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Property content guides children's memory for social learning episodes



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ABSTRACT

How do children's interpretations of the generality of learning episodes affect what they encode? In the present studies, we investigated the hypothesis that children encode distinct aspects of learning episodes containing generalizable and non-generalizable properties. Two studies with preschool ($N = 50$) and young school-aged children ($N = 49$) reveal that their encoding is contingent on the generalizability of the property they are learning. Children remembered generalizable properties (e.g., morphological or normative properties) more than non-generalizable properties (e.g., historical events or preferences). Conversely, they remembered category exemplars associated with non-generalizable properties more than category exemplars associated with generalizable properties. The findings highlight the utility of remembering distinct aspects of social learning episodes for children's future generalization.

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1. Introduction

How does an observation about a single individual generalize to other members of a social category? This basic question in social psychology has often been addressed in terms of the special inductive richness of certain categories (e.g., race and gender) or attributes (e.g., traits and abilities). The current research builds on prior literature by exploring a possible mechanism of social generalization, specifically, that categories and attributes cue different memory and encoding processes that may support or inhibit future generalization. Imagine observing your neighbor walk to school wearing a plaid skirt. There are many ways to encode this event. Some are very general: "Plaid is the school uniform." Some are more specific: "This girl likes plaid." How generally an event is encoded could affect how likely information about the event is to be retrieved

and used to generate predictions about other encounters with students and clothing. But how do children know if they are learning a piece of category-relevant information or a fact specific to a single individual? There are likely a variety of cues to guide the generality of encoding. This research investigates how one cue to the generality of the learning episode, the nature of the property being learned, affects children's encoding of learning episodes.

2. Memory for general and specific learning episodes

The present research focuses on how cues to the generality or specificity of a learning episode affect which aspects of the episode children encode. General learning episodes are those that contain information pertaining to a category, whereas specific learning episodes are those that contain information about a single individual. We propose that for general learning episodes, children encode less detail of individual category members (i.e., targets) and more about the properties present in the learning

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episode, relative to specific learning episodes. Conversely, for specific episodes, children encode more detail of targets and less detail of the properties associated with targets as compared to general learning episodes.

The proposal that children encode distinct aspects of general and specific learning episodes is supported by prior research on children's target and property memory. Several studies have suggested that children form weaker representations of targets when their category membership is highlighted (e.g., Heit & Hayes, 2005; Taylor, Fiske, Etoiff, & Ruderman, 1978; Wilburn & Feeney, 2008; but see Sloutsky & Fisher, 2004). For example, using an induction-then-recognition paradigm, Hayes, McKinnon, and Sweller (2008) found that 5 year-olds made more recognition errors for targets after completing a category-based induction task than after making evaluative judgments of targets (e.g., young or old?). These results suggest that when category membership is salient, children remember less about the individuating features of any specific category member. Conversely, children exhibit superior memory for targets when the learning episode is specific (Riggs, Kalish, & Alibali, in press; Sabbagh & Shafman, 2009). For instance, Riggs et al. (in press) examined children's memory for individuals in generic and non-generic learning episodes and found that children showed better recall for targets when they were presented non-generically (i.e., with names and personal pronouns) than generically (i.e., with category labels). Together these findings support the existence of category-level and individual-level encoding patterns for targets: when the task highlights a target's category, children encode the target with less detail than when the task emphasizes the target's individual features.

In addition to differential memory for targets, children also differentially encode properties depending on whether they apply generally to a category or specifically to an individual. Recent studies have found that children are better at recalling properties predicated of categories than properties predicated of a single individual (Cimpian & Erickson, 2012; Riggs et al., in press). For example, Cimpian and Erickson (2012) found that children remembered the generic property "Girls are really good at making a puzzle called wug" more often than the non-generic property "She is really good at making a puzzle called wug." This result suggests that children encode generic properties at the category level and specific properties at the individual level because they remember the former more often than the latter. Similarly, research on selective encoding has found that young children encode more detail about high-value information, which is important to remember in the future, than low-value information, which is not important to remember in the future (Castel et al., 2011). Properties that are general to a category may have high value for children because they apply to a wider set of instances and are more likely to be retrieved in the future than properties that are specific to an individual.

Sabbagh and Shafman (2009) propose a mechanism for children's category-level and individual-level encoding of targets and properties. They argue that when children learn category-level (i.e., generalizable) information, they activate an "episodic blocking mechanism" that prevents

them from retaining contextual details of the learning episode (e.g., details about the target). By forgetting the details of the target, children are able to consolidate and retain the generalizable information for future use when the target is absent. Conversely, when learning individual-level (i.e., non-generalizable) information, children encode a detailed representation of the target, which interferes with their consolidation of the non-generalizable information. In Sabbagh and Shafman's study, children were better at remembering targets who supplied an idiosyncratic rather than a conventional word label, but showed superior recall for the conventional label compared to the idiosyncratic label. Thus, on this account, children form strong representations of generalizable information when they forget the episodic components of the learning event, namely the target or speaker. However, when the episodic details are relevant (e.g., when the child is learning something specific to a particular person), those details are retained, but memory for non-generalizable information (e.g., the idiosyncratic label) is more transient. Koenig and Woodward (2010) report similar findings in 24-month-old infants learning from accurate and inaccurate speakers.

3. Cues that guide category-level vs. individual-level encoding

Up to this point, we have discussed general and specific learning episodes as if it is obvious which is which. How do children know whether what they are learning is generalizable to a group or specific to an individual? Luckily, the environment is replete with cues to assist in this process, including the prevalence of labels. Generic labels, which are frequently used in mothers' speech to their children (Gelman, Taylor, & Nguyen, 2004), are particularly good cues to the generality of the learning episode, and they are utilized by young children to guide how generally they encode new information (Cimpian & Erickson, 2012; Riggs et al., in press). Another cue to the generality of a learning episode is the nature of the property being learned. Some types of properties generalize across category members whereas others are restricted to a particular individual (Goodman, 1955). Gelman (1988) has shown that children constrain the types of properties they generalize. For example, children do not generalize that other spiders will be "a year old", after observing that one is, but they do generalize that other spiders will catch "besitolas" after observing that one does. Whereas the former statement pertains to a single spider at a particular point in time, the latter is informative of the kind "spiders" because it relates to their food source. Generalizable properties are thus those that are safe to generalize across category members, and non-generalizable properties are those that should not be generalized across category members by virtue of their category membership alone (e.g., other spiders may be 1 year old, but they are not 1 year old *because* they are a spider). If children can distinguish generalizable from non-generalizable properties, the generalizability of the property can be used as a cue to the appropriate level at which a learning episode should be encoded.

In order for property type to guide children's encoding, they must have sufficient world knowledge to recognize the types of properties that are typically generalizable and those that are typically non-generalizable. Research on psychological essentialism has found that children have a sophisticated understanding of the shared nature of internal biological features and that they reliably generalize these properties across category members (Gelman, 2003; Hatano & Inagaki, 1994). In the social domain, Kalish and Lawson (2008) found that young children generalize deontic properties across social category members, but not behavioral frequencies or psychological traits. If children use the nature of the property as a cue to encode at the category or individual level, learning generalizable properties (e.g., "has a femur in her leg") will lead to category-level encoding such that children associate them with all members of a group. Learning non-generalizable properties (e.g., "has dirt on her feet"), however, will evoke individual-level encoding such that children associate them with particular group members rather than the category as a whole.

4. Present studies

Does the nature of the property lead children to differentially encode targets and properties? In the current studies, children learned about 8 individual members of novel social groups, each of whom displayed a novel property. In each experiment, properties were of two types, one that we expected to be treated as generalizable to a category and one that we expected to be treated as non-generalizable (i.e., specific to an individual). If children are sensitive to the generalizability of properties, they should encode different features of the learning episode in each case. In the case of generalizable properties (e.g., "has a ginglymus in his elbow"), children should encode category-relevant features of targets. In the case of non-generalizable properties (e.g., "has dirt on her feet"), attention should be focused on the individuating features of targets, such as specific clothing, facial features, or posture. Additionally, properties that are generalizable should be remembered more often than those specific to a single target.

If this memory pattern is observed, we can also use it as a means to test whether or not children perceive a property as generalizable. In Study 1, we contrast morphological and historical properties, which have been established as generalizable or non-generalizable, respectively, in several prior studies. In Study 2, however, we use children's encoding patterns to test a hypothesis about their interpretations of another pair of properties: norms and preferences. Specifically, we hypothesize that children will treat normative properties (what someone ought or ought not to do) as more general than psychological preferences (what someone likes or dislikes).

These studies compare memory performance of preschool-aged children and early school-aged children. Children's interpretations of the generality of a property may be a product of accumulating social knowledge, such that younger children are less able than older children to clearly distinguish generalizable and non-generalizable

properties. Alternatively, category and individual-level encoding may happen only when memory resources are limited, as they are in preschool-aged children (Gathercole, Pickering, Ambridge, & Wearing, 2004). If children can remember both targets and properties, there is less need to be selective in what they encode. In fact, Riggs et al. (in press) found that young school-aged children (but not preschool-aged children) recalled both the targets and properties of learning episodes containing either generic or non-generic information. Although encoding at either the category or individual level allows for the most important aspects of the episode to be remembered, it may only be useful to encode selectively when memory capacity is limited. In sum, the present studies investigate how the content of the properties being learned affects children's memory for learning episodes, and whether what children encode from these episodes changes across development.

4.1. Study 1

In Study 1, we examine memory for morphological properties, historical properties, and the targets associated with each. Past research has shown that children perceive morphological properties as general features of membership in a species and that they generalize them to other members of the same category (Gelman & Markman, 1986; Gutheil, Vera, & Keil, 1998). Historical properties, in contrast, are specific to a single individual. They may involve an accident, a temporal characteristic (e.g., being 3 years old), or a feature that is inherently variable within an individual. They do not make for safe generalizations across category members and are often inconsistent within the same individual over time, a fact to which children are sensitive (Gelman, 1988). For example, a person may have seen a bald eagle on her vacation, which neither predicts that another member of her category will see a bald eagle nor that she will see a bald eagle on her next vacation.

When learning a morphological property, we predict that children will follow a category-level encoding pattern: they will remember properties more often and targets less often than when learning a historical property. When learning a historical property, we predict that children will follow an individual-level encoding pattern: they will remember properties less often and targets more often than when learning a morphological property. Thus, morphological properties may be a cue that the learning episode should be encoded generally and historical properties may be a cue that the episode should be encoded specifically.

4.1.1. Participants

Participants were 55 children from two age groups: preschool-aged children ($n = 28$, 16 females; M age = 4.1 years; range: 3.0–4.11) and young school-aged children ($n = 27$, 15 females; M age = 6.9; range: 6.0–7.8). Half of the children in each group received the block of morphological properties first and the other half received the block of historical properties first. Children were recruited from preschools and after-school programs in a mid-sized Midwestern city.

4.1.2. Stimuli

The target stimuli were illustrations of individuals displaying characteristics (e.g., traditional dress and skin color) of members of realistic ethnic groups (e.g., Russian and Chinese). Each set in the memory test consisted of three individuals: a target and two distractors, each of whom shared observable features such as clothing type, skin color and hair color, but differed in specific outfit, facial features, and posture. The stimuli for the morphological properties were illustrations of parts of the human body (e.g., an eyeball for “vitreous humor in her eyes”). The stimuli for the historical properties were illustrations of locations or objects present in the property descriptions (e.g., a meadow for “getting bit by a krem in the meadow”). Morphological properties were presented as features that targets “have”, whereas historical properties were presented in terms of the actions of the target. Because the morphological properties contained unfamiliar words, we also included one novel word in every historical property (see Table 1). Distractor items for both types of properties in the memory test were related to the original properties. For example, a picture of an eyeball appeared with pictures of a nose and an ear, and a picture of a meadow appeared with pictures of a forest and a jungle.

4.1.3. Design and procedure

The study used a $2 \times 2 \times 2$ design; age group (preschool and school-aged) was a between-subjects factor and property type (morphological and historical) and memory measure (target and property) were within-subjects factors. Each child completed eight trials in the learning phase, eight trials in the memory test (2 questions per trial), and eight trials in the generalization task. Each phase included eight target-property pairings (4 morphological and 4 historical), blocked by property type. There were three dependent measures: target memory, property memory, and generalization. Correctly remembering a target required the child to select the individual they had seen in the learning phase from among two distractors who were visually similar to the target. Correctly remembering a property required the child to select the property that was associated with the target in the learning phase from among two distractors that were similar in type. In the generalization task, children were asked to predict whether another individual from the same social category as the target would share the property (e.g., would also have vitreous humor in her eyes).

Children were tested individually in a laboratory space or in a quiet corner of their daycare center. Children were randomly assigned to receive either the morphological items first or the historical items first. The study was

administered on a computer and took 7–10 min to complete. The procedure consisted of a learning phase, distraction phase, memory test, and generalization task.

4.1.3.1. Learning phase. In the learning phase, participants were presented with two blocks (e.g., morphological and historical) of four target-property pairs. The order of the two blocks as well as the order of the specific item pairs within each block was randomized across participants. Prior to the block of morphological items, children were told that they would be seeing people from around the world and learning about the “insides of people’s bodies.” Prior to the block of historical items, children were also told that they would be seeing people from around the world and learning about “things that happened to people.” At the beginning of each trial, the experimenter introduced the target according to its novel category name (e.g., “This is a Foru”). Then, a color illustration representing the property appeared and was ascribed to the target (e.g., “She has plasma in her blood.”). The target illustration then moved towards the property to focus children’s attention on the screen and to increase the amount of exposure children had to the stimuli.

4.1.3.2. Distraction phase. After the learning phase, children played a simple computer game that required them to click on pictures of puppets that appeared intermittently with pictures of the targets and distractors. Younger children saw pictures in two-second intervals and older children saw pictures in one-second intervals. Performance on this task was not recorded. The two-minute delay was instituted so that children had the opportunity to forget the stimuli.

4.1.3.3. Memory test. Following the distraction phase, children were asked to remember what they had learned about the different people in the learning phase. Memory trials appeared in the same order as in the learning phase. On each trial, children first indicated which individual they had seen, given choices of the target and two distractors, all from the same social group (see Fig. 1). After identifying the target, children then chose which property was associated with the target. For the morphological property items, children were asked which body part was associated with a specific characteristic (e.g., “did you learn that she has plasma in her blood, nails, or bones?”). Children chose the correct body part from a choice of three illustrations (see Fig. 2). For the historical property items, children were asked which location or object was associated with a specific event (e.g., “did she hurt her jezo when she tripped over a stump, root, or rock?”). Again, children chose the

Table 1
Study 1 property stimuli.

Morphological properties	Historical properties
1. Has vitreous humor in his/her eye	1. Hurt his/her jezo after tripping on a stump
2. Has a ginglymus in his/her elbow	2. Saw a zoma on the vine
3. Has plasma in his/her blood	3. Got bit by a krem in the meadow
4. Has papillae on his/her tongue	4. Swam with a taro in the river



Fig. 1. Screenshot of a sample target memory trial.

correct location or object from a choice of three illustrations. We used different illustrations to represent the correct property from those the children had seen in the learning phase. The positions in which the correct target and property appeared were counterbalanced across trials. Children were not given feedback about their performance on the memory task.

4.1.3.4. Generalization task. In the final phase of the study, children were asked whether or not they would generalize a property they had learned about the original target to a different target from the same social group. First, children were reminded of what they had been told in the learning phase (e.g., “Remember this Foru? I told you that she has plasma in her blood.”). Then, they were shown one of the distractor targets from the memory test and asked if that individual shared the same property as the original target (“What about this Foru? Will she have plasma in her blood too?”).

4.1.4. Results and discussion

A 2 (age: younger and older) \times 2 (property type: morphological or historical) \times 2 (memory measure: target or

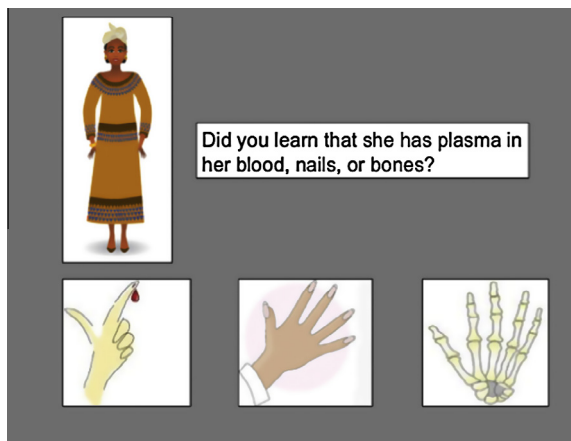


Fig. 2. Screenshot of a sample property memory trial.

property) mixed model analysis of variance was conducted on memory performance. The analysis yielded main effects of age, $F(1,52) = 16.28$, $p = .0002$, $\eta^2 = .24$, and memory measure, $F(1,52) = 24.13$, $p < .0001$, $\eta^2 = .32$. Older children remembered more overall, and participants remembered properties better than targets. Consistent with our hypotheses, there was a significant interaction between property type and memory measure, $F(1,52) = 19.59$, $p < .0001$, $\eta^2 = .27$ (see Fig. 3). This interaction was comprised of two simple effects. Children showed better memory for targets in the historical condition than the morphological condition, $F(1,52) = 13.89$, $p = .0005$, $\eta^2 = .21$, and better memory for properties in the morphological condition than the historical condition, $F(1,52) = 5.39$, $p = .024$, $\eta^2 = .09$. There was no significant three-way interaction between age, property type, and memory measure, suggesting that the observed memory pattern was comparable across age groups.

We also tested whether patterns observed at the group level held on an individual basis. We examined how often individual children showed better memory in one condition or the other. Significantly more children showed better target memory in the historical than the morphological condition than showed the reverse pattern (25 historical > morphological vs. 9 morphological > historical, $p = .003$, sign test). For property memory, significantly more children remembered morphological properties more than historical properties than showed the reverse pattern (27 morphological > historical vs. 11 historical > morphological; $p = .005$, sign test). Thus, the memory patterns observed at the group level were also evident within individual children.

Generalization performance was analyzed in a separate 2 (age: younger and older) \times 2 (property type: morphological or historical) mixed-model ANOVA, which revealed no significant effects of age or property type on rate of generalization. Both younger children and older children generalized all properties significantly less often than would be expected by chance ($p < .05$ for all).

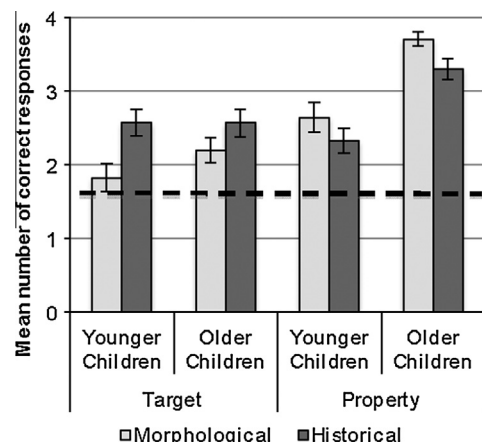


Fig. 3. Mean number of correctly recalled target and property items within each age group for children in Study 1. Memory for targets and properties in each condition and for each age group was significantly better than would be expected by chance (dashed line), $p < .05$. Note: Error bars represent standard errors of the mean.

These results suggest that children's encoding is guided by the generality of the property they are learning. When asked to identify a target from a set of distractors from the same social category, children in both age groups exhibited superior memory for the targets of historical properties over the targets of morphological properties. Additionally, children remembered morphological properties at a higher rate than historical properties. Given the consistent presentation of properties and the conservative within-subjects nature of the design, these results are especially striking: the only cues to guide children's encoding were the introductions to each block and the properties themselves. These findings are consistent with the proposal that learning generalizable properties elicits category-level encoding and learning non-generalizable properties elicits individual-level encoding.

However, despite differences in encoding, children did not explicitly generalize morphological properties more than historical properties. This lack of generalization could be an artifact of the memory task, which may have confused children. In the memory task, we asked children to remember the specific individual about whom they had learned the property. Children could have interpreted the demand to remember the specific individual as a cue that the property was specific to that individual. Thus, even if children had originally encoded the properties distinctly (some general, some specific), the memory task may have led to a revised interpretation of all properties as specific. In order to claim that property generalizability affected encoding of targets and properties, we need to ensure that children actually perceived morphological properties as more generalizable than historical properties. Although there is strong support in the existing literature for this association (morphological properties are general whereas historical ones are not, e.g., Gelman, 1988), it would be useful to establish this association for the specific stimuli we used in the experiment. We address this issue in Study 1b, in which we presented children with an independent measure of generalization of morphological and historical properties.

4.2. Study 1b

4.2.1. Participants

Participants were 27 children between the ages of 3 and 7 (M age = 5.1 years; range: 3.4–7.11) recruited from the same population as Study 1. No child had participated in Study 1.

4.2.2. Stimuli

The target stimuli consisted of four of the target illustrations from Study 1 and four corresponding distractor illustrations, one for each target illustration. The property stimuli were identical to those used in Study 1.

4.2.3. Procedure

4.2.3.1. Practice phase. Prior to the generalization task, children completed two practice trials in which they were asked whether they would generalize properties that were visually apparent. On the first trial, children were told, "Here are two people, Binisha and Foru. Binisha wears

boots. Does Foru wear boots too?" Along with this statement, children were shown two pictures of individuals, only one of whom was wearing boots. If children incorrectly stated that Foru wore boots, they were corrected before moving onto the second practice trial. On the second trial, children were told, "Here are Binisha and Foru again. Binisha has a mustache. Does Foru have a mustache too?" Along with this statement, children were shown two pictures of individuals, both of whom had mustaches. If children incorrectly stated that Foru did not have a mustache, they were corrected. Following the practice trials, an experimenter explained to the child that for the next set of questions, they would not be able to see whether or not the two people shared the property, but that they would have to decide on their own.

4.2.3.2. Generalization task. Children then received eight generalization trials. For each trial they were introduced, with proper names, to two people who appeared to be from the same social group (though were not labeled as such). Children were told either a morphological or historical property pertaining to the person on the left and were then asked whether the person on the right shared that property (e.g., "Here are Jezaran and Briston. Jezaran tripped over a stump and hurt his jezo. Do you think Briston tripped over a stump and hurt his jezo, too?"; see Fig. 4). Feedback was not given on this task. After four trials, the children were reintroduced, in order, to the four pairs they had already seen and asked about a different property (e.g., "Here are Jezaran and Briston again. Jezaran has vitreous humor in his eyes. Do you think Briston has vitreous humor in his eyes too?"). For each pair, there was both a morphological and historical property, but the order in which they appeared was randomized.

4.2.4. Results and discussion

A one-way, paired samples t -test was conducted to test the effect of property type on generalization. Consistent with our hypotheses, we found that children generalized morphological properties ($M = .49$, $SD = .32$) more often than historical properties ($M = .22$, $SD = .27$), $t(26) = 4.031$, $p = .0004$, $r^2 = .38$. Age did not affect generalization perfor-

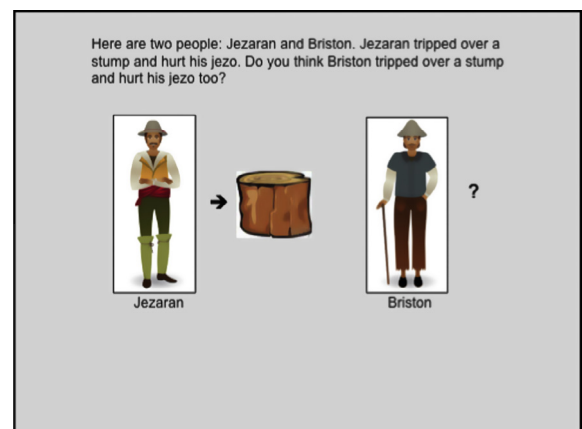


Fig. 4. Screenshot of sample trial in generalization task of Study 1b.

mance; there was no significant correlation between age and difference score (number of morphological properties remembered minus number of historical properties remembered for each child), $r(25) = .253$, $p = .203$. This result provides evidence that children between the ages of 3 and 7 do indeed perceive morphological properties to be more generalizable than historical properties. In light of these findings, we suggest that the lack of generalization in Study 1 occurred because the memory task, which children completed before the generalization task, affected children's inferences about the generalizability of the properties. Without this task, children do treat morphological properties as more generalizable than historical properties, which is consistent with previous research (Gelman, 1988).

4.3. Study 2

In Study 2, we use children's memory patterns as a means to test their interpretation of the generality of two properties that form a less canonical contrast: norms and preferences. Children learned either a norm (e.g., something one has to do or is not allowed to do) or a preference of a particular individual. Norms are shared by a community or culture, making them good candidates for generalization across members of a particular social group. Preferences, however, are largely variable within individual group members, and they are not usually deterministic of one's category membership.

Some evidence suggests that preschoolers understand norms as features of social categories, while preferences are understood as features of individuals (Kalish, 2012). Consistent with this hypothesis, young children are not strongly disposed to generalizing psychological states, including preferences (Aloise, 1993; Henderson & Graham, 2005; Kalish & Lawson, 2008). In contrast, children readily generalize normative rules. For example, children will generalize a newly acquired convention to a third party even in the absence of normative language (Schmidt, Rakoczy, & Tomasello, 2011). If children do not generalize preferences, do they also encode them and the targets they are associated with more weakly than norms, which they understand as generalizable to members of a social group (Turiel, 1998)? In Study 2, we test the hypothesis that children interpret norms as more general than preferences. Evidence that children encode norms and preferences differentially would support this view. Additionally, in Study 2, we more carefully control the content of the properties by randomizing whether they were described as norms or preferences. In this study, the same content appeared as a norm and preference, between subjects.

4.3.1. Participants

Forty-four children participated in this study. Half of the children were preschool-aged ($n = 22$, 12 females; M age = 4.3; range: 3.3–4.11) and the other half were young school-aged ($n = 22$, 10 females; M age = 6.9; range: 6.1–7.10). Two children were excluded for failing to complete the study. Half of the children in each age group received the block of normative properties first and the other half

received the block of preference properties first. None of the children had participated in Study 1 or Study 1b.

4.3.2. Stimuli

The target stimuli were identical to those used in Study 1. The stimuli for both the norms and preferences were illustrations of the objects presented in the property descriptions (e.g., a floor for “likes to sit on the floor when eating”). To control for property salience, all eight property stimuli could be predicated as either a norm or a preference (see Table 2). We included both positively and negatively valenced norms and preferences so that any differentiation children made between the two types of properties could not be due solely to a specific linguistic marker (e.g., “likes”). Distractor items for properties were related to the object of the original property (e.g., pictures of a chair and couch appeared with floor).

4.3.3. Design and procedure

The design and procedure used for Study 2 were identical to Study 1, with a few notable exceptions. First, children learned normative properties and preference properties. Second, all property stimuli were randomized across both blocks, such that items were evenly represented as either norms or preferences across participants. Lastly, norms and preferences were either positively framed (e.g., “has to” or “likes to”) or negatively framed (e.g., “is not allowed to” or “doesn't like to”). For example, the property item “walks to church” could be framed as “has to walk to church” or “is not allowed to walk to church” (norm) or as “likes to walk to church” or “doesn't like to walk to church” (preference).

Children in each age group were randomly assigned to receive either the norm items first or the preference items first. Prior to the norm block, children were told that they would be seeing people from around the world and learning about things that people have to do and are not allowed to do. Prior to the preference block, children were again told that they would be seeing people from around the world, but learning about things that people like and do not like. The study took between 7 and 10 min to complete.

4.3.4. Results and discussion

A 2 (age: younger and older) \times 2 (property type: norm or preference) \times 2 (memory measure: target or property) mixed model analysis of variance was conducted on memory performance. There were significant main effects

Table 2
Study 2 property stimuli.

Norm/preference properties
1. Walks to church
2. Drinks orange juice for lunch
3. Eats yogurt with a fork
4. Colors with colored pencils
5. Travels by train
6. Sits on the floor when he/she eats
7. Plays videogames on the weekend
8. Plays soccer on Tuesdays

of age, $F(1,42) = 12.29$, $p = .001$, $\eta^2 = .23$, memory measure, $F(1,42) = 73.76$, $p < .0001$, $\eta^2 = .63$, and, unlike in Study 1, property type, $F(1,42) = 14.35$, $p = .0005$, $\eta^2 = .25$. Older children remembered more overall, properties were more often remembered than targets, and items associated with preferences were more often remembered than those associated with norms. These main effects were qualified by a significant interaction between property type and memory measure, $F(1,42) = 21.29$, $p < .0001$, $\eta^2 = .34$ (see Fig. 5). Within this interaction, there was a significant simple effect of property type on memory for targets, such that children remembered more targets of preferences than of norms, $F(1,42) = 28.5$, $p < .0001$, $\eta^2 = .40$. There was also a non-significant trend for the simple effect of property type on memory for properties, $F(1,42) = 3.53$, $p = .067$, such that children remembered norms more than preferences. There was no significant three-way interaction between age, property type, and memory measure.

Again, we examined individual patterns of memory performance within each condition by counting the number of individual children who showed better memory in one condition over the other. For target memory, significantly more children remembered targets of preferences more often than targets of norms than showed the reverse pattern (28 preference > norm vs. 2 norm > preference; $p < .0001$, sign test). However, it was not the case that more children remembered norms more often than preferences, compared to the reverse (10 norm > preference vs. 3 preference > norm; $p = .12$, sign test). Results at the individual level are thus consistent with those found at the group level.

Generalization performance was analyzed in a separate 2 (age: younger and older) \times 2 (property type: morphological or historical) mixed model ANOVA, which revealed significant main effects of age, $F(1,42) = 4.46$, $p = .04$, $\eta^2 = .10$, and property type, $F(1,42) = 16.16$, $p = .0002$, $\eta^2 = .28$, on rate of generalization. Children in both age groups generalized norms more than preferences, but

younger children generalized more overall than older children (younger $M = 2.9$ vs. older $M = 2.1$ for norms, younger $M = 1.9$ vs. older $M = 1.5$ for preferences). Younger children generalized norms significantly more often than would be expected by chance ($p = .006$), but they were at chance when generalizing preferences. Older children generalized preferences significantly less often than would be expected by chance ($p = .02$), but they were at chance when generalizing norms. At the individual level, significantly more children generalized norms more often than preferences than showed the reverse pattern (28 norm > preference vs. 6 preference > norm; $p < .0001$, sign test).

We also analyzed the relationship between memory and generalization in a set of contingency analyses. To conduct these analyses, we compared the rates at which children remembered targets for trials on which they did generalize compared with trials on which they did not generalize. We conducted a similar analysis comparing property memory for trials on which children did generalize compared with trials on which they did not generalize. We hypothesized that children would be more likely to remember targets on trials on which they did not generalize than on trials on which they did generalize, but more likely to remember properties on trials on which they did generalize vs. trials on which they did not generalize. These analyses were conducted with one-tailed Wilcoxon tests, given our directional predictions. Both younger ($z = -2.08$, $p = .019$, $r = .44$) and older children ($z = -2.18$, $p = .015$, $r = .46$) were significantly more likely to remember targets on trials on which they did not generalize, but neither age group showed any difference in property memory for trials on which they did vs. did not generalize. Thus, children's memory for targets is related to whether or not they generalize the properties associated with them.

The memory patterns observed in Study 2 suggest that young children encode norms at the category level and preferences at the individual level. When children learned about targets associated with norms, they attended less to the individuating features of the targets than when they learned about targets associated with preferences. This finding is especially interesting in light of the randomization of property content. If a property is framed as a rule, children perceive it to apply more broadly than if it is framed as a preference, despite the fact that the content may be unfamiliar or unusual.

Children also tended to exhibit superior memory for norms than for preferences; however, this result was not statistically significant, likely due to the ceiling performance of older children. It is important to note that the stimuli for the study were selected so that the same content could be used in both norm and preference items. Thus, the norms and preferences used in the study were somewhat unusual. It is unclear whether the differences between properties might be stronger or weaker with more familiar or typical content.

Lastly, children explicitly generalized norms at a higher rate than preferences. This finding coupled with the observed memory patterns suggest that children recognize norms as properties shared across members of a social category and preferences as properties specific to individual group members.

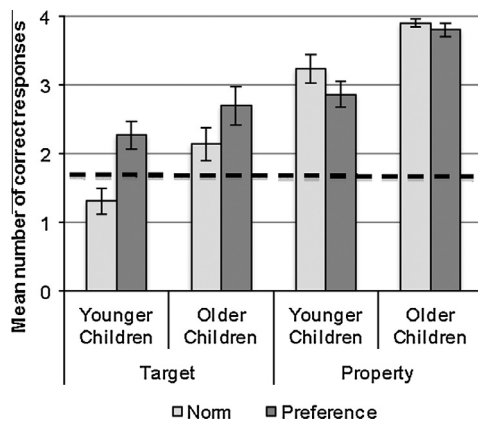


Fig. 5. Mean number of correctly recalled target and property items within each age group of children in Study 2. Younger children's memory for the targets of norms was at chance level. Memory for all other targets and properties for each age group was significantly better than would be expected by chance (dashed line), $p < .05$. Note: Error bars represent standard errors of the mean.

5. General discussion

The present studies examined whether the generalizability of a property affects children's encoding of social learning episodes. When asked to identify targets among distractors from the same social category, both younger and older children were better at remembering targets associated with non-generalizable properties than targets associated with generalizable properties. Thus, generalizable properties cue category-level encoding of targets and non-generalizable properties cue individual-level encoding of targets. We also found that children remembered generalizable properties more than non-generalizable properties, particularly in the case of morphological and historical properties, suggesting that they encode generalizable properties at the category level. These results provide strong evidence that children's memory for social encounters is intimately connected to the generalizability of what they are learning.

The findings of these studies suggest that children not only recognize the generality of the properties we tested, but that they encode learning episodes contingently on this generality. Given that we cued a categorical learning context by highlighting each target's group membership (e.g., "This is a Foru"), one might have expected children to encode all of the learning episodes generally regardless of the property. Alternatively, some research predicts that younger children would have encoded the specific details of all the learning episodes because they focus their attention on fine-grained detail (Ridderinkhof, van der Molen, Band, & Bashore, 1997) and show relatively accurate memory for targets associated with a particular category (Sloutsky & Fisher, 2004). Our results do not favor either of these accounts, but instead suggest that children's encoding is calibrated to the generalizability of the learning event. Children do not spontaneously discard the specific details of all novel targets whenever a categorical context is cued, nor do they over-attend to the specific features of category members. Rather than an overall bias to encode generally or specifically, children's encoding patterns reveal that they encode different aspects of a learning episode depending on the type of property they are learning.

The study design also allowed us to consider potential age differences in encoding. Given that older children are able to remember more about each social encounter than younger children, they might have encoded both targets and properties for both general and specific learning episodes. However, both younger and older children in the present studies encoded distinct aspects of trials containing generalizable and non-generalizable properties. This finding suggests that differential encoding might be a more general feature of social cognition. Future research should examine whether this encoding pattern continues into later childhood and adulthood. The present results are also evidence of the sophistication of preschoolers' understanding of the generalizability of properties encountered in the world. Even with presumably limited exposure to diverse social categories, young children recognize that learning a morphological property or norm associated with one person is also informative of the category as a whole. This

result is consistent with proposals about young children's early folk-biological intuitions (Coley, 1995; Inagaki & Hatano, 2002) and may also point towards an early-emerging heuristic that helps children reason about the social world (Hirschfeld, 2001).

5.1. Differences in task demands across Study 1 and Study 2

The methods used in Study 1 and Study 2 were nearly identical, but the results from the two studies were not. Although children in both studies remembered targets of non-generalizable properties more than targets of generalizable properties, only children in Study 1 remembered generalizable properties significantly more often than non-generalizable properties.

Why were preferences remembered nearly as well as norms? One possibility is that children perceived preferences of individual group members as representative of the group as a whole. Some preferences are shared by members of a group, even if they lack the prescriptive force of norms (e.g., food preferences; see Rhodes & Gelman, 2008). However, given the robust target effect, our results do not support this explanation. A more likely explanation is that children of both age groups were near ceiling for property memory because we used properties with familiar words, but unusual content. For example, children are familiar with orange juice, but may have found it unusual (and thus highly memorable) that someone would drink it for lunch, regardless of whether it was normative or idiosyncratic. Along these lines, if a person exhibited an unusual or deviant preference in the real world (e.g., preferring broccoli over chocolate), a child would presumably be more likely to remember it than a typical preference, especially if the unusual preference evoked an emotional reaction (Stein & Liwag, 1997). We would expect common preferences and norms to be remembered differentially in a more natural and less controlled context.

Children in Study 1 generalized morphological and historical properties at rates below chance, despite the fact that they differentially encoded learning episodes containing these types of properties. In Study 1b, we found that without the memory task, children explicitly generalized morphological properties more than historical properties. However, children in Study 2 generalized norms more than preferences, even given the potentially confusing nature of the memory task. One explanation for this result is that Study 2 provided appropriate contrasting cases and Study 1 did not. Morphological properties are plausibly generalized at the level of species: Humans have vitreous humor in their eyes. Thus, the appropriate contrast class would be a non-human. We suspect children would have generalized morphological properties if they had been presented with a series of taxonomic categories (e.g., humans vs. non-humans) rather than social categories. In contrast, normative properties plausibly generalize at the level of social categories: Forus have to walk to church. In this case, the task provided participants with a ready set of contrast instances because children learned about multiple social categories. Additionally, because we used unusual norms, participants knew that the norms did not apply to them

or to people they knew. Thus, morphological and normative properties differed in the accessibility of relevant contrasts.

5.2. Utility of differential encoding on generalization

Children's relatively superior memory for generalizable properties and targets of non-generalizable properties may be beneficial for future generalization. If children remember the specific details of every category member displaying a generalizable property, they might overly restrict their generalization to the individuals present in the original learning episode. For example, if a child learned that a Foru with long brown hair had to walk to church, and she encoded the hairstyle (or other individuating features of the target), she might not generalize having to walk to church when encountering another Foru with a different hairstyle. By forgetting the individuating features of any particular target, children may be better able to generalize information across category members who do not match on specific surface features (Vlach, Ankowski, & Sandhofer, 2012). Of course, children cannot forget everything about the targets of generalizable properties: they must encode general features of the target so that they can easily recognize other category members encountered in the future. However, if walking to church was idiosyncratic to a particular Foru, children would need to encode the individuating features of that Foru, or else they would not remember which Foru was associated with the property. Thus, encoding specific details of targets may narrow generalization, whereas discarding those details may promote it.

Remembering generalizable properties may also benefit children's future generalization. In order to generalize a property to other category members, children have to remember what the property is. If children do not remember what it was they learned about Forus, they are left with nothing to generalize to future Forus they encounter. Conversely, if children remember a property that is specific to a single Foru, they may be more likely to over-generalize this property to other Forus. Young children may also be strongly motivated to learn general facts about the world (Cimpian & Erickson, 2012; Kalish, 2012). This motivation, coupled with stronger memory for generalizable properties, presumably helps children efficiently build up knowledge about the social world.

Although we believe that memory plays an important role in children's generalization, the design of the current studies does not allow us to conclusively test this hypothesis. Our paradigm did not test a causal effect of memory on generalization, because we reminded children of the original target and property pair before we asked them to generalize. In the contingency analyses in Study 2, we did find a significant relationship between target memory and generalization, despite the fact that children were reminded of the original pair. This result is suggestive of a more robust link between memory and generalization in the real world, when children are not necessarily reminded of what they have learned in the past. Future research on the link between memory and generalization should

explore how memory directly affects generalization in a setting in which children must generate the previously learned property on their own.

5.3. Implications for social essentialism

The present findings have important implications for research on social essentialism. Social essentialism is a cognitive bias that leads children to assume homogeneity within social groups (Birnbaum, Deeb, Segall, Ben-Eliyahu, & Diesendruck, 2010; Diesendruck & Halevi, 2006). Unlike psychological essentialism, which allows for rapid learning of biological categories (Gelman, 2003; Medin & Ortony, 1989), social essentialism may have negative consequences, such as increased prejudice toward outgroups, because children overgeneralize properties observed in a single group member (Hirschfeld, 1996; Rhodes, Leslie, & Tworek, 2012). The present research suggests that children may be more precise in their expectations of group homogeneity, as revealed by the fact that they did not encode all of the properties we presented at a category level.

Given that children do differentiate whether to encode learning episodes at the category or individual levels, what other factors might contribute to their well-documented tendency to generalize individual-level behaviors to other group members? Recent research from Rhodes et al. (2012) has found that generic language facilitates social essentialist beliefs about a variety of social categories. Future research should explore what other environmental or cultural influences contribute to children's social essentialist beliefs, in spite of their ability to appropriately encode at the individual level. Alternatively, if children's knowledge of which properties apply at the category or individual levels is limited, their social essentialist beliefs might be reduced simply by learning more about the generalizability of various social properties. Parents and educators could facilitate this process by scaffolding children's knowledge about which pieces of social information are general and which are specific to an individual.

6. Conclusion

Overall, the results from these studies provide evidence that children's encoding is calibrated to the generality of what they are learning. More specifically, even preschool-aged children use the generalizability of the property to determine how generally they should encode a learning episode. We suggest that category-level and individual-level encoding puts children in a good position to generalize appropriately in the future. Children can only generalize what they remember, but they will not generalize appropriately if they remember too much. Determining how broadly to generalize new information is a substantial challenge in children's conceptual development. The current study confirms that property type is one important cue to generalization, and it supports the proposal that selective encoding is a mechanism guiding social inferences.

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