tardif, 2013), which in past work seems to emerge earlier in East Asian samples than in U.S. samples. Again, we fond modest evidence that these types of beliefs may have influenced children's generalizations—older U.S. children were less likely to extend novel labels to new objects than younger U.S. children, but Chinese children of all ages assumed the label could not be extended to another object. More work is needed to explore these beliefs across development (such as infancy into middle childhood) to uncover possible cultural divergences in children's generalizations.

One final area in which we found cultural differences was in the use of statistically nonrandom sampling to infer preferences for one object over the other. Specifically, without an explicit framing of picking a toy that he likes, U.S. preschoolers, but not Chinese preschoolers, inferred that the agent's nonrandom sampling (i.e., 20% condition) indicated that the agent preferred a specific toy (see Garvin & Woodward, 2015 for further investigation of the effects of framing on preferences). Although this result with the U.S. sample has been replicated in multiple samples at multiple ages from infancy to preschool (Garvin & Woodward, 2015; Heck et al., 2021; Kushnir et al., 2010; Ma & Xu, 2011; Wellman et al., 2016) and in cultures outside the United States (e.g., in Israel, Diesendruck et al., 2015), this is the first study to attempt to explore the finding in a Chinese sample. Though we caution against forming strong conclusions from one study, our results suggest that our Chinese sample of preschoolers took the positive evidence (that the objects were selected from any box) as a sign of a preference and disregarded the negative evidence (the object that was not chosen) even more so than children in the U.S. sample. This too is a question that requires further study.

Constraints on Generality

This project had a particular interest in how preschool-aged children from two cultural backgrounds, the United States and China, infer social meaning from ambiguous actions. The research was conducted in specific cities within each country, so it is unclear whether our findings would generalize to children in other areas of the country. It is also unclear whether our findings are generalizable to the greater global population. The majority of children from both cultures in our studies were in high-income, well-educated households. Also, in Study 2, families in our study had the time and accessibility to participate in a study run over Zoom during a global pandemic. Research should continue to explore how different individual factors (e.g., race, education, income) play a role in children's social generalizations. Finally, it would be fruitful for research to explore the development of children's social generalizations of nonlinguistic conventions in even younger children. The benefit of the generalization method is that it is simple and nonverbal, making it easy for young children to engage with. This method, therefore, could easily be modified for toddlers or even infants to participate.

Our project presents new avenues for research on children's rational social learning. In Study 2, we chose functions and rules to represent nonlinguistic conventions, but there are plenty of other conventions we could have chosen (e.g., social norms, family rituals, school rules). It would be fruitful to continue to explore how children compare these conventions against each other using the generalization method. Furthermore, in our studies, we intentionally did not indicate any possible relationship between the two agents in our generalization method. If we were to somehow indicate that the agents are in the same social group (e.g., by choosing the same type of animal puppets or by wearing the same color T-shirts), we may see some differences in children's social generalizations for each type of action.

Conclusion

Children use human actions to form rich inferences about the social world (Gopnik et al., 1999; Tomasello, 2019). In our project, we uncover children's rational learning when inferring a social action. Namely, U.S. and Chinese preschool children use their prior beliefs about the framing of actions when deciding whether an individual's action is generalizable to others: Preferences do not generalize, labels generalize, and nonlinguistic conventions fall somewhere in the middle. Most notably, preschoolers made different inferences about the two nonlinguistic conventions—viewing both object functions and game rules as more generalizable than preferences, but game rules are not highly generalizable and can be changed. These findings in particular highlight that preschoolers use ambiguous actions to learn about social and personal actions. For example, when a child watches his mother clap when she is happy, the child is likely learning that his mom claps when she is happy because that is how people express themselves and because that is how his mom wants to express herself in that moment. The ambiguity of human actions, therefore, does not hinder children's learning of the social world. Instead, children's learning incorporates ambiguity to form rich and complex theories of social and personal meaning.

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Received September 29, 2023
Revision received February 13, 2024
Accepted March 29, 2024 ■

Correction to "When Fairness Is Not Enough: The Disproportionate Contributions of the Poor in a Collective Action Problem" by Malthouse et al. (2023)

In the article "When Fairness Is Not Enough: The Disproportionate Contributions of the Poor in a Collective Action Problem" by Eugene Malthouse, Charlie Pilgrim, Daniel Sgroi, and Thomas T. Hills (*Journal of Experimental Psychology: General*, 2023, Vol. 152, No. 11, pp. 3229–3242, https://doi.org/10.1037/xge0001455), the third and final research question in The Collective-Risk Social Dilemma section now appears as follows: 3. If what people perceive as fair is insufficient to solve the problem, under what conditions do groups still manage to succeed? The online version of this article has been corrected.

https://doi.org/10.1037/xge0001631