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ARTICLE

Parents' talk about conceptual categories with infants: stability, variability, and implications for expressive language development

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Abstract

Children's exposure to talk about conceptual categories plays a powerful role in shaping their conceptual development. However, it remains unclear when parents begin to talk about categories with young children and whether such talk relates to children's language skills. This study examines relations between parents' talk about conceptual categories and infants' expressive language development. Forty-seven parent-infant dyads were videotaped playing together at child age 10, 12, 14, and 16 months. Transcripts of interactions were analyzed to identify parents' talk about conceptual categories. Children's expressive language development was assessed at 18 months. Findings indicate that parents indeed talked about conceptual categories with infants and that talk was stable across time, with college-educated parents producing more than non-college-educated parents. Further, parents' talk about conceptual categories between 10 and 16 months predicted children's 18-month expressive language. This study sheds new light on mechanisms through which early experiences may support children's language development.

Keywords: generics; parental input; infants

Introduction

Children's developing understanding of conceptual categories plays a critical role in their language development. Young children's learning of new words stands at the crossroads of their language and conceptual development and serves as a gateway to development in both domains (Waxman, 2007). To acquire a new word, children have to process transient speech, identify a linguistic form and a relevant referent, and establish an initial word-referent mapping. They then have to achieve a word-category mapping by systematically generalizing the word to referents of the same kind beyond the situation where the word-referent mapping was initially accomplished (Arunachalam & Waxman, 2010; Waxman, 2007). Moreover, children go through a protracted process of strengthening

and enriching the lexical entry by hearing and using the word repeatedly, which likely relies on and leads to additional conceptual processing including selective activation of concepts and refinement of conceptual structures (Adams & Bullock, 1986; McMurray, Horst & Samuelson, 2012; Samuelson & McMurray, 2017).

Echoing sociocultural theories of cognitive development (Vygotsky, 1978), recent theories of conceptual development emphasize that a priori cognitive constraints and social interactions jointly shape children's learning of the conceptual structures of their culture (Adams & Bullock, 1986; Callanan, 1991; Fischer & Bullock, 1984; Gelman, 2009; Markman, 1992; Mervis, 1987; Waxman, 2003, 2007). In particular, parents' communicative input powerfully shapes children's conceptual development by providing rich data and facilitating category-based inferences (Callanan, 1991; Gelman, Coley, Rosengren, Hartman, Pappas & Keil, 1998). However, to date, studies of parents' communication about categories with children have focused on toddlers and preschool-aged children. The current longitudinal study explores whether and how parents of diverse educational backgrounds discuss categories with their infants aged 10 to 16 months and if variation in parental talk about categories predicts infants' expressive language skills at 18 months.

Children's Word Learning and Parents' Language about Objects and Categories

Most theories of lexical development, such as social interactionist, constraints-based, and attention-based theories, agree that children acquire words through their interactions with the social world, especially with their parents (Bruner, 1983; Hirsh-Pasek, Golinkoff, Hennon & Maguire, 2004; Hoff, 2006; Smith, 2000; Vygotsky, 1978). Empirically, within and across social classes, parents who talk more and use more diverse words and longer sentences with their children tend to have children with larger vocabularies (Hoff & Naigles, 2002; Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991; Pan, Rowe, Singer & Snow, 2005; Weisleder & Fernald, 2013). Researchers have also proposed mechanisms through which parental input facilitates children's word learning. For instance, input provides data for children's word segmentation, word-referent mapping, and enrichment of lexical entries (Aslin, Saffran & Newport, 1999; Hoff & Naigles, 2002; McMurray et al., 2012; Newman, Rowe & Bernstein Ratner, 2016), and parent-child mutual engagement in conversation helps children use nonlinguistic information to begin to understand the language they hear (e.g., Hoff & Naigles, 2002; Tamis-LeMonda, Kuchirko & Song, 2014; Tomasello & Todd, 1983). A less-explored mechanism relevant to the current study is the proposal that input highlighting properties and boundaries of categories may facilitate children's word learning (Adams & Bullock, 1986; Brown, 1958; Callanan, 1991; Mervis, 1987). In this section, we review empirical evidence supporting this hypothesis.

Parents' Talk about the Properties of Objects and Categories

Many have argued that children gain important information about properties of categories from adult input (Adams & Bullock, 1986; Callanan, 1991; Callanan & Sabbagh, 2004; Ninio & Bruner, 1978; Waxman, 1991). For example, in a study by Callanan (1991), parents taught their two- to four-year-olds labels at basic (e.g., mixer), superordinate (e.g., machine), and subordinate (e.g., handheld mixer) levels. When teaching basic and subordinate labels, parents frequently discussed perceptual features and parts (e.g., "Sometimes you lick the cake off the *mixers*"). In contrast, when teaching superordinate labels, parents more often mentioned functions (e.g., "Machines do work for us").

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Callanan argued that these regularities in input imply the boundaries of categories (e.g., "Machines do work for us." suggests that machines form a coherent category) and orient children's attention to generalizable features typical of categories (e.g., "doing work for us" is typical of machines). Adams and Bullock (1986) found that parents' discussion of object properties also helped children integrate atypical examplars into categories. In their study, parents discussed how atypical members fit into basic-level categories while also marking their differences from prototypes (e.g., "Appaloosas are horses with spots"), thus supporting children's learning of both basic-level labels and specific names for atypical instances. Parents also explained deeper, functional features of categories (e.g., behaviors peculiar to certain animal types), which may help children override salient yet misleading perceptual similarities and dissimilarities. However, neither Callanan (1991) nor Adams and Bullock (1986) directly examined children's word-learning outcomes.

Parents' feedback concerning properties of objects in response to children's misuse of labels has also been shown to help children acquire labels (e.g., Adams & Bullock, 1986; Banigan & Mervis, 1988; Mervis, 1984). For instance, Mervis and Mervis (1988) found that parents' corrective labeling in conjunction with demonstration of object attributes (e.g., running one's finger along the slot of a piggy bank while labeling "bank") was more likely to lead to improvements in infants' comprehension of object names than either acceptance of incorrect labels or corrective labeling without demonstration. This finding was interpreted as evidence that corrective labeling coupled with demonstration of properties fostered alignment between child-basic and adult-basic categories, which supported children's acquisition of labels.

While these studies provide preliminary evidence that input about properties helps children to learn object labels, research using artificial-noun-learning paradigms provides more direct evidence that input concerning properties supports children's word learning. For example, in Wei, Ronfard, Leyva, and Rowe (2019), parents taught their 18- to 24-month-olds that a novel creature is called a "wug". Cluster analyses showed that parents who merely focused on labeling or acting on the wug (e.g., "This is a wug") had toddlers who were less accurate in recognizing the taught label than toddlers with parents who combined diverse teaching strategies, including labeling or manipulating the wug, providing information about the wug (e.g., "The wug is pink and round"), and asking the child to label, manipulate, or provide information about the wug (e.g., "Where are the wug's eyes?"). The authors contend that parents' discussions of the wug's properties may have underscored attributes useful for word-referent mapping and recognizing the referent across contexts, thereby facilitating children's acquisition of the label. Indeed, Smith, Jones, Landau, Gershkoff-Stowe, and Samuelson (2002) provide causal evidence that training infants to focus on object shape, a property that more reliably determines categorical membership than other properties, promotes infants' vocabulary growth. The authors propose that focusing on shape allowed infants in the treatment condition to form a generalization principle (namely, that objects with similar shapes likely shared a label), which allowed them to acquire object names at more rapid rates than untrained infants.

Taken together, the aforementioned studies suggest that adults' talk about categories produced in experimental settings may support children's word learning, but the role of naturalistic input in the home environment remains unclear. The present study aims to bridge this research gap by investigating if parents' talk about conceptual categories while playing with their infants predicts children's expressive language.

Parents' Generic Language

While the studies cited above illuminate associations between children's word learning and input concerning object properties and category boundaries, none analyzed parental input so as to distinguish talk about entire categories (e.g., "Camels have humps") from labeling of individual instances (e.g., "This camel has a hump"). For this, we must look at the literature on parents' use of generics: phrases that provide information about properties of entire categories (as opposed to specific exemplars) (Gelman et al., 1998; Krifka, Pelletier, Carlson, ter Meulen, Chierchia & Link, 1995). In many languages, including English, generics are expressed in linguistic forms distinguishable from talk about individuals (e.g., Spanish: Gelman, Sánchez Tapia & Leslie, 2016; Mandarin: Gelman & Tardif, 1998; Tardif, Gelman, Fu & Zhu, 2012; Quechua: Mannheim, Gelman, Escalante, Huayhua & Puma, 2010; homesigners: Goldin-Meadow, Gelman & Mylander, 2005). In English, generics are sentences whose verbs appear in non-progressive tenses and whose noun phrases do not contain cues specifying a particular individual. Generic noun phrases (NPs) can take the form of bare plurals (e.g., "Strawberries are delicious"), indefinite singulars (e.g., "A lion says rawr"), or mass nouns (e.g., "Fire is hot").

Children acquire generics early in life, likely through parent-child interactions. Two-year-olds have been observed to produce generics (Gelman, Goetz, Sarnecka & Flukes, 2008; Pappas & Gelman, 1998) and to distinguish generics from talk about individuals (Gelman & Raman, 2003; Hollander, Gelman & Star, 2002; Rhodes, Leslie, Bianchi & Chalik, 2018). Parents commonly use generics with children as young as 20 months (Gelman et al., 1998; Graham, Nayer & Gelman, 2011), and their use of generics varies depending on the domain under discussion (Gelman et al., 1998). Importantly, previous studies examining parents' generic language have predominantly focused on highly educated parents of middle socio-economic-status (SES), and it remains unknown whether and how parents' use of generics, or talk about categories in general, varies depending on their levels of education (as is the case for many aspects of parental input, for reviews, see Hoff, 2006; Rowe & Weisleder, 2020).

Individual differences in parents' use of generics may have important developmental implications because children's exposure to generics plays a powerful role in shaping their conceptual development and fostering category-based inferences. For example, research indicates that hearing generic language facilitates young children's understanding that properties are conceptually central (Cimpian & Markman, 2009) and generalizable to exemplars of the same category (Graham et al., 2011). Similarly, children tend to attribute facts about individuals to deep, inherent causes if they have previously heard generic talk and formed generic beliefs about relevant categories (Cimpian & Erickson, 2012b). Generics also support children's processing and retention of information (Cimpian & Erickson, 2012a; Gülgöz & Gelman, 2015).

Despite these cognitive implications of generics, there remain important gaps in research. We have a poor understanding of whether and how parents use generics with infants younger than 20 months and how generics affect children's real-world vocabulary acquisition outside of experimental word-learning tasks. Moreover, we know little about other ways in which parents discuss categories with children beyond generics. Gelman et al. (1998) found that parents subtly convey category membership during joint book reading by using utterances and gestures to link taxonomically related animals' pictures. Categories may also be conveyed through the use of quantifiers (e.g., universal quantifiers such as "every" and "all"; indefinite quantifiers such as "some" and "many") or explicit references to kinds or types (e.g., "A cow is a kind/type of animal") (Adams & Bullock, 1986; Hollander et al., 2002; Mannheim et al., 2010). However, it remains unknown how

frequently these types of non-generic talk about entire categories (as opposed to labeling individual exemplars) appear in parent-infant conversations.

The Current Study

The first goal of this study is to explore whether and how parents talk about categories with infants aged 10 to 16 months. It is unclear when parents begin discussing categories with children. In fact, by age two, children have already gained substantial conceptual and expressive language skills and shown sensitivity to generics (e.g., Gelman & Raman, 2003; Hollander et al., 2002; Rhodes et al., 2018). Examining parents' discussion of categories with infants is a critical first step to understanding how communicative input contributes to these achievements in children's early conceptual and expressive language development. We also aim to examine whether parents' talk about categories varies by their levels of education. Parents' use of abstract explanations (e.g., "A fork is considered a tool because you use it to eat") is positively associated with their level of education (Rowe, 2012), suggesting that more highly educated parents may speak to their children in a more abstract, conceptual manner. The final objective is to examine whether variation in parents' discussion of categories with their 10- to 16-month-olds, including but not limited to their use of generics, predicts children's expressive language skill at 18 months, controlling for parent education and parental vocabulary diversity. As reviewed above, while studies have shown that parents' talk about object or category properties facilitates children's acquisition of *individual words* (e.g., Mervis & Mervis, 1988; Wei et al., 2019), no research has investigated whether such talk has long-term implications for children's expressive language development. Further, parents of higher SES and those who use more diverse words with children tend to have children with larger vocabularies (Huttenlocher et al., 1991; Pan et al., 2005). Therefore, we investigate associations between parents' talk about categories and infants' expressive language controlling for parental education and vocabulary diversity in order to isolate the unique contribution of category talk. Our findings will offer valuable insights into mechanisms through which communicative input shapes children's language development.

The current study addresses the following questions:

1. Do parents discuss conceptual categories with infants, and if so, how?
2. Does parents' input about conceptual categories vary by parent education?
3. Does parents' discussion of categories predict infants' expressive language skills?

Methods

Participants

The current study uses data from a longitudinal training study aimed at increasing parents' use of gestures with infants (Rowe & Leech, 2019). Fifty parents and their 10-month-olds participated in the training study. Families were recruited through direct mailings and community and social media advertisements in a metropolitan city in Northeastern US. We used census data to target zip codes that would allow us to recruit a sample diverse in educational background. Three dyads were excluded from the analyses due to an inability to contact the parent or a change of the target parent during the study. We excluded one dyad from all descriptive and regression analyses because the parent produced an exceptionally large amount of GL and CL (about two or more SDs

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above the mean across all parents at all four visits). We also conducted all analyses with the outlier family included and the key findings remained the same. The final sample of 46 families consisted of 45 mother-child dyads and one grandmother-child dyad (the grandmother designated herself as the child's primary caregiver). Twenty-four parents (52%) had at least a college degree ("college-educated parents" henceforth) and 22 parents (48%) received less education than a college degree ("non-college-educated parents"). Parents' educational attainment (in years) was strongly correlated with their income, *Pearson's* $r = 0.70$, $p < .001$. Because converging evidence has suggested that parents' education robustly relates to their input style and children's language outcomes (e.g., Hoff, 2003; Huttenlocher et al., 1991), we used education as an index of family SES. Thirty-three parents were White, four were Black, and nine self-identified as Mixed Race or Other. All participating children (24 girls, 22 boys) heard English at least 75% of the time at home. None had developmental or language delays or was born prior to 37 weeks.

Procedures and Measures

Semi-Structured Parent-Child Play Sessions

A trained researcher visited the families at home when children were 10, 12, 14, and 16 months. Half of the dyads were randomly selected to receive training in gesture use, and the 10-month visit occurred before the training. We controlled for treatment status in the analyses presented in this paper. At each visit, dyads played with the contents of three bags for a total of 15 minutes. The same three bags were used when children were 10 and 14 months (i.e., Visits 1 and 3), and they respectively contained the wordless picture-book *Good Night Gorilla*, a ring-stacker toy, and a barn playset. When children were 12 and 16 months (i.e., Visits 2 and 4), the bags instead contained the wordless picture-book *Good Dog Carl*, a shape sorter toy, and a supermarket playset. The play sessions were videotaped.

Infants' Expressive Language Skills

At each home visit, parents reported infants' receptive and productive vocabulary using the MacArthur-Bates Communicative Development Inventories short form (MCDI, Fenson, Dale, Reznick, Bates, Thal, Pethick, Tomasello, Mervis & Stiles, 1994). Parents reported the words their children understood (receptive scale) and produced (productive scale) out of 89 lexical items. At child age 18 months, parents filled out the MCDI and a trained researcher assessed the children's language skills using the expressive language subscale of the Mullen Scales of Early Learning (Mullen, 1995). The Mullen for expressive language for the 15-30 month age range includes items that measure gestures, first words, and object labels; hence, for the age range of our participants, it primarily assessed their vocabulary skills. The Mullen gives raw scores, T scores (average of 50, SD of 10), percentiles, and age equivalents for each domain; we used both percentiles and raw scores in our analyses.

Transcription and Coding

Recordings of play sessions were transcribed verbatim and verified by trained researchers using CHAT (Codes for the Analysis of Human Language) rules and codes (Child Language Data Exchange System; MacWhinney, 2000). The unit of transcription was an utterance,

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defined as any sequence of words or communicative actions preceded and followed by a customary pause between sentences, an acoustic marker, an interruption, a change in conversational turn, or a change in intonational pattern (Rowe, 2012).

Two researchers then reliably coded the transcripts for parents' generic language (GL) and six other types of categorical language (CL) (namely, "references to kinds", "use of quantifiers", "property language", "analogies", "connections", and "other") at the utterance level, Cohen's Kappa = 0.80 (calculated based on all GL and CL codes). Infants did not produce any generic or categorical utterances. A generic utterance includes a present indicative verb and a noun phrase (NP) referring to a category (usually an indefinite or plural NP), AND it provides information (e.g., a property) about that category (e.g., "*A horsy* says neigh") (Gelman et al., 1998). If an utterance contained more than one concept (i.e., indefinite NP) discussed in a generic form, each concept was coded separately (e.g., "*Bats* live in *caves*" contains two generic concepts/indefinite NPs). The researchers then coded the domain of each generic concept: natural kinds (e.g., flowers, dogs), artifacts (e.g., soap, pizza), people (e.g., cashiers, babies), experiences (e.g., hugs, baths), and intangible kinds (e.g., noise, energy).

Previous studies have focused exclusively on generics (Gelman et al., 1998), but prototypical generics are only one of a variety of ways in which parents discuss category membership and properties with children. Hence, we also coded other utterances in which parents explicitly and implicitly described and demarcated categories for infants. Categorical language (CL) is defined as utterances referring to AND/OR providing information about categories (in contrast, prototypical generics must include a present indicative verb, NP(s) referring to a category, AND provide information about the category). Of note, language referring to specific instances of a category is considered as a mere label and is not coded as CL (e.g., "This dog is named Carl"). We coded six types of CL in addition to GL: references to kinds, use of quantifiers, property language, analogies, connections, and miscellaneous categorical utterances coded as "other" (see Table 1 for the detailed coding scheme). We took a bottom-up approach to developing these CL categories. That is, we derived the categories by carefully observing and summarizing the ways in which parents naturally discussed categories during the play sessions. The categories also align well with prior research on input about concepts and types. "Reference to kinds" and "use of quantifiers" are based on extant research showing that adults commonly refer to kinds/types and use quantifiers to invoke entire categories (Adams & Bullock, 1986; Mannheim et al., 2010). We developed the category "property language" because language highlighting properties of categories has been shown to support children's word learning (Smith et al., 2002; Wei et al., 2019). The categories "analogies" and "connections" drew upon previous findings that parents often explicitly connect objects in the same or different categories across contexts when talking to infants and toddlers (e.g., drawing connections between objects that are perceptually present and objects that are absent or prior knowledge; such talk has been termed as "connections", "associative talk", or "bring-in talk") (Callanan & Sabbagh, 2004; Choi & Rohlfing, 1990; Crowley, Callanan, Jipson, Galco, Topping & Shrager, 2001; Grimminger, Rohlfing, Lüke, Liszkowski & Ritterfeld, 2020; Jant, Haden, Uttal & Babcock, 2014; Wei, Leech & Rowe, 2020). For conciseness, we use "CL" to refer to the abovementioned six types of CL, excluding prototypical generics. Relative to CL, GL is linguistically distinctive (it includes indefinite NPs) and informationally rich (it provides information about a category). As with GL, if a categorical utterance referred to more than one concept, each concept was coded separately. We grouped the category-denoting NPs into five domains: natural kinds, artifacts, people, experiences, and intangible kinds.

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Table 1. Coding Scheme for Generic Language (GL) and Categorical Language (CL)

	Definition	Example
Generic Language (GL)	Expressions about entire categories (as opposed to specific exemplars) that provide information about properties of those categories.	"*A horsy* says neigh."
Categorical Language (CL)		
Reference to Kinds	Explicit references to kinds or types, typically utterances stating how one thing is a kind/type of another.	"This is *a funny kind/type of vehicle.*" "There are *two kinds of* blue."
Use of Quantifiers	Use of universal quantifiers or indefinite references to denote categories.	"*All kangaroos* can hop." "*Some frogs* are green."
Property Language	Utterances that typically follow generic utterances and describe the properties of a category WITHOUT explicitly mentioning the category.	Parent: "What do lions say?" (GL) Parent: "*Rawr.*" ("CL - property language"; this utterance refers to a property of lions—the fact that they say "rawr" —but does not mention the category "lion," as is required for a GL utterance.)
Analogy	Utterances that compare one category (or instance of a category) to another category, hence highlighting similarities or differences BETWEEN categories.	"That baby is riding the dog (an exemplar of the category "dogs"; no code) like *a horse* ("CL – analogy")."
Connection	Utterances that compare one instance of a category to one or more instances of the same category, emphasizing shared membership and/or properties WITHIN categories.	"This giraffe looks like *giraffes* ("CL – connection") we see at the zoo."
Other CL	Other utterances that denote category membership and/or properties but does not belong in the above categories.	"Have you seen *an armadillo* before?" ("CL – other"; it includes an indefinite NP denoting a category but does not provide information about armadillos)

Results

Stability and Variability in Parents' Use of Generic and Categorical Language

Because families participated in a training study targeting gesture use, we tested if treatment status was associated with children's language measures or parents' use of GL, CL, or all generic and categorical language combined (GCL henceforth) at any visit, and found no significant relations, all *ps* > .1. To answer our first research question about whether and how parents discuss categories with infants, we calculated the frequency of GL and CL as the number of concept word tokens each parent discussed using GL and CL

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(see Table 2 for descriptive statistics)[1]. We also calculated the frequency of GCL by tallying up the frequency of GL and CL. To account for individual differences in parents' talkativeness, we computed the density of GL, CL, and GCL as the frequency of GL, CL, or GCL per 100 parent utterances (including single-word utterances and multi-word utterances) or per 100 parent multi-word utterances (utterances consisting of two words or more) (see Table 2). As reported in Table 2, overall, GL and CL were low in frequency. At each visit, GL and CL each individually made up under 1% of parents' utterances. Nevertheless, GL and CL were present in most parents' infant-directed talk. Across the four visits, 43 parents (91%) used GL at least once, 45 parents (96%) produced CL, and all 47 parents used GCL (see Table 2 for the number of parents who used GL, CL, and GCL at each visit).

To examine stability and change over time, Wilcoxon Tests (with Holm-Bonferroni corrections for multiple comparisons) showed no significant changes in the frequency or density of GL, CL, or GCL between each pair of visits, all $ps > .05$ (throughout this paper, "density" refers to the frequency of GL/CL/GCL concepts per 100 parent utterances unless otherwise indicated). Linear-trend ordinary least squares (OLS) regression models showed no associations between time (Visits 1 through 4) and frequency or density of GL and frequency of each subtype of CL, $ps > .05$, indicating no evidence for an upward or downward linear trend, except that the frequency of analogies increased over time, $\beta = 0.27$, $p < .001$, $F(1, 170) = 13.56$. The frequency of GL and CL was moderately correlated at each visit, Pearson's $rs = 0.51$, 0.53, 0.56, and 0.45 respectively from Visit 1 to 4, $ps = 0.0003$, 0.0002, 0.0001, and 0.002. That is, at each visit, parents who used more GL also tended to produce more CL. Tests using density yielded similar but weaker correlations, except for a marginally significant correlation at Visit 4, $rs = 0.48$, 0.46, 0.52, and 0.30 respectively from Visit 1 to 4, $ps = .0006$, 0.002, 0.0003, and .06.

Similarly, within each conceptual domain, parents' GL and CL use was generally stable over time. Figure 1 presents the mean frequency of GL and CL by domain (we found similar patterns using density instead of frequency). Most GL and CL we observed pertained to natural kinds and artifacts, while GL and CL referring to people, experiences, and intangible kinds were rarer. Within each domain, Wilcoxon Tests with Holm-Bonferroni corrections showed few significant changes in the frequency of GL and CL, except for changes in the frequency of natural-kind GL from child age 12 to 14 months and 12 to 16 months, $W = 686$ and 647 respectively, $ps = 0.04$ and 0.02, artifact-related GL from 12 to 14 months, $W = 1122$, $p = .02$, and artifact-related CL from 10 to 12 months, 10 to 16 months, and 14 to 16 months, $W = 748$, 589, and 594 respectively, $ps < .05$.

Individual differences in GL use were stable over time, whereas those in CL use were more varied. In general, parents' GL use was moderately correlated between visits, except for a lack of correlation between Visits 2 (child age 12 months) and 3 (14 months), and Visits 3 (14 months) and 4 (16 months) (see Table 3 for test statistics). Hence, overall, parents who used more and denser GL at one visit also did so at other visits. In contrast, parents' CL use was less robustly correlated between visits. Looking across domains, GL and CL about natural kinds and artifacts, the two domains most frequently discussed, were robustly and moderately correlated in both frequency and density. That is, parents

[1]A concept was counted twice if a parent discussed it twice. Perhaps due to the small amount of GL and CL, the number of concept types (the number of different concepts discussed) was very similar to that of concept tokens, so we used only tokens in our analyses.

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Table 2. Descriptive Statistics M (SD) [range] of the Frequency and Density of GL, CL, and GCL.

	Child Age			
	10 Months (Visit 1)	12 Months (Visit 2)	14 Months (Visit 3)	16 Months (Visit 4)
Number of parents who produced GL	32	36	32	32
Frequency of GL	1.87 (1.97)	1.84 (1.73)	2.05 (2.57)	2.51 (3.06)
	[0, 7]	[0, 6]	[0, 10]	[0, 14]
Density of GL (per 100 utterances)	0.76 (0.77)	0.65 (0.61)	0.76 (0.97)	0.82 (0.90)
	[0, 3.02]	[0, 2.22]	[0, 4.04]	[0, 3.20]
Density of GL (per 100 multi-word utterances)	1.00 (0.99)	0.90 (0.82)	0.99 (1.26)	1.07 (1.16)
	[0, 3.49]	[0, 2.96]	[0, 5.17]	[0, 4.13]
Number of parents who produced CL	30	32	32	35
Frequency of CL	1.63 (1.90)	1.93 (2.27)	2.07 (2.64)	3 (3.32)
	[0, 7]	[0, 10]	[0, 13]	[0, 13]
References to Kinds	0	0.07 (0.34)	0	0.05 (0.31)
		[0, 2]		[0, 2]
Use of Quantifiers	0.07 (0.33)	0.02 (0.15)	0.02 (0.15)	0
	[0, 2]	[0, 1]	[0, 1]	
Property Language	0.41 (1.00)	0.19 (0.50)	0.64 (1.75)	0.32 (0.72)
	[0, 5]	[0, 2]	[0, 9]	[0, 3]
Analogies	0.15 (0.51)	0.42 (0.66)	0.48 (0.80)	1.02 (1.82)
	[0, 3]	[0, 2]	[0, 3]	[0, 10]
Connections	1 (1.49)	1.02 (1.26)	0.90 (1.36)	1.51 (2.21)
	[0, 6]	[0, 4]	[0, 5]	[0, 9]
Other CL	0	0.21 (0.97)	0.02 (0.15)	0.10 (0.37)
		[0, 6]	[0, 1]	[0, 2]
Density of CL (Per 100 Utterances)	0.75 (0.90)	0.72 (0.81)	0.76 (0.96)	1.04 (1.16)
	[0, 3.26]	[0, 3.52]	[0, 4.87]	[4.35]
Number of parents who produced GCL	40	40	41	39
Frequency of GCL	3.5 (3.26)	3.77 (3.52)	4.12 (4.56)	5.51 (5.15)
	[0, 13]	[0, 16]	[0, 20]	[0, 24]
Density of GCL (Per 100 Utterances)	1.51 (1.42)	1.37 (1.23)	1.52 (1.68)	1.86 (1.60)
	[0, 5.53]	[0, 5.63]	[0, 7.49]	[0, 5.49]

who used more GL and CL when discussing natural kinds also tended to use more GL and CL when talking about artifacts. However, individual differences in GL and CL pertaining to people, experiences, and intangible kinds were not stable across domains, perhaps due to the low frequency of GL and CL focused on those domains.

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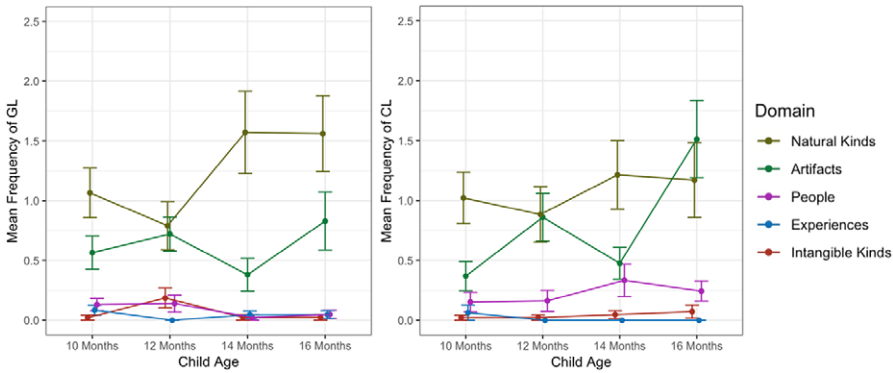

Figure 1. Mean Frequency of Generic Language and Categorical Language by Domain

Table 3. Correlations among Parents' Use of GL and CL Across Time and Domains

	Generic Language		Categorical Language	
	Frequency	Density	Frequency	Density
Correlations Across Time				
10 Month ~ 12 Months	0.32*	0.35*	0.28~	0.39*
10 Month ~ 14 Months[2]	0.42**	0.46**	0.36*	0.32*
10 Month ~ 16 Months	0.62***	0.62***	0.45**	0.38*
12 Months ~ 14 Months	0.20	0.17	0.09	0.04
12 Months ~ 16 Months[2]	0.43**	0.50**	0.27~	0.26
14 Months ~ 16 Months	0.27	0.26	0.24	0.20
Correlations Across Domains[1]				
Natural Kinds ~ Artifacts	0.48***	0.42**	0.48***	0.39**
Natural Kinds ~ People	0.20	0.16	0.27~	0.15
Natural Kinds ~ Experiences	0.11	−0.02	−0.01	0.01
Natural Kinds ~ Intangible	0.23~	0.34*	−0.07	0.06
Artifacts ~ People	0.23	0.18	0.20	0.008
Artifacts ~ Experiences	0.05	−0.04	−0.05	−0.03
Artifacts ~ Intangible	0.42**	0.51***	0.003	−0.0009
People ~ Experiences	−0.09	−0.11	0.02	0.01
People ~ Intangible	−0.13	−0.11	−0.09	−0.05
Experience ~ Intangible	0.29~	0.09	−0.06	−0.05

Note. ~ p < .1, * p < .05, ** p < .01, *** p < .001, based on Pearson's correlation tests.
[1]For each domain, we calculated the mean frequency and density of GL and CL across *ALL FOUR VISITS* and used the mean scores in the correlation tests.
[2]Visits where families were given the same toys.

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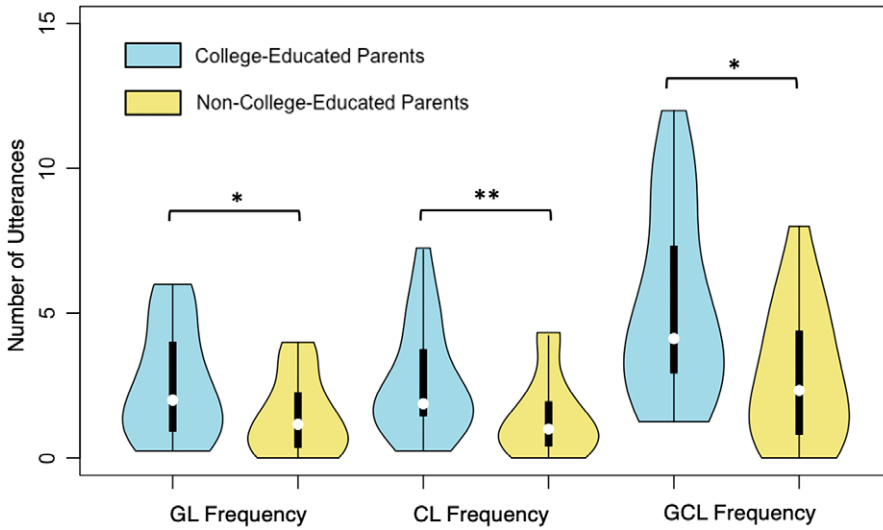

Figure 2. Frequency of GL, CL, and GCL by Parent Education Level
Note. * p < .05, ** p < .01, based on Wilcoxon tests with Holm-Bonferroni corrections.

Does parent talk about categories vary by education level?

Next, we examined whether GL, CL, and GCL use varied by parent education level. Because there was so little change in parents' use of GL, CL, and GCL from child age 10 to 16 months, we created the variable "mean frequency of GL", a holistic measure of parents' use of GL, by averaging the frequency of GL across Visits 1 through 4. For children who missed certain visits, we calculated the average frequency of GL based on the visits they participated in (e.g., a child who missed Visit 2 at 12 months would receive an average frequency score based on parents' use of GL at 10, 14, and 16 months). Of the possible 184 recordings, 13 (7%, including 4 from Visit 2, 4 from Visit 3, and 5 from Visit 4) were missing due to inability to schedule a visit or infant fussiness. Similarly, we created mean frequency and density variables for GL, CL, and GCL. Wilcoxon tests with Holm-Bonferroni corrections showed that averaged across the four visits, college-educated parents used more and denser category language than non-college-educated parents for all variables: GL (*M_frequency* = 2.55 and 1.42 respectively, *SD* = 1.88 and 1.32; *M_density* = 0.93% and 0.50%, *SD* = 0.66% and 0.44%), CL (*M_frequency* = 2.66 and 1.42 respectively, *SD* = 1.87 and 1.36; *M_density* = 1.05% and 0.51%, *SD* = 0.70% and 0.47%), and GCL (*M_frequency* = 5.20 and 2.85 respectively, *SD* = 3.22 and 2.32; *M_density* = 1.98% and 1.01%, *SD* = 1.11% and 0.77%), all *p*s < .05. Figure 2 illustrates group-based differences in GL, CL, and GCL frequency.

Associations between GL, CL, and GCL and Infants' Expressive Language Development

We used a series of OLS regression models to examine whether parents' use of GL, CL, and GCL each individually predicted children's Mullen expressive language percentile scores at 18 months, using the percentile scores because they better account for the slight age differences within our sample (e.g., children who are just over 19 months or not yet

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18 months). Six families were excluded from the regression analyses because children were missing Mullen scores at 18 months, resulting in a final sample of 40. We also reran the analyses using the Mullen raw scores. Whether or not we were controlling for age, the findings remained the same[2].

Children's mean Mullen percentile score was 55.07, $SD = 30.99$, range = 4 – 99. Their mean Mullen raw score was 18.9, $SD = 3.63$, range = 14 – 28. As for control variables, on average, 10-month-olds' receptive vocabulary (MCDI receptive scale raw score) consisted of 8.93 words, $SD = 7.91$, range = 0–34, and their expressive vocabulary (MCDI productive scale raw score) consisted of 0.82 words, $SD = 1.25$, range = 0 – 5. Due to a lack of variability in 10-month-olds' expressive vocabulary, we used their receptive vocabulary as an index of baseline vocabulary knowledge. Parent education was a continuous variable, years of formal schooling, $M = 15.6$ years, $SD = 2.14$, range = 10 (less than high school degree) to 18 years (graduate or professional degree). To isolate the unique contributions of GL, CL, and GCL over and above parent vocabulary diversity, we calculated parents' word types (i.e., the number of different words they produced during the play interaction) using the CLAN program (M = 210.60, SD = 51.68, range = 102.5 - 334.5) and included each parent's mean word type across Visits 1 to 4 as a control variable. Indeed, parents who used more or denser GL and CL tended to produce more word types, $ps < .01$, Pearson's r = 0.72 (mean GL frequency and mean word type across four visits), 0.62 (mean GL density and mean word type), 0.44 (mean CL frequency and mean word type), and 0.28 (mean CL density and mean word type; marginal significance, $p = 0.056$). We also included treatment status as a covariate because 23 families (50%) received the intervention.

Table 4 presents OLS regression models predicting 18-month expressive language skills. The mean frequency and density of GL and GCL, as well as the mean frequency (but not mean density) of CL, significantly predicted children's expressive language at 18 months over and above covariates including parent education, child 10-month vocabulary, treatment status, and parent mean word type. For example, Model 6 indicates that an increase of one SD in parents' mean frequency of GCL was associated with an increase in children's 18-month expressive language of 0.56 SD.

We then assessed whether parents' use of GL, CL, and GCL individually mediated associations between parent education and child 18-month expressive language using the "Mediation" R package (Tingley, Yamamoto, Hirose, Keele & Imai, 2014). This method utilizes nonparametric bias-corrected bootstrapping (we used 5000 iterations) to generate 95% confidence intervals (CI) for each average causal mediation effect (ACME), and a CI that does not include zero suggests a significant ACME. This method is increasingly recommended for assessing mediation effects in studies with smaller sample sizes (Malin, Cabrera & Rowe, 2014; Preacher & Hayes, 2008). Results indicated that controlling for 10-month vocabulary, treatment status, and parent mean word type, the mean density of GCL mediated associations between parent education and children's 18-month expressive language, p (ACME) = .05, B (ACME) = 2.00, 95% CI [0.14, 4.79]. The mean frequency and density of GL and CL and the mean frequency of GCL by themselves, however, did not mediate relations between parent education and 18-month expressive

[2]We also used the productive and receptive MCDI raw scores at 18 months as the outcome measure of vocabulary, and the directions of findings were the same. Because the MCDI is a parent report and is affected by parents' potential biases to a greater degree than Mullen scores, we report findings using Mullen percentile scores.

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Table 4. OLS Regression Models Predicting 18-Month Expressive Language

	Dependent Variable: Child Expressive Language at 18 Months						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	−76.61	−32.49	−16.49	−56.29	−64.09	−34.00	−47.16
	(46.39)	(44.17)	(46.32)	(44.41)	(45.72)	(42.84)	(44.26)
Parent Education	0.27	0.22	0.21	0.16	0.16	0.15	0.14
	(0.18)	(0.16)	(0.17)	(0.18)	(0.19)	(0.16)	(0.18)
Child 10-Month Vocabulary	0.25	0.17	0.20	0.24	0.26	0.20	0.23
	(0.17)	(0.15)	(0.16)	(0.16)	(0.17)	(0.15)	(0.16)
Treatment	0.08	0.04	0.06	0.16	0.16	0.12	0.14
	(0.15)	(0.14)	(0.14)	(0.15)	(0.15)	(0.13)	(0.14)
Parent Mean Word Type	0.43*	0.04	0.18	0.34*	0.42*	0.13	0.29
	(0.16)	(0.20)	(0.18)	(0.16)	(0.16)	(0.17)	(0.16)
Mean GL Frequency		0.56**					
		(0.19)					
Mean GL Density			0.45**				
			(0.17)				
Mean CL Frequency				0.37*			
				(0.16)			
Mean CL Density					0.28~		
					(0.17)		
Mean GCL Frequency						0.56**	
						(0.17)	
Mean GCL Density							0.43*
							(0.16)
R^2	0.30	0.45	0.42	0.40	0.36	0.47	0.42
F-Statistic (df)	3.49*	5.26**	4.69**	4.26**	3.53*	5.74***	4.64**
	(4; 33)	(5; 32)	(5; 32)	(5; 32)	(5; 32)	(5; 32)	(5; 32)

Note. ~ p < .1, * p < .05, ** p < .01, *** p < .001. Standardized βs are displayed with standard errors in parentheses.

language, *p*s > .1. As discussed above, parents' GL use and mean word type were strongly correlated. Further, controlling for GL use, parent word type no longer predicted children's 18-month expressive language. We thus tested if parental GL mediated education-based differences in children's 18-month expressive language, if only controlling for 10-month vocabulary and treatment status, but not parent mean word type. Results showed that controlling for covariates, the mean frequency and density of GL mediated associations between parent education and children's 18-month expressive language, *ps* (ACME) = .02 and 0.03 respectively, *Bs* (ACME) = 3.27 and 3.01, 95% CI [0.80, 7.26] and [0.64, 7.06].

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Discussion

Drawing on rich longitudinal observations, this study shows that parents spontaneously use various forms of categorical talk, including generics, with infants aged 10 to 16 months. Our findings also indicate that college-educated parents have a stronger tendency to discuss categories than non-college-educated parents. Further, our findings demonstrate that parents' talk about categories with 10- to 16-month-olds predicts infants' expressive language skills at 18 months, over and above parent vocabulary diversity (i.e., word types) and education. Here we discuss the stability and variability in parents' discussion of categories, and then we turn to how such talk contributes to children's expressive language skills.

Generally consistent with prior literature, we found that GL and CL were relatively low in frequency and density. In our sample, 0.72%-0.93% utterances contained generic concepts, depending on the visit. Similarly, in Gelman et al. (2008), 1.75% of parent utterances were generics, which is higher than the density in our sample, but still low in number. The small disparity between the two studies is likely due to demographic and methodological differences. For example, Gelman and colleagues' sample included eight children over age two and more diverse communicative contexts, whereas our sample is larger and more diverse in parental education. The toys and books used also differed between the two studies. Importantly, despite their relatively low frequency, GL and CL were naturally present in the 15-min play sessions. Across the four visits, all 47 parents used GCL at least once. At each visit, at least 32 parents used GL and at least 30 parents produced CL. If parents were to engage in five 15-minute interactions each day with their children (a rough estimation based on previous studies documenting infants' and toddlers' exposure to parental linguistic input in the home environment and during lab-based parent-child interactions; e.g., Adams, Marchman, Loi, Ashland, Fernald & Feldman, 2018; Tamis-LaMonda, Kuchirko, Luo, Escobar & Bornstein, 2017), then we can extrapolate that children with college-educated parents would have heard an estimated 12 more category-related utterances per day compared to children with non-college-educated parents. Cumulatively, this variation may have important implications for children's expressive language development.

In addition to delineating the frequency and density of GL, we developed a comprehensive coding scheme and coded six other types of CL: references to kinds, use of quantifiers, property language, analogies, connections, and miscellaneous CL coded as "other". Previous studies examining effects of parents' category-relevant input either did not distinguish labeling of individual instances from talk about entire categories (Adams & Bullock, 1986; Callanan, 1991; Callanan & Sabbagh, 2004; Mervis & Mervis, 1988), or only focused on GL (e.g., Gelman et al., 1998). In addition to GL, CL, although rarely examined in the literature, may also serve as a powerful vehicle through which parents convey information about categories in daily interactions. When combined, the additional forms of CL constituted 0.72%-1.04% of parent utterances, similar to the density of GL. The current study extends prior literature by systematically integrating various ways in which parents discuss categories with young children beyond prototypical GL as well as comparing whether GL and CL differentially predicted children's language development.

Echoing prior research (e.g., Gelman et al., 1998), most GL and CL pertained to natural kinds, followed by those referring to artifacts, people, experiences, and intangible kinds. Gelman et al. (1998) argue that parents frequently use GL to discuss natural kinds because natural kinds are typically regarded as particularly richly structured categories. That is, compared to other types of categories, natural kinds are encoded in

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language, facilitate inductive inferences, provide a basis for biological reasoning (Gelman et al., 1998; Rhodes & Gelman, 2009), and are more likely to have generic knowledge associated with them (Goldin-Meadow et al., 2005). Hence, parents may find it easier to conceptualize natural kinds as abstract entities and discuss them in a more abstract, conceptual manner. An additional explanation of our findings is that several toys and books used during the semi-structured play sessions included animal and fruit elements (e.g., the barn playset and the shop playset), likely eliciting more natural-kind GL and CL from parents.

When we further examined the stability and variability in parents' talk about categories, we found that the frequency and density of GL, CL, and GCL were notably stable across time and domains, suggesting high internal consistency in parents' tendency to discuss categories. Specifically, there were no significant changes in the frequency or density of GL, CL, or GCL between each pair of visits. The fact the families played with the same toys at child age 10 and 14 months as well as at 12 and 16 months may have contributed to the observed stability, but even between consecutive visits where families were provided with different toys, there was no evidence for significant changes in parents' GL, CL, and GCL. Within each conceptual domain (i.e., natural kinds, artifacts, people, experiences, and intangible kinds), parents' GL and CL use were also generally stable over time. Further, individual differences in GL use were stable over time, whereas those in CL were more variable. Specifically, parents' GL use was moderately correlated between each pair of visits (except for a lack of correlation between 12 and 14 months, and between 14 and 16 months), meaning that parents who used more and denser GL at one visit also did so at others. As for consistency across domains, parents who used more GL and CL when discussing natural kinds also tended to use more GL and CL when talking about artifacts, with natural kinds and artifacts being the two domains in which the majority of GL and CL occurred. Finally, at each visit, parents who used more GL also used more CL. In sum, our findings indicate that parents' tendency to discuss categories appears to be a stable individual trait. This echoes previous research showing similarly stable individual differences in parents' use of generics across time and domains (Gelman, Ware, Kleinberg, Manczak & Stilwell, 2014).

Taking a deeper look at individual differences in parents' talk about categories, we found that on average across the four visits, the college-educated parents used more and denser GL, CL, and GCL than non-college-educated parents. This finding highlights that parents exhibit diverse communicative styles when playing with their infants. One explanation for this finding is that parents with different educational backgrounds may have perceived the pragmatic demands of the semi-structured play sessions differently. That is, college-educated parents may have considered them as more educational and thus adopted a teaching stance by discussing categories and their properties. More broadly, parents who have had prolonged experience with formal schooling may have been socialized to use more abstract language, which serves as a powerful medium for the transmission of knowledge in school systems (Bruner, 1972; LeVine, LeVine, Schnell-Anzola, Rowe & Dexter, 2012; Olson, 1977). Indeed, parents who receive more formal education tend to use more explanations (Rowe, 2012). Like explanations, talk about categories is a form of abstract language that goes beyond mere descriptions of individual objects in the immediate environment. Hence, the group differences in GCL use may reflect parents' different tendencies towards use of abstract language as a result of their socialization through formal schooling. While college-educated parents more frequently discussed categories and properties, non-college-educated parents may have perceived the sessions as more casual, and hence engaged in affective, playful exchanges with children

which may potentially scaffold other important aspects of child development, such as social skills (e.g., Tamis-LeMonda, Shannon, Cabrera & Lamb, 2004).

We then investigated relations between parents' talk about categories and children's expressive language skills. A baseline regression model indicated that, consistent with previous research (Hoff & Naigles, 2002), parents' mean word type predicted infants' expressive language skills at 18 months, as measured by the expressive language subscale of the Mullen Scales of Early Learning. When we included the frequency and density of GL, CL, and GCL, averaged across the four visits from child age 10 months to 16 months, parents' use of GL and GCL each individually predicted infants' 18-month expressive language and rendered parents' mean word type non-significant. Additionally, the mean frequency of GCL mediated associations between parent education and child expressive language skill at 18 months, suggesting that college-educated parents' more extensive use of language about categories may have supported their children's acquisition of conceptual categories and corresponding labels. Taken together, these findings indicate that GL and CL, although relatively low in frequency and density, appeared to play a powerful role in supporting children's expressive language development. It is important to emphasize that GL and CL were present in almost all parents' speech at each visit, and hence the links between parents' talk about categories and child language were not driven by only a few families. Moreover, even within the 15-minute play sessions, we found vast individual differences in parents' use of GL and CL, suggesting that there is substantial variation in children's exposure to utterances about categories in their daily interactions. Cumulatively, individual differences in parents' category-related language may have far-reaching implications for children's expressive language development, and the current study is the first in the literature to provide insights into this association.

Furthermore, our findings also suggest that parents' GL had stronger and more robust predictive validity than CL. The frequency and density of GL each individually predicted 18-month expressive language, whereas CL frequency, but not density, significantly predicted expressive language. Additionally, the models including the frequency or density of GCL did not explain substantially more variance in 18-month expressive language than those including only the frequency or density of GL. These findings may be attributable to the higher internal consistency in parents' use of GL. While individual differences in CL were variable, those in GL were more stable across time, meaning that parents' use of GL was less susceptible to momentary shifts in their attention and interests or to their recent experiences. Hence, GL may have had more persistent, cumulative effects on children's expressive language development. Another potential explanation for the relatively strong predictive power of GL is that, compared to CL, which takes various forms, GL may have been more noticeable to young children because of its unique syntactic forms (Callanan, 1991; Gelman et al., 1998).

How do we interpret the associations between parental input about categories and children's expressive language development? Critically, we found that talk about categories remained predictive of children's expressive language even after controlling for parental lexical diversity. This finding suggests that such input is helpful for children's language acquisition not only because it includes diverse words, but also because it supports word learning on a conceptual level, as argued in the studies reviewed earlier. Drawing on previous research, we hypothesize that parents' discussion of categories, especially GL, may provide rich information about category properties and boundaries. This information could be crucial to children's conceptual and language development for the following reasons. First, children may attend to different category properties than adults do when observing the world (Mervis, Pani & Pani, 2003). Moreover, some

attributes are inherently nonobvious and are typically learned from adults' testimony (Adams & Bullock, 1986; Gelman, 2009; Harris & Koenig, 2006). Indeed, in our data, several parents discussed distinguishing properties of animal kinds (e.g., "Horses gallop. Cows don't"), some of which are not immediately observable (e.g., "Milk comes from cows." "Roosters don't lay eggs"). Furthermore, young children's semantic categories may be broader or narrower than those of adults (Mervis, 1984, 1987). Parents' discussion of categories may reveal misalignments between child and adult categories and help children revise their initial categories (Chapman, Leonard & Mervis, 1986; Mervis & Mervis, 1988). For instance, when a child said "green" while playing with stacking rings, the mother pointed out that among the three rings, "there are two kinds of blue and one kind of green." Consequently, infants exposed to richer GL and CL may gather more information about category boundaries and properties, which they can utilize when constructing conceptual representations, attaching labels to categories, and recognizing objects of the same kind across contexts.

Conclusion, Limitations, and Future Directions

Although previous studies have examined parents' use of category LABELS with infants (e.g., Callanan & Sabbagh, 2004; Huttenlocher, Waterfall, Vasilyeva, Vevea & Hedges, 2010; Ninio & Bruner, 1978), the present research is the first to systematically delineate how parents of diverse educational backgrounds use various forms of language referring to the properties and boundaries of entire categories with infants. It is also the first to demonstrate that parents' talk about categories predicts children's expressive language development. This finding provides evidence to support a hypothesized yet rarely examined mechanism through which parental input facilitates children's word learning (Adams & Bullock, 1986; Brown, 1958; Callanan, 1991; Mervis, 1987). That is, the finding suggests that parents' discussion of categories and their properties provides rich, useful data for children's acquisition of conceptual categories and their corresponding labels.

Although this study bridges important gaps in the literature, it has several limitations and brings forth additional questions. First, given our relatively limited sample size, future studies should test if our findings are replicable with a larger sample and in other languages and cultures. Additionally, although beyond the scope of the present study, future studies can investigate how young children, especially infants and toddlers, process and uptake parental input about categories. Finally, although the present research indicates that parents' discussion of categories supports children's language development, it is important to note that generics, and perhaps other kinds of categorical talk, may also have adverse effects on children's conceptual development. For example, while parents in our sample rarely produced GL and CL pertaining to people, previous research suggests that hearing generics may lead to transmission of essentialist beliefs about social categories, such as stereotypes concerning gender or race (e.g., Rhodes, Leslie & Tworek, 2012; Segall, Birnbaum, Deeb & Diesendruck, 2015). Future research can explore the benefits and potential risks of input about conceptual categories in different domains.

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Data Availability Statement. The dataset analyzed during the current study is available at https://osf.io/kpd2w/.

Declarations of interest. none.

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