Cognition 229 (2022) 105246

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/cognit

The influence of linguistic form and causal explanations on the development of social essentialism

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ARTICLE INFO

Keywords:
Social essentialism
Generic language
Causal reasoning
Cognitive development
Social categorization

ABSTRACT

Generic descriptions of social categories (e.g., *boys* play baseball; *girls* have long hair) lead children and adults to think of the referenced categories (i.e., boys and girls) in *essentialist* terms—as natural ways of dividing up the world. Yet, key questions remain unanswered about *how, why,* and *when* generic language shapes the development of essentialist beliefs. The present experiment examined the scope of these effects by testing the extent to which generics elicit essentialist beliefs because of their linguistic form or because of the causal information they convey. Generic language led children ($N = 199$, $M_{age} = 6.07$ years, range = 4.5–7.95) to essentialize a novel social category, regardless of the causal information used to describe category-property relations (either biological or cultural). In contrast, both linguistic form and causal information influenced adults' ($N = 234$) beliefs. These findings reveal a unique role of linguistic form in the development and communication of essentialist beliefs in young children.

1. Introduction

When a child hears statements like "boys are good at soccer" or "girls like pink", they draw inferences about the mentioned features (i.e., being good at soccer or liking pink), as well as about the nature of the mentioned categories more generally (e.g., boys and girls). From early childhood, generic statements—statements that refer to abstract categories rather than individual members of a category—prompt children to view the mentioned categories as intrinsically distinct "kinds" (i.e., to assume that boys and girls are fundamentally different *kinds* of people; Cimpian & Markman, 2011; Leshin, Leslie, & Rhodes, 2021; Rhodes, Leslie, & Tworek, 2012). Once children start thinking of categories in this manner, they expect that category members will share key similarities with one another (e.g., that girls *in general* like pink), that category-related features will persist across circumstance and development (e.g., that girls will *always* like pink), and that, ultimately, category membership is determined by an inherent and internal "essence" (e.g., a girl "essence" that makes girls who they are; Gelman, Ware, & Kleinberg, 2010; Rhodes et al., 2012). The goal of the present research was to examine the circumstances under which generic language elicits these essentialist beliefs about categories in young children, both to shed light on the mechanisms by which language shapes the development of children's conceptual representations and to determine the scope of these effects.

Experimentally, hearing generic language prompts children to form essentialist beliefs about the mentioned categories. For example, children taught about a new animal category with a series of generics (e.g., "*Zarpies* have striped hair"; "*Zarpies* flip in the air") developed stronger essentialist views of Zarpies than did children who learned the same information presented non-generically (e.g., "*This* Zarpie has striped hair" or "*This* one has striped hair"; Gelman et al., 2010). In particular, children who heard the generic descriptions of Zarpies expected Zarpies to have more features in common with one another and expected those features to be both innate and stable over time. Generic language exerts similar effects on children's representations of social categories, as well (Leshin et al., 2021; Rhodes et al., 2012; Rhodes, Leslie, Bianchi, & Chalik, 2018). The effects of generics on children's beliefs extend across time (beyond the experimental session in which they are exposed to the generic language; Gelman et al., 2010; Rhodes et al., 2012), influence children's beliefs about the categories and their features *generally* (beyond the particular features they heard described generically; Gelman et al., 2010; Hollander, Gelman & Raman, 2009; Leshin et al., 2021; Rhodes et al., 2012), have immediate consequences for children's behavior towards category members (Leshin et al., 2021; Rhodes et al., 2018), and shape multiple components of children's essentialist beliefs. To illustrate this last point, children introduced to the category "Zarpies"

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https://doi.org/10.1016/j.cognition.2022.105246
Received 10 February 2022; Received in revised form 24 June 2022; Accepted 28 July 2022
Available online 17 August 2022

with generic (rather than specific) language both endorsed more intrinsic category-based explanations (rather than individual or situational explanations) for a specific Zarpie's behavior and viewed the features associated with the category as determined and inflexible (Leshin et al., 2021; *see also* Graham, Nayer & Gelman, 2011). Taken together, these experimental studies suggest that generic language provides one mechanism by which essentialist representations of categories (e.g., tigers, girls, boys) might be transmitted to children.

This proposal is further bolstered by studies of parent-child conversations. For example, parents frequently produce generics for categories for which they themselves hold essentialist beliefs (e.g., certain human social categories and animal species; Gelman et al., 1998; Rhodes et al., 2012; Segall et al., 2015), and children develop essentialist beliefs about categories that adults frequently reference with generics (Gelman et al., 2004; Rhodes et al., 2012; Segall et al., 2015). Further illustrating the power of generic language to elicit essentialist beliefs in the social domain in particular, the *form* of parental language (e.g., whether parents produce generics or not) is a stronger predictor of whether children essentialize particular social categories (e.g., religious-ethnic distinctions) than the *content* of parental speech (e.g., whether the parent explicitly describes group differences; Segall et al., 2015). In addition, individual differences in parental production of generics correlate with the extent to which their children essentialize the mentioned categories both immediately and across time (Gelman et al., 2014). Perhaps unsurprisingly given these findings, both parental production of generics and children's essentialist beliefs increase together across early childhood (Gelman et al., 2004).

1.1. Key open questions

Despite the robust evidence of a link between generic language and essentialism, key open questions remain about *how, why,* and *when* generic language shapes the development of essentialist beliefs. One important question is whether generics lead to essentialism particularly when they are used to describe properties with biological origins (e.g., "girls have ovaries") or more generally—including when they are used to describe culturally-determined properties (e.g., "boys love soccer"). Prior experimental studies (Gelman et al., 2010; Leshin et al., 2021; Rhodes et al., 2012) presented children with a mix of biological and cultural properties, making it difficult to evaluate this question. One possibility is that generics facilitate essentialist interpretations *broadly* because they communicate the abstract belief that the referenced category is a meaningful and coherent way to carve up the social world (Foster-Hanson & Rhodes, 2021; Leshin et al., 2021; Rhodes & Moty, 2020). From this perspective, even if the generic does not describe a biological property or causal mechanism, hearing abundant generic descriptions of a category can still lead to essentialist views because this language signals that members of the community view the category as a natural kind. An alternate view, however, is that generics only evoke essentialist beliefs when they describe category-feature relations that are more obviously biological (because such relations would be more easily understood as stemming from intrinsic causes according to children's intuitive theories of biology; Noyes & Keil, 2019, 2020; Vasilyeva, Gopnik, & Lombrozo, 2018; 2020; Vasilyeva & Lombrozo, 2020). Under this view, generic language might elicit essentialism for sentences like "girls have ovaries" but not necessarily for sentences like "boys love soccer", *unless* such sentences were accompanied by more information indicating putative biological causes (e.g., that boys are born with strong legs that make them better at kicking), but not when coupled with information that appeals to cultural origins (e.g., that boys are good at soccer because they are more often taught to play soccer). The current research explores these two possibilities by examining the joint effects of both language form (specific vs. generic) and causal origin information (biological vs. cultural) on the development of essentialist beliefs. Before moving on to describe our empirical approach, we discuss these two theoretical possibilities in more detail.

1.2. Account 1: Generics broadly signal essentialist kinds

The view that generic language elicits essentialist beliefs *broadly* in young children—even when generics don't explicitly describe any biological features or mechanisms—rests on two key ideas (Foster-Hanson & Rhodes, 2021; Gelman & Roberts, 2017; Rhodes & Moty, 2020). The first is that by early childhood, children are already beginning to develop essentialist beliefs about the world: They expect *some* categories in their environment to reflect fundamentally distinct natural kinds and so are "on the look-out" for cues to which categories have this status. The second is that children interpret a speaker's use of generics as a signal that the speaker views the referenced category in this manner.

Evidence in support of the first idea includes findings that children develop essentialist beliefs early in childhood, before exposure to the type of formal instruction that could explicitly teach or reinforce essentialist ideas. For example, children develop the essentialist belief that a baby born to tiger parents will inevitably grow up to be a ferocious tiger, even if it is raised only in a community of peaceful sheep, long before they learn about genes or DNA or any quasi-scientific explanation of how traits are passed down through generations (Gelman & Wellman, 1991; Waxman, Medin, & Ross, 2007). Further, children develop essentialist views on their own, even in cultural contexts where adults endorse and describe alternative causal models for how category members acquire their features (e.g., Astuti et al., 2004). The early development of essentialist beliefs suggests that essentialism comprises a basic explanatory framework that children quickly learn to rely on to make sense of their environment (for reviews, see Gelman, 2003; Gelman et al., 2004). Yet, although children are capable of essentialist thought in early childhood, they do not apply these essentialist beliefs to all social distinctions they encounter. Rather, children apply essentialist beliefs selectively—only to those social distinctions that are particularly important and informative in their local cultural environments (Pauker, Xu, Williams & Biddle, 2016; Rhodes & Mandalaywala, 2017; Diesendruck & HaLevi, 2006). Accordingly, essentialist beliefs about particular social dimensions often show a protracted developmental trajectory across childhood (e.g., Mandalaywala et al., 2019; Rhodes & Gelman, 2009; Roberts & Gelman, 2016; Taylor, Rhodes & Gelman, 2009). From this perspective, generics can serve as one important cue to distinguishing which categories are important (as described in more detail below). Therefore, on this account, to elicit essentialist beliefs about particular categories, generics do not have to *create* essentialist beliefs from scratch—they only need to point children to apply these beliefs to particular categories that are salient in their environment.

The second part of this proposal is that one of the ways that generic language cues children to apply essentialist beliefs to categories is by signaling that speakers view the particular categories referenced as essential kinds. By age two-and-a-half, children recognize that generics refer to abstract kinds, not particular individuals or subsets. For example, when looking at a picture of two penguins, preschoolers answer "yes" when asked the generic question "Do *birds* fly?", but respond "no" when asked the more specific question "Do *these* birds fly?", indicating that they can use the linguistic form of the sentence to differentiate when the speaker is referring to the abstract kind *birds,* versus the particular set of birds in the picture (Gelman & Raman, 2003; Graham, Nayer & Gelman, 2011). Also, by age two and throughout childhood, children expect adults (and knowledgeable speakers generally) to know the *right* way to refer to categories and defer to experts regarding category labels (Jaswal, 2004, 2007). Therefore, when children recognize that a knowledgeable speaker has chosen to use a generic to refer to an abstract kind (e.g., "*boys* love soccer" instead of "*that* boy loves soccer"), they are likely to assume that "boys" represents an abstract kind that really exists in the world (because a knowledgeable adult referred to the category as if it does). In this way, generic language signals to children to assume that certain categories in their environment reflect real, natural structures in the world by signaling that adults in their environment see them that way.

Consistent with this account, Moty and Rhodes (2021) found that children's interpretation of generics depended on their beliefs about speaker knowledge. When children heard generic claims about a novel social category (e.g., "Zarpies are good at climbing"), they assumed both that other members of the referenced category would share these properties (e.g., that another Zarpie would also be good at climbing) and that members of other salient but not mentioned categories would not be (e.g., that "Gorps" would not be good at climbing). Importantly, children drew this pattern of inferences only when the generic was said by someone who was knowledgeable about the referenced categories; they did not do so when generics were provided by speakers who lacked reliable information about the categories. This pattern suggests that part of the way that generics shape children's beliefs is by signaling the status of adult beliefs about the relevant categories.

Additional evidence that generic language elicits essentialist beliefs in part because of what children think they signal about speaker beliefs comes from studies showing that generics elicit essentialist representations even when they do not communicate any information about category features at all. Foster-Hanson, Leslie, and Rhodes (2019) presented children with puppet shows where two speakers disagreed about whether a particular generic provided an accurate description of a given Zarpie property. One puppet made a generic claim, such as "*Zarpies* haves striped hair" and another disagreed, either by saying "That's not right about *Zarpies*" (which maintains the generic scope but disagrees with the feature) or by saying "No, *this* Zarpie has striped hair" (which agrees with the feature but disagrees about the generic scope). When children heard the conversations that agreed on the generic scope—despite disagreement about the features—they still developed more essentialist beliefs about the referenced category, even though they hadn't learned anything about any of the features that characterize the kind. In this experiment, the generics signaled how the speakers saw the category, but they never communicated information about shared features (biological or otherwise); yet, generic language still elicited essentialist beliefs in children. Thus, on the view that generic language elicits essentialist beliefs in children in part by signaling that knowledgeable community members view particular categories as essentialized kinds, generics can do so regardless of the properties and explicit causal information they convey.

1.3. Account 2: Generics elicit essentialist beliefs when they describe shared biological features

The alternative possibility is that the consequences of generic language are more limited in scope. For example, Noyes and Keil (2019, 2020) proposed that generics lead children to view categories as reflecting meaningful kinds (i.e., informative and coherent groupings) but not necessarily *essential* kinds (which they operationalized as kinds that are naturally determined by the presence of inherited internal properties). From this perspective, generics elicit these heritability beliefs when they communicate information about shared biological properties, but not otherwise. In support of this view, Noyes and Keil (2019) found that generics describing both physical properties (e.g., "Vawns have freckles") and cultural properties (e.g., "Vawns believe the sun is their god") led adults to think that the category "Vawn" was coherent and meaningful (i.e., endorsing a kind assumption; see also Gelman, 2003) but that only the generics describing physical properties elicited the essentialist belief that these properties were inherited. Similarly, Noyes and Keil (2020) found that across middle to older childhood, children began to view only generic biological features (e.g., "Vawnsies have super strong fingernails")—and not generic cultural features (e.g., "Vawnsies spin in circles when the sun goes down")—as describing heritable properties, but endorsed the belief that the referenced category was a coherent kind after both types of generics. In their experiment, younger children did not distinguish generics that described biological and cultural generics; instead, younger children overall favored the idea that category-feature relations are caused by socialization. Notably, these studies operationalized essentialism narrowly in terms of heritability, rather than as a more multifaceted set of interrelated beliefs about category structure.

Also consistent with the view that generics elicit essentialism selectively, generics can describe various types of causal structures, including, for example, category-property relations that arise from extrinsic or structural forces (rather than intrinsic essences). Thus, generics will not necessarily elicit essentialist beliefs if people have access to salient external causes that explain the category regularities. For example, sentences such as "Zarpies walk around looking up to the sky" do not elicit essentialist beliefs about Zarpies when participants are first told that Zarpies live in a "land of giants," since this provides a clear external reason for why Zarpies would often need to look up (Vasilyeva et al., 2018, 2020). Young children are also capable of reasoning about external sources of category-based regularities more generally (Dunlea & Heiphetz, 2021), consistent with the possibility that when the appropriate cues are provided, children can interpret generics as describing such external causes. For example, children ages 5–10 attribute status differences between groups to extrinsic structural mechanisms when such mechanisms are explicitly explained to them (Hussak & Cimpian, 2015; Peretz-Lange & Muentener, 2021; Peretz-Lange, Perry, & Muentener, 2021). But while children appear capable of reasoning about these types of structural causes for category regularities described with generics by early childhood, there is no evidence that they spontaneously do so (or that they consider structural explanations by default). Rather, children appear capable of this type of structural reasoning when they are *explicitly* told about obvious, perceptually-available causes (e.g., the presence of giants; a fence that keeps groups physically separated from one another). Thus, evidence that children can interpret generics as describing regularities caused by extrinsic mechanisms does not necessarily contradict the proposal that generics elicit essentialism more generally, except in certain cases where particular extrinsic mechanisms are explicitly described.

1.4. The present experiment

Because varying methods, categories, and measures have thus far been used to address the various theoretical possibilities described above, the goal of the present study was to consider these accounts together in a coherent experimental paradigm. Specifically, we aimed to advance understanding of how generic language shapes the development of children's beliefs about categories by manipulating both the language form (generic, specific) and the causal origin (biological, cultural) used to describe category features. To provide a clear test of the implications of generics describing either biological or cultural features, we presented the same properties across generic (e.g., "*Zarpies* have striped hair") and specific (e.g., "*This Zarpie* has striped hair") conditions, but explicitly described these as arising from biological (e.g., "*...because they are born with striped hair*") or cultural (e.g., "*...because they are taught to paint stripes in their hair*") causal mechanisms. This design stands in contrast to prior work, which presented different properties in different conditions and relied on children to make the appropriate inferences about whether they stemmed from biological or cultural causes. We chose to specify a method of social acquisition that focused particularly on teaching because teaching is a common way that social and cultural properties are passed on within cultures (Astuti et al., 2004; Gelman & Roberts, 2017; Tomasello, 2016; Tomasello, Kruger & Ratner, 1993). In fact, only humans (as opposed to other primates) uniquely engage in instructed teaching practices as a means of communicating behaviors and beliefs normative to their culture, making teaching a particularly important process for understanding human social groups (Thornton & Raihani, 2008; Tomasello, 2016).

To distinguish the effects of generic linguistic form from the effects of causal information about features, we crossed our manipulation of causal information (i.e., whether children learned of cultural or biological causal mechanisms for the observed properties) with a linguistic

form manipulation (i.e., whether children heard generic or specific descriptions of the properties), which allowed us to test the separate and possibly interactive contributions of these different components of linguistic input on children's beliefs. To examine how broadly linguistic form and causal information shape children's beliefs, and consistent with the view that essentialism comprises a series of interrelated beliefs about categories, we measured numerous components of children's essentialist beliefs about categories, including their beliefs about (a) intrinsic, category-based explanations, (b) the flexibility of category-related features, (c) the heritability of category-linked properties, and (d) within-category homogeneity. In contrast to recent work that has narrowly operationalized essentialism as beliefs about the heritability of category-linked properties alone (Noyes & Keil, 2019, 2020), the present study adopts the common perspective that essentialism is a multifaceted set of interrelated beliefs (Atran, 1990; Gelman, 2003; Haslam, Rothschild, & Ernst, 2000; Medin & Ortony, 1989; Prentice & Miller, 2007)—an important issue we return to in depth in the General Discussion. As such, we have included various measures of essentialist beliefs that will allow us to understand the boundary conditions of the effects of linguistic form (generic, specific) and causal origin (biological, cultural) on multiple dimensions of essentialist thought. Lastly, to shed light on the developmental trajectory of these phenomena, participants included children ages 4.5 to 7 years and adults.

If generic language broadly elicits essentialist beliefs because of how it functions in communication (rather than only when it conveys information about biological features), then we should find higher endorsement of essentialist beliefs in both generic language conditions, regardless of the causal origin information provided. However, if generic language elicits essentialist beliefs because it is often used to convey biological information, participants should endorse essentialism more strongly when they are told about properties that originate from biological causes, and especially when those properties are described in generic terms. Testing these competing explanations is critical for understanding how and when generic language shapes children's understanding of the social world.

2. Method

2.1. Participants

2.1.1. Child sample

Two hundred and nineteen 4.5- to 7.9-year-old children took part in a 15-min online study. Children participated on their own time at any point during the open study window (June 2020 to August 2020) and were compensated with an Amazon Gift Card for their time. The study was conducted on families' own computers via an online platform developed for remote developmental research (the Princeton and NYU Discoveries in Action Lab, or PANDA; Rhodes et al., 2020). The platform captured both survey and video data from participating families who provided informed consent.

As per our pre-registration (https://osf.io/6xney), we aimed to collect data from 220 participants. The sample size was based on a power analysis of effects obtained by Leshin et al., 2021, which called for approximately 200 participants, and was increased slightly to account for potential drops (occurring at a rate of approximately 10% for research conducted via the virtual lab). Our final sample included 199 children (54.27% female, M_{age} = 6.07 years, range = 4.50–7.95). The racial-ethnic composition of the final sample (as reported by children's parents) was 70.35% White, 14.07% Multiracial, and 9.05% Asian; 6.53% declined to provide this information. Overall, 12.56% of participants reported themselves as being of Hispanic, Latinx, or Spanish descent. Twenty additional children participated but were excluded for unsuccessful video uploads (n = 14), not speaking English throughout the duration of the study (n = 2), or for completing an insufficient number of trials (n = 4), as specified in our pre-registrated exclusion criteria.

2.1.2. Adult sample

Approximately half of the adult sample (n = 115) was recruited from the university undergraduate participant pool, but as a result of COVID-19, we modified our data collection procedures to collect the remaining half (n = 119) by posting the study on Prolific, an online data collection platform. To maintain consistency between undergraduate and Prolific samples, we restricted the age-range on Prolific to individuals between 18 and 24 years of age who identified as English speakers, as outlined in the addendum to our pre-registration. Thus, our final adult sample consisted of a total of 234 (59.4% female) adult participants. The racial-ethnic composition of our sample was 50.86% White, 26.5% Asian, 9.4% Multiracial, 7.26% Black or African American, and 0.4% Native American; 5.56% declined to provide this information. Overall, 6.84% of the adult sample identified as being of Hispanic, Latinx, or Spanish descent.

An additional 109 adults attempted the session but were excluded (as per our pre-registered exclusion criteria) for not completing the entire study (n = 55), failing audio verification checks (n = 30), self-reporting as a non-English speaker (n = 15), being under 18 years of age (n = 3), or failing >3 of the 5 Winograd Schema questions included in our paradigm (n = 6; Levesque, Davis, & Morgenstern, 2012).

2.2. Study procedure

Using a 2 (language form: generic vs. specific) by 2 (causal origin: biological vs. cultural) fully crossed between-subjects design, participants were randomly assigned to one of four experimental conditions that differed in both the language form and causal origin used to describe the 16 novel properties in the storybook manipulation. The study was presented as a series of short videos and verbally narrated questions, which participants responded to by clicking on the designated buttons on the screen to indicate their response. The study was configured such that participants could not skip to the response screen without hearing the full narration of each question but could choose to not answer the question itself. Child and adult participants were administered identical versions of the study.

Prior to beginning the test trials, participants underwent a warm-up phase to introduce them to the biological and cultural origin explanations. After hearing each causal origin explanation, participants were asked two comprehension questions: one that probed the causal origin of being able to smell things (e.g., "What about being able to smell things with your nose? Is that something that you were born with, or something you learned from other people?"), and one that probed the causal origin of knowing the ABCs (e.g., "What about knowing the ABCs? Is that something you were born with, or something you learned from other people?"). Children responded accurately 84% of the time and adults responded accurately 97% of the time on the two comprehension questions. Regardless of the accuracy of their responses, all participants were shown the correct answers afterwards and were retained in analyses, as outlined in our pre-registration.

Next, participants were guided through a narrated storybook about a novel category of people referred to as "Zarpies." The illustrated Zarpie images were diverse across age, gender, and ethnicity (depicted with varying skin tones). The storybook contained 16 pages, each depicting an individual Zarpie displaying a novel property (e.g., having stripes in their hair) or engaging in a novel behavior (e.g., drawing stars on their knees). Each page of the storybook included a one-line description of the depicted property, which followed one of four combinations of language form and causal origin information: (a) generic form/biological origin, (b) generic form/cultural origin, (c) specific form/biological origin, or (d) specific form/cultural origin (see Table 1 below for a complete list of properties included in the storybook). Full study scripts and materials, including a video of the complete procedure, can be viewed on OSF: (https://osf.io/8e2np/).

Additionally, 56.28% of families who participated in the child session elected to share the video of their study session with authorized researchers via Databrary, 2012; registered users of Databrary can

Table 1
List of the 16 properties described in the storybook task.

Storybook Task: Prompts			
Look at this Zarpie!			
1. […] love to eat flowers.			
Language Form: Specific **This Zarpie** loves to eat flowers. This Zarpie loves to eat flowers because…		**Language Form**: Generic **Zarpies** love to eat flowers. Zarpies love to eat flowers because…	
Causal Origin: Biological **… this Zarpie was born** feeling like flowers taste yummy.	**Causal Origin:** Cultural **… this Zarpie was taught** that flowers taste yummy.	**Causal Origin:** Biological **… Zarpies are born** feeling like flowers taste yummy.	**Causal Origin:** Cultural **… Zarpies are taught** that flowers taste yummy.
2. […] has stripes in her hair.			
3. […] can bounce a ball on his head.			
4. […] likes to sing.			
5. […] climbs tall fences.			
6. […] flaps his arms when he is happy.			
7. […] has freckles on his feet.			
8. […] hops over puddles.			
9. […] really doesn't like walking in the mud.			
10. […] draws stars on her knees.			
11. […] can flip in the air.			
12. […] is scared of ladybugs.			
13. […] really doesn't like ice cream.			
14. […] chases shadows.			
15. […] wraps baby in an orange blanket.			
16. […] sleeps in tall trees.			

As noted above, the 16 properties were identical across conditions, but the *language form* and *causal origin* used to describe the properties were explained varied across conditions in a fully crossed, between-subjects design. The prompts that participants heard for the first property are provided here; for the complete list of prompts provided for the other 15 properties, please see https://osf.io/8e2np/.

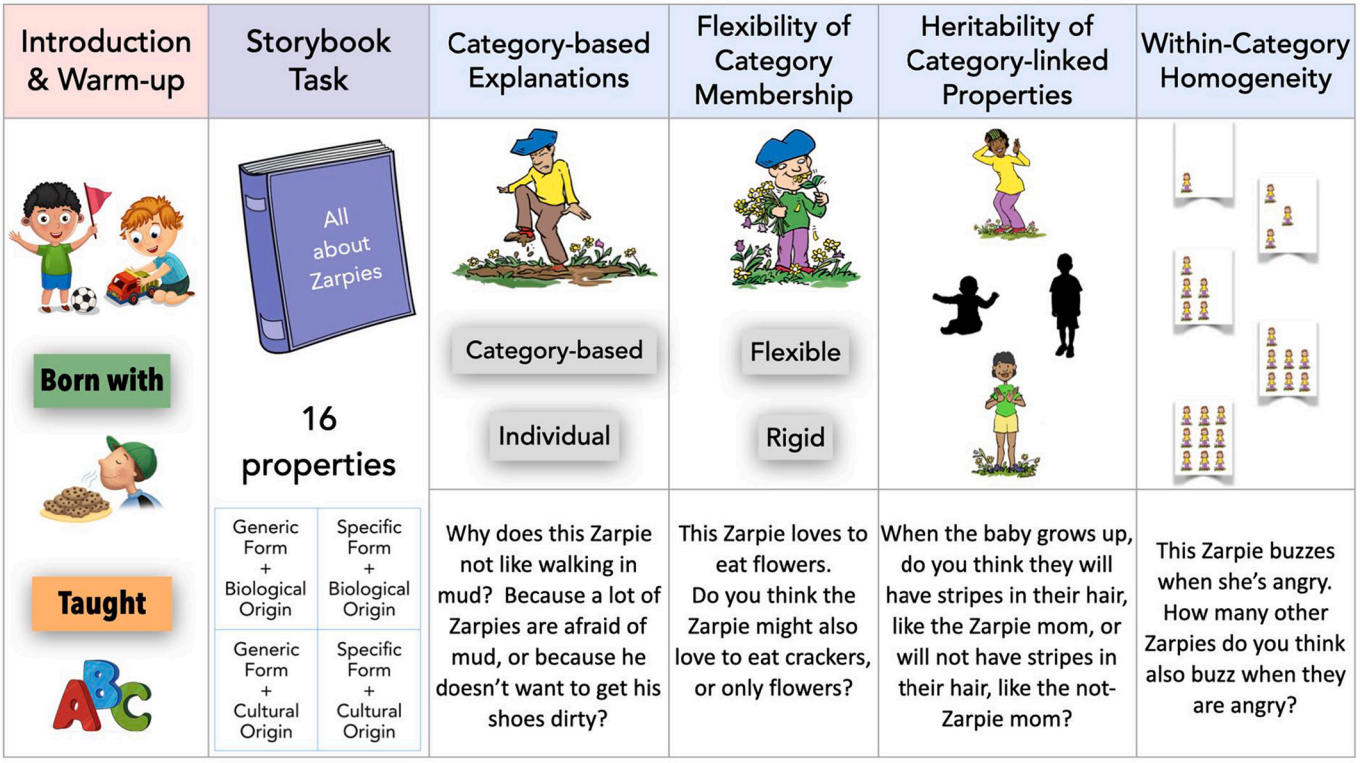

Fig. 1. Summary of the full study protocol, including example items for the essentialism measures (see Table 2 for a full description of measures). Panel headers highlighted in blue describe each construct of interest.

access these videos at https://nyu.databrary.org/volume/1399. After participants viewed the storybook, they completed four measures of essentialist beliefs about Zarpies in the order presented in Fig. 1. Lastly, children completed two measures of their attitudes and intended behavior towards Zarpies (however, because these measures were not central to our main research questions, descriptions of these measures and their findings are included in the Supplementary Online Materials).

2.2.1. *Category-based explanations task*

To examine participants' use of category-based explanations, participants were asked why an individual Zarpie was engaged in a certain activity or behavior (e.g., "Why is this Zarpie hopping over a puddle?"; Cimpian & Markman, 2009) and offered a choice of one intrinsic category-based explanation and one extrinsic individual explanation. Across three items (all of which used properties included in the storybook), instances of choosing the intrinsic category-based explanation (e.g., "A lot of Zarpies think it's fun to hop over puddles") were coded as "1" (indicating an essentialist belief), while selections of extrinsic individual explanations (e.g., "She is practicing for a game of hopscotch") were coded as "0" (indicating a non-essentialist belief). For a full description of each item included in the essentialism measures, see Table 2. Two children skipped the category-based explanations task and were thus dropped from these analyses (child explanations $n = 197$).

Table 2
The four essentialism measures children completed following the storybook manipulation (together comprising the *essentialism composite*).

Category-based Explanations
1. Look at this Zarpie. He really doesn't like walking in the mud. […] Do you think it's because **a lot of Zarpies are afraid of mud**, or because he doesn't want to get his shoes dirty?
2. Look at this Zarpie. She's hopping over a puddle. […] Do you think it's because **a lot of Zarpies think it's fun to hop over puddles**, or because she is practicing for a game of hopscotch?
3. Look at this Zarpie. He's chasing a shadow […] Do you think it's because **a lot of Zarpies love to chase shadows**, or because he is running a race?
Flexibility of Category-linked Properties
1. Look at this Zarpie. This Zarpie flaps her arms when she's happy. Do you think the Zarpie might sometimes say 'hooray' when she's happy too, or **only flap her arms**?
2. Look at this Zarpie. This Zarpie loves to eat flowers. Do you think the Zarpie might also love to eat crackers too, **or only flowers**?
3. Look at this Zarpie. This Zarpie sleeps in a tall tree. Do you think the Zarpie might sometimes sleep in a bed, too, or **only in a tree**?
Heritability of Category-linked Properties
1. Now the baby is a big kid. […] Do you think the kid will **have stripes in their hair, like the Zarpie mom**, or will not have stripes in their hair, like the not-Zarpie mom?
2. Now the baby is a big kid. […] Do you think the kid will **love to sing, like the Zarpie mom**, or will not love to sing, like the not-Zarpie mom?
Within-Category Homogeneity
1. Now, look at this Zarpie. This Zarpie buzzes when she's angry. How many other Zarpies do you think also buzz when they're angry? [Only one, a few, some, most, or all?]
2. Now, look at this Zarpie. This Zarpie dances in circles. How many other Zarpies do you think also dance in circles? [Only one, a few, some, most, or all?]

For the first three tasks, the bolded text represents an essentialist response (coded as "1") and the non-bolded text represents a non-essentialist response (coded as "0"). Responses to the within-category homogeneity measure were coded on an ordinal scale from 1–5, with higher numbers representing higher endorsement of essentialist beliefs.

2.2.2. Flexibility task

Across three items, participants were told about a property (previously mentioned in the storybook) exhibited by an individual Zarpie (e.g., "This Zarpie sleeps in a tall tree") and were asked whether they believed the Zarpie exclusively demonstrated that trait ("only sleeps in tall trees"; coded as "1," indexing an essentialist belief) or whether there was potential for them to exhibit other traits ("might sometimes sleep in a bed, too"; coded as "0," indexing a non-essentialist belief). One child skipped the flexibility task and was dropped from these analyses (child flexibility $n = 198$).

2.2.3. Heritability of category-linked properties task

To assess participants' beliefs about the heritability of category-linked properties, we used a modified switched-at-birth paradigm (Gelman & Wellman, 1991). Participants were told a story about a fictitious child who was born to a Zarpie mother but was raised by a non-Zarpie motherand were then asked to predict whether the child would grow up to possess a familiar property of the Zarpie parent (e.g., "have stripes in their hair"; coded as "1", indicating an essentialist belief) or the non-Zarpie parent (e.g., "will not have stripes in their hair"; coded as "0", indicating a non-essentialist belief). Prior to administering the two target questions, participants were asked two comprehension questions to ensure the scenario was communicated effectively. From the full sample, only eleven participants (child $n = 4$; adult $n = 7$) failed both of these comprehension check questions. As per our pre-registration, however, all participants were retained for analyses. Two children chose to skip the heritability of category-linked properties task altogether and were thus dropped from these analyses (child heritability $n = 197$).

2.2.4. Within-category homogeneity task

To measure participants' perceptions of within-category homogeneity, participants were presented with information about a novel Zarpie property (e.g., "This Zarpie buzzes when she's angry") and were asked to predict how many other members of the category exhibited the same trait. Participants' responses on these two items were coded on a 1 to 5 scale that corresponded to: (1) only one, (2) a few, (3) some, (4) most, or (5) all, with higher numbers indicating stronger endorsement of within-category homogeneity (and thus, greater endorsement of essentialist beliefs). To indicate their response, participants chose from a visual scale that clearly represented each proportionate response. Prior to being administered the target questions, all participants received training on how to use the visual scale. One child skipped the within-category homogeneity task and was dropped from these analyses (child homogeneity $n = 198$).

2.3. Participant video coding

As outlined in our pre-registration, we conducted an initial data quality confirmation check on all videos to confirm that parents and children provided consent and that it was indeed a child completing the study. Then, to estimate the level of interference (if any) from parents, siblings, or others during children's study sessions, a random subset of approximately 20% of children's videos ($n = 38$) were coded by a trained researcher using the Datavyu coding platform (Datavyu Team, 2014), more than half of which ($n = 20$) were coded by a second researcher for reliability (interrater reliability = 100.00%). This protocol was informed by initial validation work completed for the first empirical study conducted on our online platform (Leshin et al., 2021); in that study, >85% of study videos (178 sessions total) were coded, trial-by-trial, for the presence of interference from parents, siblings, and other external influences. Instances of interference were extremely low (< 1% of coded trials), and exploratory analyses conducted without the trials containing interference yielded identical results to analyses with all trials retained. Based on these findings, we adopted the protocol of coding only a subset of videos for studies conducted on our online platform (PANDA) thereafter and, provided that similarly low rates of interference are detected, retaining all trials in analyses (as pre-registered). For more details on this approach, including a detailed codebook of how we operationalized interferences, please see https://osf.io/8e2np/.

As expected, coding for the present study revealed extremely low rates of interference. Consistent with the rates of interference identified in Leshin et al. (2021), as well as other experimental studies run on the platform since (Leshin et al. (in press); Rizzo, Britton, & Rhodes, 2021; Xu et al., 2022), we documented external interference on <1% of trials. Thus, we opted to retain all trials from the complete sample of child participants in our analyses. Video data was not collected for adult participants, and thus video coding was not conducted for the adult sample.

3. Results

3.1. Analysis strategy

We first examined the effects of the manipulations on a composite measure of essentialism (as in previous studies using similar paradigms; Leshin et al., 2021; Rhodes et al., 2012; 2018), and then on each measure of essentialist beliefs separately. To create the composite essentialism score, we examined participants' responses jointly across three measures: (1) category-based explanations, (2) flexibility of category membership, and (3) heritability of category-linked properties. Responses for the homogeneity measure were excluded from this composite because they were on a different response scale and were not included in previous studies of the effect of generic language on essentialism using similar methods. For both the composite score and the three binary measures (category-based explanations, flexibility of category membership, beliefs about the heritability of category-linked properties), data were analyzed in R (version 4.0.2) using generalized linear mixed models (GLMM). In particular, we used the "glmer" function in the lme4 package, specified for a binomial distribution (Bates et al., 2015). We report and interpret Wald X^2 tests from the glmer results as indicators of significant effects. Means are presented as the probability of choosing the essentialist response with 95% confidence intervals. When appropriate, coefficients were transformed to odds ratios as measures of effect size and for ease of interpretation, with 95% confidence intervals provided.

For the measure of perceptions of within-category homogeneity, data were analyzed in R (version 4.0.2) using mixed ordinal logistic regression models in the ordinal package (Christensen, 2019). We report and interpret the results of likelihood ratio tests (LRT) as indicators of significant effects. Means are presented as average responses on the 1–5 scale with 95% confidence intervals.

All mixed effects models included item number and participant ID as random intercepts, and tested for language form, causal origin, and their interaction as fixed effects. Given the distinct age-group patterns in our data, here we report analyses of each age-group (children, adults) separately (analyses of the full sample with age-group as an additional between-subjects factor may be found in the Supplementary Online Materials). To examine changes across age in our child sample, we included participant mean-centered age as a predictor in these analyses. Significant interactions involving children's mean-centered age were examined using simple slopes follow-up tests.

3.2. Analyses of children

3.2.1. Essentialism composite

Children endorsed more essentialist responses in the generic ($M = 0.61$, *95% CI* [0.57, 0.65]) than specific ($M = 0.47$, *95% CI* [0.43, 0.50]) conditions (main effect of linguistic form, Wald $X^2(1) = 31.78$, $p < .001$). Indeed, relative to hearing specific language, children were 1.80 times (95% *CI* = 1.28, 2.55) as likely to endorse essentialist beliefs after

hearing generic language. The effects of linguistic form varied across age (interaction of linguistic form and mean-centered child age, Wald $X^2(1) = 10.59$, $p = .001$), such that the likelihood of children providing essentialist responses increased across age after hearing generic language ($\beta = 0.37$, *95% CI* [0.17, 0.56]), but not after hearing specific language (see Fig. 2a). There were no main or interactive effects of causal information on children's essentialism composite scores (*ps* > .10).

3.2.2. Task-specific analyses

Generic language increased children's essentialist responses in a similar manner across all four tasks. Children who heard generic language endorsed more category-based explanations ($M_{generic} = 0.58$, *95% CI* [0.52, 0.64]; $M_{specific} = 0.35$, *95% CI* [0.30, 0.41]; Wald $X^2(1) = 30.84$, $p < .001$; Fig. 2b), viewed category properties as more rigid on the flexibility task ($M_{generic} = 0.64$, *95% CI* [0.58, 0.70]; $M_{specific} = 0.55$, *95% CI* [0.50, 0.61]; Wald $X^2(1) = 3.73$, $p = .05$; Fig. 2c), viewed properties as more heritable (although this contrast did not reach significance on its own; $M_{generic} = 0.60$, *95% CI* [0.53, 0.67]; $M_{specific} = 0.50$, *95% CI* [0.43, 0.57]; Wald $X^2(1) = 3.68$, $p = .055$; Fig. 2d), and generalized the category-based properties more broadly on the homogeneity task ($M_{generic} = 3.30$, *95% CI* [3.07, 3.53]; $M_{specific} = 2.65$, *95% CI* [2.49, 2.85]; $X^2(1) = 13.74$, $p < .001$; Fig. 2e).

For the flexibility items, the effect of language interacted with age (Wald $X^2(1) = 8.70$, $p = .003$; see Fig. 2c), such that children's endorsement of essentialism increased with age in the generic conditions ($\beta = 0.37$, *95% CI* [0.009, 0.73]) but decreased with age in the specific conditions ($\beta = -0.36$, *95% CI* [−0.65, −0.06]). There were no other effects of age within the child sample (with the exception that overall, children endorsed more category-based explanations with age, Wald $X^2(1) = 12.41$, $p < .001$) and as with the analysis of the composite, there were no main or interactive effects of causal origin information on any individual measure of essentialism among children (*ps* > .14).

3.3. Analyses of adults

3.3.1. Essentialism composite

Overall, adults endorsed more essentialist beliefs in the generic ($M = 0.50$, *95% CI* [0.47, 0.53]) than specific ($M = 0.39$, *95% CI* [0.36, 0.43]) conditions (main effect of linguistic form, Wald $X^2(1) = 15.52$, $p < .001$) and more in the biological ($M = 0.47$, *95% CI* [0.44, 0.50]) than cultural ($M = 0.42$, *95% CI* [0.38, 0.45]) conditions (main effect of causal information, Wald $X^2(1) = 4.82$, $p = .03$; see Fig. 3a), with no interaction between these two factors (language form, causal origin; $p = .42$). Relative to hearing specific language, the odds of adults endorsing essentialist beliefs were 1.52 times (*95% CI* = 1.04, 2.24) as high after hearing generic language. Relative to hearing explanations with cultural causal origins, the odds of adults endorsing essentialist beliefs were 1.21 times (*95% CI* = 0.83, 1.76) as high after hearing explanations with biological causal origins.

3.3.2. Task-specific analyses

The effect of linguistic form among adults was found on three of the four essentialism measures. Adults endorsed more category-based explanations in the generic ($M = 0.60$, *95% CI* [0.55, 0.66]) than specific ($M = 0.40$, *95% CI* [0.35, 0.45]) conditions (main effect of linguistic form, Wald $X^2(1) = 22.20$, $p < .001$; see Fig. 3b), viewed the category properties as more rigid on the flexibility task in the generic ($M = 0.47$,

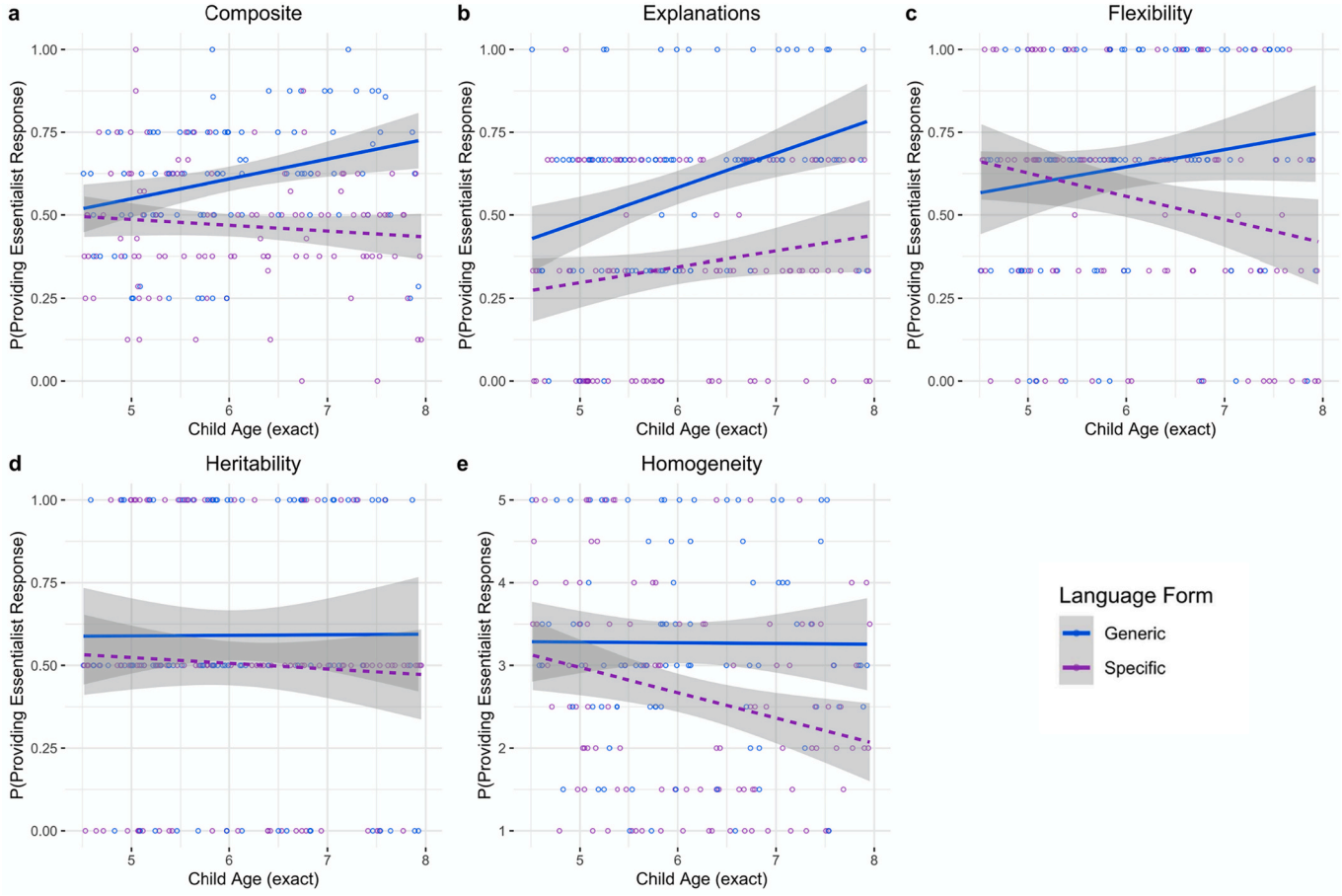

Fig. 2. Proportion of children's essentialist responses across age, split by language form condition. Colors correspond to language form conditions (generic = blue solid line, specific = purple dotted line), lines represent fitted regression lines, and shaded regions represent 95% confidence intervals. Smaller shapes represent average responses per participant.

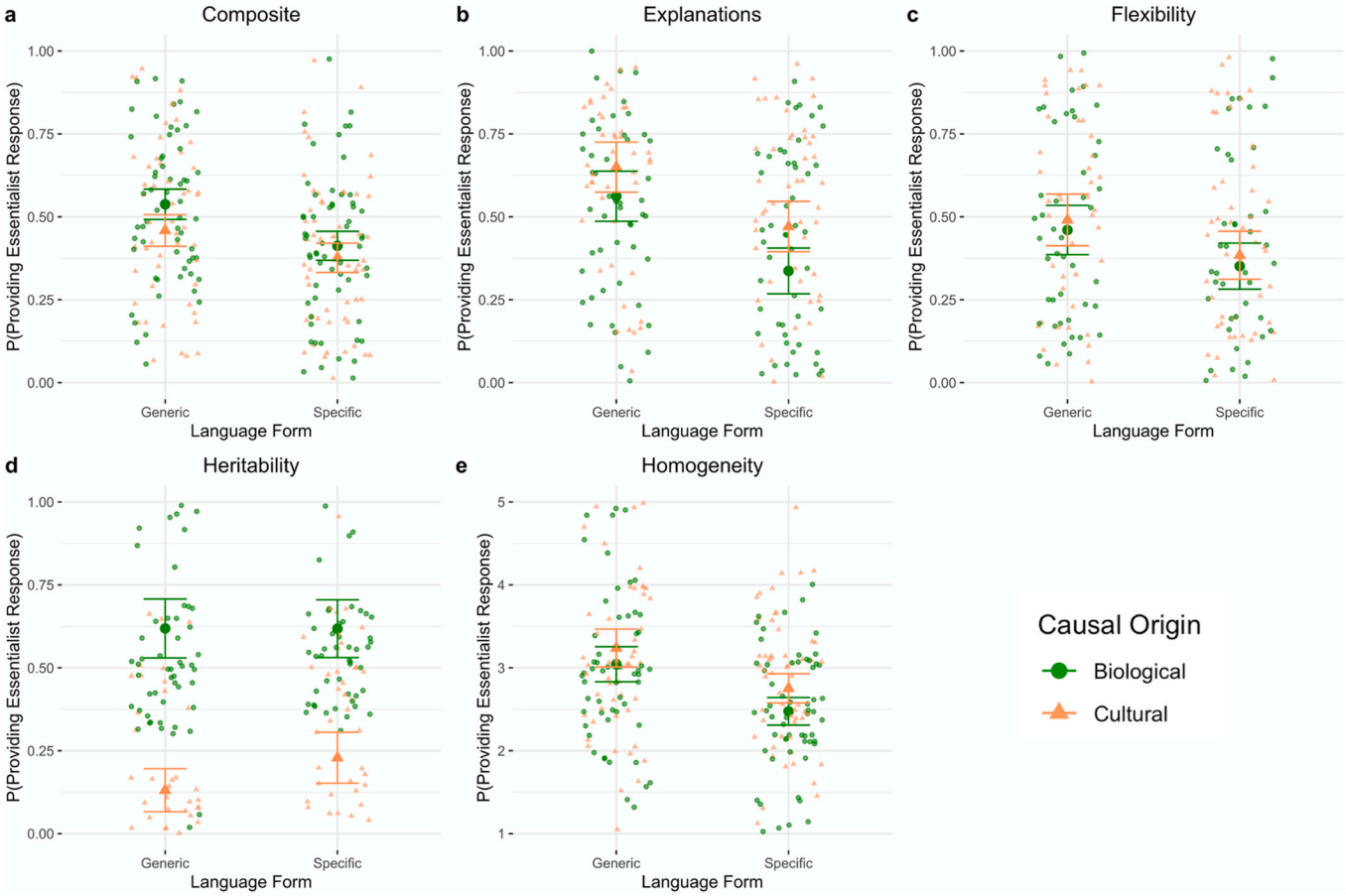

Fig. 3. Adults' mean essentialist responses as a function of language form and causal origin conditions. Large shapes represent group means, small shapes represent average responses per participant, and error bars represent 95% *CIs*.

95% CI [0.42, 0.53]) compared to specific conditions ($M = 0.37$, *95% CI* [0.32, 0.42]; main effect of linguistic form, Wald $X^2(1) = 5.29$, $p = .02$; see Fig. 3c), and generalized more broadly in the homogeneity task in the generic ($M = 3.14$, *95% CI* [2.98, 3.29]) than specific ($M = 2.61$, *95% CI* [2.49, 2.73]) conditions (main effect of linguistic form, $X^2(1) = 18.69$, $p < .001$; see Fig. 3e). There was no effect of linguistic form on adults' responses on the heritability task ($p = .27$; see Fig. 3d).

The effects of causal information on adults' essentialist beliefs varied by task. Adults endorsed more category-based explanations in the cultural ($M = 0.56$, *95% CI* [0.50, 0.61]) than biological ($M = 0.44$, *95% CI* [0.39, 0.50]) conditions (main effect of causal information, Wald $X^2(1) = 8.34$ $p = .004$; see Fig. 3b), and were more likely to generalize the novel properties on the homogeneity task in the cultural ($M = 2.98$, *95% CI* [2.84, 3.13]) compared to biological ($M = 2.75$, *95% CI* [2.62, 2.89]) conditions (main effect of causal information, $X^2(1) = 4.15$, $p = .04$; see Fig. 3e). On the heritability task, adults viewed the properties as more heritable in the biological ($M = 0.62$, *95% CI* [0.56, 0.68]) than cultural ($M = 0.18$, *95% CI* [0.13, 0.23]) conditions (main effect of causal information, Wald $X^2(1) = 80.40$, $p < .001$; see Fig. 3d). We found no effects of causal information on adults' responses on the flexibility task ($p = .51$; see Fig. 3c). Lastly, and consistent with the analyses of the child sample, there were no interactive effects of language form and causal origin information on either the composite or any individual measure of essentialism among adults ($ps > .13$).

4. General Discussion

This experiment sheds light on the circumstances under which generic language leads to essentialist thought in young children and adults. One possibility we considered was that generics elicit essentialist beliefs broadly, by signaling that a child's community views the mentioned category as an essential kind (Leshin et al., 2021; Rhodes et al., 2012; Rhodes & Moty, 2020; Rothbart & Taylor, 1992). We also considered the alternative possibility that generics invoke essentialist beliefs only when they communicate information about shared biological features (and not cultural features), because doing so provides direct input that something intrinsic defines category membership and determines category features (Noyes & Keil, 2019, 2020; Vasilyeva et al., 2018, 2020; Vasilyeva & Lombrozo, 2020). Our results provided support for the first possibility by demonstrating that generic language acts as a powerful cue to essentialist beliefs even when used to describe features that arise from cultural causal origins (in this case, teaching). In addition, these findings speak to the developing influence of causal explanations on essentialist thought by showing that causal information influenced adults', but not children's, essentialist beliefs (and influenced adults' beliefs in distinct ways across measures). These findings contribute key insights to broader debates in developmental and cultural psychology concerning the mechanisms involved in the transmission of essentialist beliefs among children and adults.

Linguistic form heavily influenced children's beliefs about the novel category. That is, generic language increased children's endorsement of essentialism and did so in a similar manner across all four essentialism measures; children who learned about the category via generic (rather than specific) language endorsed more category-based explanations for individual behavior, viewed category-related features as less flexible, expected category-related features to be more heritable (this finding was directionally consistent but did not reach significance, $p = .055$), and also expected features of individuals to generalize more broadly across

other members of the category. In contrast, causal origin information (i.e., whether the properties were described as arising from biological or cultural causes) did not influence any measure of children's essentialist beliefs. Thus, the present findings indicate that generics elicit essentialism (across multiple dimensions of essentialist thought) when they describe category-property relations that stem from both biological and cultural causal origins. Importantly, generics also elicit essentialist thought even when no explicit causal cues are provided. Across multiple studies using very similar paradigms (Gelman et al., 2010; Leshin et al., 2021; Rhodes et al., 2012), descriptions of Zarpie properties were provided using either generic or specific language, without any sort of causal origin information included. Even in the absence of these explicit causal cues (biological or otherwise), both children and adults who heard generic descriptions of Zarpies in past research still endorsed more inherent category-based explanations for the observed Zarpie properties and viewed the features as stable across circumstance and development.

Taken together, these findings run counter to the proposal that generics elicit essentialism only when they describe biological features or causal relations (e.g., Noyes & Keil, 2020). Empirically, numerous differences could contribute to the discrepant conclusions from different studies on this issue. For example, Noyes and Keil (2020) found that children viewed category features as more heritable after hearing generics that described biological rather than cultural properties. However, their study was not designed to test the independent and interactive roles of linguistic form and property type, as they did not include comparison conditions that presented information non-generically (and thus did not allow for an assessment of the role of linguistic form on its own). In addition, the study presented different properties in the cultural and biological conditions (whereas the present study described the same properties across conditions, with explicit explanatory information about whether they arose from cultural or biological mechanisms).

Also, and perhaps most importantly, the present study operationalized essentialism as a broad and multifaceted construct, whereas Noyes and Keil (2020) operationalized essentialism in terms of heritability (based on the switched-at-birth task), alone. Although we found similar patterns across the four measures of essentialism that we included in the present study, the effects did appear weakest (descriptively) for the switched-at-birth task compared to the other three. In the main analyses presented here, the effects of generic language on children's responses on the switched-at-birth task did not reach significance ($p = .055$). The effect of linguistic form condition on children's responses on this task did reach significance, however, in our pre-registered analyses comparing children and adults responses directly (presented in the SOM; these analyses considered children as a group rather than testing for effects across age). Regardless, it may be the case that generic language has a relatively weak influence on this dimension of essentialist thought, relative to other dimensions and measures, which could contribute to the divergent conclusions suggested by these different studies. From this perspective, generic language could lead children to think that something *intrinsic* and generalizable explains category-linked regularities (as suggested by our findings on the other three measures) but not necessarily to view this intrinsic entity as *inherited* unless combined with other information or cues (or perhaps, additional examples of generic language across time). Alternatively, it is possible that weaker effects on this measure stem from the fact that the switched-at-birth task is more challenging for children to make sense of, perhaps particularly in an unmoderated format. Thus, it would be useful in future work to examine the effects of generics on additional measures of children's beliefs about heritability and biological origins to shed further light on this issue.

While there is general agreement that the switched-at-birth task provides a relatively direct measure of psychological essentialism (although people can sometimes endorse heritability without essentialism; see Rhodes, 2013), there is theoretical disagreement over whether some of the other measures that we included here (i.e., the explanation task, homogeneity task, and flexibility task) indicate essentialist thought or more general kind-related beliefs (for discussion, see Gelman, 2003; Noyes & Keil, 2020; Rhodes & Moty, 2020). In our view, these measures reflect interrelated components of essentialist thought because children's responses across these measures reflect the belief that something intrinsic to the category explains the associated features (explanation task), constrains those features such that they cannot be expressed otherwise (flexibility task), and is found consistently across category members (homogeneity task). Elsewhere, we have argued that these interrelated beliefs develop together across early childhood as children construct their understanding of the world (Foster-Hanson & Rhodes, 2020; Rhodes & Moty, 2020). From our perspective, while it is possible to distinguish these beliefs from a purely conceptual or philosophical perspective, they are connected to one another (and reflect a generally essentialist stance towards categories) as they develop and operate in a child's mind.

In our view, it is more useful to conceptualize essentialism in terms of this multifaceted set of interrelated beliefs, rather than solely in terms of heritability, because they often develop together and jointly shape other aspects of cognition and behavior (for discussion, see Rhodes & Mandalaywala, 2017; Rhodes & Moty, 2020). At the same time, we cannot resolve this debate about the most useful conceptualization of essentialism with the present data. Nevertheless, the present findings show that generic language increases children's belief that categories are explanatory and that their features are inflexible, generalizable, and determined by birth, even when generics explicitly describe cultural causal relations (at least in the case of teaching), offering an important contribution to the empirical and theoretical literature on this question.

Adults' essentialist beliefs were also sensitive to the effects of generic language on three of the four essentialism measures (all except the heritability task). Adults who heard generic language (compared to specific language) endorsed more category-based explanations for individual behavior, viewed category-related features as inflexible, and expected features of an individual category-member to generalize broadly across the entire category. Thus, these findings are consistent with prior work showing consistency across development in how generics shape and reflect thought (Gelman et al., 2010; Rhodes et al., 2012; Segall et al., 2015).

Unlike children, however, adults' essentialist beliefs were also sensitive to causal origin information. On the heritability task, adults viewed features explained with biological causes as more heritable than features with cultural causes—a distinction that young children did not draw. As can be seen in the comparison of Figs. 2 (children) and 3 (adults; see also Fig. 1 in the SOM), adults endorsed heritability in the biological information conditions (regardless of language) at approximately the same levels as children did so in the generic conditions (regardless of property information). What differed most across development were essentialist beliefs after hearing about cultural causes: Adults reliably judged the features as socially acquired in the cultural causes conditions, whereas younger children did not. These developmental changes could reflect both the development of adults' explicit understanding of biology and heredity (Coley, Arenson, Xu, & Tanner, 2017; Shtulman & Schulz, 2008; Solomon, Johnson, Zaitchik, & Carey, 1996; Waxman et al., 2007; Xu & Coley, 2020), which could lead them restrict their heritability beliefs to more biological properties, as well as adults' more nuanced understanding of the social and cultural forces that structure society and contribute to category regularities, which could contribute to their understanding of cultural transmission as a social process. These patterns more generally suggest that children attend more to the *form* of language and adults more to the *content* of language when making inferences about which category-linked properties are inherited.

Consistent with adults' more developed understanding of the extrinsic, culturally-based processes that underlie social categories, adults also viewed the category as having more explanatory power and the features as more generalizable in the cultural origin condition compared to the biological origin condition. This likely suggests that

when appropriate, adults rely on culturally-grounded theories of social categories (perhaps focused on structuralism or group norms) such that they view social categories as more powerful when they learn about causal structures grounded in relevant extrinsic or cultural processes (Haslanger, 2011, 2016; Rangel & Keller, 2011). The pattern of findings on both the heritability and explanation task are thus consistent with the possibility that although young children and adults can represent both essentialist and more externalist causal models of social categories, there is a shift across development in how readily children assume that the categories they encounter—perhaps particularly those they hear described with generics—have each of these structures (Peretz-Lange et al., 2021; Peretz-Lange & Muentener, 2019, 2021; Vasilyeva et al., 2018, 2020; Yang, Naas, & Dunham, 2022). For example, when asked to reason about a status disparity between novel social categories for example, young children defaulted to intrinsic explanations overall but attributed the status disparity to extrinsic structural forces increasingly across age—especially when provided with explicit extrinsic framing (Peretz-Lange et al., 2021; Peretz-Lange & Muentener, 2019, 2021). These findings are consistent with results of the present study, as well as with the view that various externalist theories of social categories often become more pronounced—and are applied more systematically—across development (Peretz-Lange et al., 2021; Rhodes & Gelman, 2009; Vasilyeva et al., 2020; Yang et al., 2022).

Relatedly, although the current study found that generic language elicited essentialism in children when generics expressed both biological and cultural causal relations, these findings do not indicate that generics will always lead to essentialism, nor do they contradict the point that children and adults can represent various types of causal structures. When thinking about why "Zarpies walk around looking up to the sky" for example, children and adults can indeed entertain structuralist explanations when given explicit structural cues such as "Zarpies live in a land of giants," which provide context for the generic statement they just heard (Vasilyeva et al., 2020). As an additional example in the domain of gender—where the use of generic gender-category labels are prevalent—children generate more structural explanations for both novel and familiar gender-linked properties after being provided with explicit structural cues (Vasilyeva et al., 2018; Yang et al., 2022).

Despite these early emerging capacities to represent extrinsic causes of category regularities, young children did not view the category features in the present study as more socially acquired when they were described as stemming from cultural than biological causes (and did not see them as more flexible or less likely to be explained by intrinsic, category-based mechanisms when they were described with cultural rather than biological causes). Thus, perhaps children more easily understand obvious physical structures (e.g., living in a land of giants, Vasilyeva et al., 2020; separate rooms dividing boys and girls, Vasilyeva et al., 2018; Yang et al., 2022) than the cultural process of teaching as an extrinsic cause of social regularities. It is also possible, however, that we might have found evidence of an early-emerging understanding of the social nature of teaching if we had implemented a within-subjects design that directly asked children to consider whether biology or teaching is more likely to cause inherent category regularities. As such, future work should more thoroughly compare children's understanding of a broader range of biological and social causes.

Although both children and adults have the capacity to draw diverse causal relationships between categories and category-linked features, the present study suggests that generic language is often interpreted as a signal that the observed property arises from inherent causal origins, particularly by young children. We found that generics such as "Zarpies climb tall fences," for example, elicited essentialist thinking regardless of whether children were led to believe that Zarpies climb tall fences *"because Zarpies are born with arms that make them good at climbing*" (a biological explanation) or *"because Zarpies are taught how to use their arms to be good at climbing*" (a cultural explanation). Overall, these findings suggest that generics elicit essentialism regardless (and sometimes perhaps in spite) of the property information they convey, consistent with the possibility that they do so by signaling that a speaker thinks a particular category represents a meaningful way to divide up the world.

Data Availability Statement

The data that support the findings of this study are openly available on OSF at https://osf.io/8e2np/.

Funding Source Declaration

Research reported in this publication was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number R01HD087672 and Award Number F31HD107965. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Author contributions

J. Benitez and M. Rhodes developed the study concept, with input from R.A. Leshin. All authors contributed to the study design. Data collection and data analysis were performed by J. Benitez. J. Benitez drafted the manuscript, and R.A. Leshin and M. Rhodes provided critical revisions. All authors approved the final version of the manuscript for submission.

Declaration of Competing Interest

None.

Acknowledgments

We thank the children and families of the Princeton and NYU Discoveries in Action Lab (PANDA) for their participation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cognition.2022.105246.

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