Language Acquisition

ISSN: 1048-9223 (Print) 1532-7817 (Online) Journal homepage: www.tandfonline.com/journals/hlac20

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To cite this article: June Choe & Anna Papafragou (2026) Distributional signatures of superordinate nouns, Language Acquisition, 33:1, 83-103, DOI: 10.1080/10489223.2024.2440348

To link to this article: https://doi.org/10.1080/10489223.2024.2440348

LANGUAGE ACQUISITION
2026, VOL. 33, NO. 1, 83–103
https://doi.org/10.1080/10489223.2024.2440348

Routledge
Taylor & Francis Group

Distributional signatures of superordinate nouns

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ABSTRACT

Taxonomies of object categories (and their noun labels) often include the subordinate (e.g., *dalmatian*), the basic (e.g., *dog*), and the superordinate (e.g., *animal*) levels of specificity. Of these, superordinate nouns are notoriously difficult to learn for young children. We hypothesize that the choice of a superordinate label encodes a particular pragmatic level of informativeness, which, in turn, leads to distributional patterns that can help the learner acquire superordinate meanings. In two studies, we analyze a set of distributional signatures of superordinate noun meanings: plurals, quantifiers, wh-phrases, and anchoring cues (e.g., *kind of*). First, in a corpus analysis of child directed speech, we find that these linguistic contexts co-occur more often with superordinate nouns compared to basic-level nouns from the same domain, matched on token frequency. Second, in a word learning experiment, we show that each of these contexts biases adult learners toward superordinate (versus basic-level) conjectures for novel words. We conclude that superordinate and basic-level nouns differ in pragmatic informativeness in ways that affect their linguistic distribution and can provide powerful cues for discovering their meanings from the input.

ARTICLE HISTORY
Received 8 March 2024
Accepted 28 November 2024

1. Introduction

1.1. *Word learning at the basic level and beyond*

It is well-known that languages encode nominal and other meanings at various levels of semantic specificity, including the so-called basic level (e.g., *dog*), a narrower, subordinate level (e.g., *dalmatian*), and a broader, superordinate level (e.g., *animal*) along a taxonomic hierarchy (Rosch et al. 1976, Mervis & Rosch 1981). Although the precise criteria for drawing these distinctions vary cross-linguistically (and even within a language, for different meaning kinds), the universal fact that words can have completely nested meanings presents a challenge for young learners from the earliest stages of acquiring their language. This characterizes the so-called subset problem of induction (Quine 1960): word meaning conjectures which enter into a subset-superset relationship (such as *dog* vs. *animal*) are difficult to disambiguate for children with limited evidence at their disposal. The difficulty is in part due to the fact that the meanings of these words differ only in specificity (*dalmatian* is more specific than *dog*, which is in turn more specific than *animal*), but there is little observable evidence from the physical world alone for the specificity of meaning that is encoded in a word (Kako 2005).

In navigating this challenge, children initially show a bias for mapping novel nouns to basic-level, as opposed to subordinate- or superordinate-level, meanings (Mervis & Pani 1980, Markman 1984, 1990). Traditionally, the advantage of basic-level categories is thought to be derived from the convergence of various perceptual mechanisms that give the basic level a processing boost: members of a basic-level category (e.g., for dog, different dog kinds) tend to have similar overall shapes, share a representative prototype, invite similar kinds of motor actions for a person interacting with them,

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and so on (see the review in Murphy 2002). This basic-level bias has been argued to act as a constraint on word meaning conjectures that facilitates early word learning: nouns at the basic-level are acquired first and appear early in production, before subordinate and superordinate-level nouns (e.g., Mervis & Crisafi 1982, Markman & Hutchinson 1984, Nelson 1988, Golinkoff et al. 1995). However, the bias also presents a challenge of its own, since it eventually needs to be set aside so that learners can acquire words beyond the basic level. In this paper, we focus on the specific issues posed by the acquisition of superordinate nouns, and the ways learners might use patterns in the linguistic input to overcome these issues during word learning (for the separate but related topic of subordinate nouns, see Waxman et al. 1991, Xu & Tenenbaum 2007, Spencer et al. 2011, Jenkins et al. 2013, Wang & Trueswell 2019, 2022, Choe & Papafragou 2023, among others).

1.2. *Acquisition of superordinate nouns*

As mentioned already, the literature has long observed that young children have difficulty with superordinate-level word meanings. Experimental work has shown that two-year-olds produce superordinate nouns much less often than subordinate nouns (and also much less frequently compared to mothers' production of superordinates during play; e.g., Lucariello & Nelson 1986). The underrepresentation of superordinate nouns (vs. subordinate and basic-level nouns) in children's production is also apparent in the MCDI data for English, which report an aggregate rate of only around 32% of children producing the superordinate noun *toy* by 18 months of age, despite *toy* being one of the most frequent words in the input (Fenson et al. 2007, Frank et al. 2016). This number is even lower for *animal* (15% by 18 months, 56% by 24 months), with missing parent-reported entries for other superordinate categories thought to be familiar to children by two-to-three years of age, such as *food, clothing*, and *tool* (e.g., Blewitt & Krackow 1992, Blewitt 1994, Blewitt et al. 2000).

One explanation for the difficulty of acquiring superordinate nouns is that young children's representation of superordinate-level categories may be less developed compared to that of adults and thus not fully available for mapping onto language. Relevant evidence comes from non-linguistic classification tasks, where children from a wide age range (two-year-olds up to seven-year-olds) have trouble sorting perceptually dissimilar toys and pictures on the basis of their shared superordinate (but not subordinate or basic-level) membership (Inhelder & Piaget 1964, Rosch et al. 1976, Mervis & Crisafi 1982, Fenson et al. 1988), relying instead on more salient perceptual properties such as shape for determining kind inclusion (Imai et al. 1994, Golinkoff et al. 1995). For instance, in Golinkoff et al. (1995), children were first shown a target image (e.g., a banana) and then three additional images for the child to choose from: a superordinate-level match (e.g., a grape), a thematic match (e.g., a monkey), and a perceptual match (e.g., a crescent moon). When asked "Can you find another one," three-to-four-year-olds made superordinate-level selections less than a quarter of the time, and this performance increased only slightly in seven-year-olds, who made taxonomic selections around half of the time (whereas adults always selected the taxonomic match). On one interpretation of such findings, the relevant standards for categorization are stated in the perceptual representations of young learners (e.g., Gentner 1982, Colunga & Smith 2005): properties like shape, texture, color, and so on are readily observable and immediately useful for subordinate and basic-level categorization, while entertaining superordinate-level conjectures is simply not the "relevant problem" for the young learner equipped with these perceptual biases (Landau et al. 1988).

On this kind of account, the acquisition of basic-level (and subordinate-level) nouns relies on the ability to hold onto distinctive perceptual representations in memory, accumulated and refined across labelled exemplars (e.g., for "dog," having a snout, a lean body, and four legs; Samuelson & Smith 1998, Liu et al. 2001, Colunga & Smith 2005, Sloutsky 2010, Sloutsky et al. 2007). In contrast, superordinate-level categories lack obvious perceptual correlates (for example, a dog, a sea cucumber, and a bee have very few perceptible features in common to define their shared membership in the category *animal*), and thus the acquisition of superordinate nouns is thought to involve a distinct set of learning mechanisms. On this view, superordinate nouns are consequently mastered later with the emergence

of more complex logical reasoning abilities after the basic-level (and even subordinate-level) distinctions are acquired (Mervis & Rosch 1981, De Barishe & Whitehurst 1986). For example, children are unable to use superordinate nouns to express superordination (e.g., "A dog is an *animal* that has four legs and . . . ") until very late in development, when the necessary cognitive changes have taken place (at around the age of 7; Sinclair 1986). Indeed, it is claimed that children may in fact be shallowly representing superordinates as *collections*, as opposed to *kinds*: when prompted to define superordinate nouns, preschool-aged children appear unable to produce verbal definitions for them (e.g., "A *vehicle* is a thing that . . . ") and resort instead to simply listing the members (e.g., "A *vehicle* is a car, a bicycle, . . . ", Anglin 1977, Nelson 1978, Wehren et al. 1981, Watson 1985). According to such criteria, the relevant domain-general cognitive developments experienced in later childhood precede the acquisition of superordinate nouns in the child's vocabulary. In fact, in some theories of word learning as closely following the trajectory of concept formation (Nelson 1974), the considerably late acquisition of superordinate nouns is taken to be suggestive of their inherent representational differences; superordinate concepts are distinguished from the subordinate and basic-level kinds because they are formed only through the child's exposure to language (Nelson 1988). In turn, the acquisition of superordinate nouns is thought to follow a dramatic shift in the child's organization of knowledge in ways that have been characterized as a shift from functional to conceptual (Moran et al. 1964), from syntagmatic to paradigmatic (Nelson 1977), and so on: this strongly coincides with formal schooling (Brown 1977) and the development of metalinguistic knowledge experienced in later childhood (see review in Smiley & Brown 1979). This general view is shared by contemporary theorists of otherwise different persuasions who posit that superordinate concepts may be "less stable" in 3-to-4-year-old children, and that learners must "acquire deeper theoretical knowledge about superordinate categories . . . before these categories can become stable hypotheses for generalizing word meanings" (Xu & Tenenbaum 2007, cf. Liu et al. 2001).

This empirical and theoretical picture of children's conceptual difficulties with superordinate categories has not remained unchallenged. A powerful challenge comes from a reinterpretation of children' failures in open-ended classification tasks, according to which inferring the intent of the task imposes an additional demand that skews children's performance (Markman & Callanan 1983). In support of this argument, Waxman & Gelman (1986) found that 3-to-4-year-olds made more superordinate-level classifications in a variant of the standard sorting task, where children were given clues to the relevance of taxonomic (superordinate kind) relations, as opposed to thematic relations. In that design, children were introduced to two puppets who were "picky" about what they liked. The first puppet who "only likes some things . . . things called *furniture*" was used in the familiarization phase to provide both the superordinate label and three instances (line drawings) of the kind (a chair, a dresser, and a stool). The second puppet who "likes a dog, or a duck, or a horse and other things like that" was introduced with those three instances presented and individually named. When the sorting task followed the standard instruction to "put the things that belong together", children failed to generalize to the *animal* category. However, performance improved when children were encouraged to consider the instances together as forming a set ("Look, those make a good group . . . How come they make such a good group?") or when the instances were given a shared label ("The puppet wants a *dobutsus* . . . I don't know what *dobutsus* means, but I know he likes things like a dog, or a duck, or a horse"). In another demonstration, Smiley & Brown (1979) showed that while five-to-six-year-olds do overwhelmingly respond with thematic matches in sorting tasks, it reflects a preference (as opposed to difference in capacity) that is reversible with explicit training, such as having the children model after an experimenter who makes taxonomic matches. Additionally, when the children were asked "last time you said that *x* (target) and *y* (thematic match) go together because . . . But is there any way that *x* and *z* (taxonomic match) can go together?", most were able to give adequate justifications for the validity of the alternative, taxonomic relationship (Smiley & Brown 1979:253).

Complementing the above evidence, research with prelinguistic infants has shown evidence for the early conceptual representation of superordinate-level kinds (e.g., animal vs. vehicle). For example, after hearing an experimenter vocalize "kind-dependent actions" on single exemplars (putting a dog to

bed and saying "night, night" or putting a key to a car and saying "vroom, vroom"), 9-month-olds transferred the actions to unseen exemplars on the basis of kind (by putting animals like snake, turtle, fish, bird, and so on to sleep, but not vehicles like chair or truck or airplane; McDonough & Mandler 1998). This pattern has been replicated for a variety of kinds including furniture, plants, and utensils (Mandler et al. 1991, Mandler & McDonough 1998). Similar findings with infants have been reported for other higher-level category contrasts such as animate versus inanimate (e.g., Keil 1989), solid versus non-solid (e.g., Feigenson et al. 2002), and objects that can move on their own versus those that require an external force (e.g., Surian & Caldi 2010).

Together, these data argue against the conclusion that younger children's superordinate-level concepts are inaccessible and/or immature compared to those of adults (Smiley & Brown 1979, Benelli 1989b, Mandler 1992, Carey 2009). In fact, on an alternative view, superordinate categories form part of a fundamental conceptual core (Mandler & Bauer 1988, Mandler 2008), from which lower-level (i.e., basic and subordinate) categories emerge during development (Waxman & Hall 1993, Carey 2009, Clark 2017). Regarding this view, the tendency to make conceptual groupings at the superordinate level is so strong that infants overgeneralize basic-level properties in inductive reasoning tasks to other instances of the same superordinate class. In one demonstration, even though 14-month-olds could recognize differences between exemplars from different basic-level categories (e.g., a dog vs. a goose), they erroneously generalized both familiar and newly taught actions such as chewing on bones from dogs to geese up until the age of two (presumably because they were both animals; Mandler & McDonough 1998, 2000). Similarly, one-year-olds have been found to overgeneralize basic-level words such as *dog* to various other perceptually dissimilar animals such as squirrels, giraffes, and turtles in language production (Rescorla 1981). To the extent that young children's representation of superordinate-level categories is not deficient or less accessible compared to that of adults, any delays or hiccups in the acquisition of superordinate nouns should thus be attributable to other factors that complicate the process of mapping such meanings onto language (for a similar perspective, see Gleitman 1990).

Regardless of the debate around the conceptual origin of superordinate-level categories, it is clear that the various processes involved in early word learning do not favor superordinate-level conjectures for word meaning, whatever their nature may be. A separate issue then is how learners map words in their input onto already available superordinate-level meanings. There is general agreement that some linguistic cues facilitate the eventual acquisition of superordinate nouns. For example, labels are thought to steer young children away from context-based thematic relations and toward kind-based superordinate relations (Waxman & Markow 1995). Research shows that 2-year-olds reduce reliance on thematic matches in object sorting tasks (e.g., picking a monkey after being shown a banana) when the initial exemplar was presented with a word versus no word ("find another one" vs. "find another *dax*," Markman & Hutchinson 1984), and when the novel word serving as the target of generalization was a count noun versus an adjective (Waxman 1990, Waxman & Kosowski 1990). Superordinate-level generalizations in 3-to-5-year-olds are also helped by more sophisticated linguistic cues to kind-inclusion such as *kind of* and *another*, as in "This is a wug. A wug is a kind of terval. This is another terval." (Callanan 1989, Woodward & Markman 1998). Additionally, the acquisition of superordinate nouns is also generally taken to benefit from the labelling of multiple exemplars (e.g., Xu & Tenenbaum 2007, Spencer et al. 2011); this effect coheres with the observation that caretakers tend to use superordinate nouns to name sets of instances of a broader kind (e.g., White 1982, Shipley et al. 1983, Callanan 1985, Lucariello & Nelson 1986).

Indeed, across many observational studies of mother-child interactions, *plurality* emerges as a common theme on caretaker's use of superordinate nouns in child-directed speech – superordinate nouns are more often used to refer to groups of objects as opposed to individual objects (White 1982, Shipley et al. 1983, Callanan 1985, Lucariello & Nelson 1986). At the same time, superordinate nouns are rarely used for ostensive labelling (i.e., pointing and naming, as in "This is an animal") unlike subordinate and basic-level nouns (Callanan 1985, Lucariello & Nelson 1986). Instead, there appears to be a strong tendency to use superordinate nouns to invoke the broader category from a set of

instances: even in the presence of only a pair of objects, caretakers use the superordinate label (as opposed to individually naming the objects) and do so as an opportunity to generalize to "other objects with similar functions" (White 1982). Caretakers do sometimes use superordinate nouns to label a single referent, but only because the basic-level label is unfamiliar or unknown; in such cases, they explicitly signal the convention that the superordinate term itself is insufficient for identification ("I have no idea what this is. Some sort of animal," Shipley et al. 1983). Other times, a superordinate label is used not for identification, but to highlight the inclusion relationship with a known basic-level category ("A koala bear is an animal," Callanan 1985). These and other evidence have led Callanan et al. (1994:135) to propose that the over-representation of basic-level nouns in child-directed speech is perhaps less about the basic-level bias, but instead reflects the perceived need to "provide extra information when [caretakers] introduce [superordinate] labels" due to the belief that "children do not expect superordinate labels." Combined, these patterns suggest that the information encoded in the use of superordinate nouns is in fact very rich, despite the apparent sparsity of superordinate nouns in the child's input.

In sum, there appear to be special considerations for the act of naming objects at the superordinate-level of specificity which imbues it with distinctive qualities; these give rise to, and may be discoverable from, systematic patterns in the language input. In the next section, we expand on this observation to sketch a fuller linguistic-pragmatic profile of superordinate nouns and identify cues in the input that might allow learners to extract their meanings.

1.3. *Pragmatics, distributional learning, and the discovery of superordinate meanings*

Our main proposal in this paper is that there are certain semantic-pragmatic properties of superordinate nouns which lend themselves to specific patterns in their linguistic contexts of use that can in turn offer clues to their meaning. Our perspective is inspired by the treatment of the so-called "hard words" in acquisition, such as verbs of transfer (*give, get*, etc.) and mental state (*think, believe*, etc.), extensively researched in the literature on distributional learning (see Gleitman et al. 2005, for review). We posit that superordinate-level meanings like *animal, fruit, vegetable*, and so on are similarly elusive to direct observation. Thus, we hypothesize that the acquisition of superordinate nouns may also benefit from attending to the distributional regularities in their contexts of use, much like how syntactic bootstrapping facilitates the acquisition of referentially non-transparent word meanings (Landau & Gleitman 1985, Gleitman 1990, Naigles 1990, Fisher 1996, Lidz et al. 2003, Papafragou et al. 2007).

We start from the premise that the distribution of superordinate nouns is in part governed by their pragmatic informativeness, that is, the circumstances that license the naming of an object (or a set of objects) at the broader category. Under this framing, the distribution of superordinate nouns reflects the choice to *name* the superordinate level; this is governed by the speaker's intent, which makes it first and foremost a linguistic-pragmatic act (cf. also Waxman & Hatch 1992, Gelman et al. 1989, Diesendruck et al. 2004, Clark 2017, Choe & Papafragou 2023). When the situation presents many choices for labelling a referent, a label for a broader category (i.e., the superordinate category) is less informative (Cruse 1977, Rosch 1978, Murphy & Brownell 1985). In contrast, basic-level meanings are by definition preferred across many contexts of use, perhaps because – other things being equal – they are informative enough to satisfy the needs of a generic addressee (Brown & Dell 1987, Lockridge & Brennan 2002, Grigoroglou & Papafragou 2019a, 2019b). From these observations, the subordinate-basic-superordinate distinction can be understood as forming a *scale* on the basis of informativeness (Horn 1972). This framing captures many of the observations about the special properties of superordinate nouns that give rise to their unique challenges in acquisition, as compared to subordinate and basic-level nouns. For example, the observation that superordinate nouns are often marked as insufficient for identifying a referent (e.g., Shipley et al. 1983) follows from the fact that superordinates are not generally useful for identifying a single referent because that use would be under-informative or otherwise signal lack of knowledge of the more specific, basic-level term (Levinson 2000).

Additionally, the pattern of mentioning the basic-level term when introducing the superordinate term (e.g., Callanan 1985) and the success of this "anchoring" strategy in word learning experiments (Callanan 1989, Waxman et al. 1991, Woodward & Markman 1998) are reminiscent of children's computation of scalar implicatures that also relies on accessing a stronger alternative (Papafragou & Musolino 2003, Foppolo et al. 2012, Skordos & Papafragou 2016).

We make two concrete proposals in the context of this pragmatic account. First, we identify a set of linguistic environments that are likely to host superordinate (as opposed to basic-level) nouns in child directed speech by virtue of highlighting the broader category that an individual (or a set of individuals) belongs to. In this set we include *plurals*, quantifiers (specifically, *some*/*all*), wh-phrases (specifically, *what*/*which*), and the lexical frames *kind/type of* and *another/other* (also called "anchoring" cues). While they do not directly contribute to the semantic profile of superordinate nouns, we expect these distributional cues to point to superordinate nouns in the input to a greater extent than they do to basic-level nouns. Specifically, we expect superordinate nouns to surface more often in the plural form than the singular form, above all else, because as mentioned previously, caretakers tend to use superordinate nouns to refer to multiple exemplars of a kind and rarely to refer to individual objects (e.g., White 1982, Shipley et al. 1983), and children appear to be sensitive to this pattern in their production (e.g., Callanan et al. 1994, Blewitt et al. 2000). The quantifiers *some* and *all* are similarly used frequently to invoke a broader set (as is the case with quantification in general). Additionally, the wh-phrases *what*/*which* + Noun Phrase (NP) are often used by caretakers to introduce the superordinate-level term in a question meant to elicit the basic-level name for an object (e.g., Nelson et al. 1993, Clark & Wong 2002). Lastly, the lexical frames *kind/type of* and *another/other* are known to help children generalize novel word meanings to the subordinate-level even after exposure to just one or two exemplars (e.g., Callanan 1985, Waxman et al. 1991). To test our hypothesis, in Study 1, we compare the rate of co-occurrence of each of these five linguistic contexts in child-directed speech with frequency-matched pairs of nouns at the superordinate ("animal", "building", etc.) and the basic ("cat", "hospital", etc.) level. Our account goes beyond prior observations about individual cues that promote children's superordinate conjectures by adding to these observations and integrating them into a pragmatically-inspired distributional account.

Second, we propose that these distributional regularities, as long as the learners attend to them, offer a powerful learning mechanism for the acquisition of superordinate nouns. In Study 2, we seek to offer proof of concept for this possibility by testing whether each of these contexts can promote superordinate (as opposed to basic-level) conjectures in a word learning experiment with adults modeled after the Human Simulation paradigm (Gillette et al. 1999), using utterances sampled from the corpus. In contrast to prior experimental work, we isolate the unique contribution of each context in facilitating superordinate-level conjectures in an impoverished setting that eliminates influences from other words in the sentence, the referential context, and the broader discourse. Together, our findings aim to show that, despite the sparsity of referential evidence for superordinate-level meanings, the acquisition of superordinate nouns is in part a matter of accessing the level of specificity encoded in the word (a process aided by attending to its distributional context of use).

2. Study 1: Corpus analysis

2.1. *Data and analysis*

Fifty-one corpora of English child-directed speech were retrieved from CHILDES (MacWhinney 2000) and filtered to include input to children from the 1-to-5-year-old age range (M_{age} = 28 months). A total of around 1.3 million utterances across 597 children entered the initial analysis to identify sufficiently frequent superordinate and basic-level nouns occurring in the input. There were approximately 730,000 tokens tagged as nouns, consisting of over 3,000 unique concrete nouns. Of these, we identified seven superordinate noun types about either natural kinds or artefacts that have been attested to be familiar to children in the 2-to-5-year-old range in prior work: *animal, fruit, tool,*

building, vegetable, dessert, and *toy* (e.g., Rosch 1978, Blewitt & Krackow 1992, Blewitt 1994, Blewitt et al. 2000, Jenkins et al. 2013).[1] For each superordinate noun, we identified a basic-level noun member within the same domain respectively, matched on token frequency in the corpus: *cat, strawberry, fork, hospital, pepper, waffle*, and *ball*. We chose a constrained set of frequency-matched basic-level items (as opposed to a distribution of all basic-level items) because we found their distribution in the corpus to be heavily skewed, with a few high-frequency items risking an overrepresentation of the minority and the many low-frequency items contributing too sparsely to the linguistic contexts of interest for the model to reliably control for item-level effects. Moreover, a principled identification of all basic-level members under a superordinate category appeared intractable at a large scale (cf. Suffill et al. 2022). In contrast, an analysis of frequency-matched pairs yields a well-controlled context for comparison that offers intuitively interpretable effects; we return to this methodological choice later in the analysis.

Using this combined set of 14 tokens, the set of utterances was further filtered to include only those that contained at least one of these tokens, which resulted in 19,537 utterances. Additionally, only those utterances where the token appeared as the head of the noun phrase were included:[2] this excluded utterances where the token appeared as a modifier, such as "Do you wanna do the *animal* puzzle?" and "Okay, put it back in the *toy* box." The final set of 17,514 utterances entered the co-occurrence analysis. The raw token frequency of the superordinate and basic-level noun pairs used in the analysis is reported in Table 1.

Each utterance was tagged for the presence of one or more of the five linguistic contexts of interest: plurals, quantifiers (*some/all* + NP), wh-phrases (*what/which* + Noun (N)), and the two anchoring cues (*kind/type of* + NP, *another/other* + N). The analysis of plurals was conducted by simply tallying up the times when each noun occurred in the plural (e.g., "animals") versus the singular (e.g., "animal") form. The other four linguistic contexts received a more local analysis: these only counted if they appeared as a modifier to the head (superordinate- or basic-level) noun. This criterion excluded utterances such as "Here's *all* different parts of an *animal*" for counting towards quantifiers. In sum,

Table 1. Token frequency of paired superordinate and basic-level nouns in the final corpus (Study 1).

Domain	Noun	Level	Token frequency
1	*toy*	Superordinate	3,317
	ball	Basic	4,160
2	*animal*	Superordinate	2,829
	cat	Basic	2,843
3	*tool*	Superordinate	427
	fork	Basic	419
4	*building*	Superordinate	327
	hospital	Basic	423
5	*fruit*	Superordinate	373
	strawberry	Basic	319
6	*vegetable*	Superordinate	313
	pepper	Basic	274
7	*dessert*	Superordinate	237
	waffle	Basic	253

[1]As mentioned already, superordinate nouns are notoriously sparse in the input to children (e.g., Blewitt 1983, Lucariello & Nelson 1986). We found this to also be true of our sample. Even superordinate terms that have been frequently used and discussed in prior experimental work with young children were too infrequent in our corpus to enter into our analysis; these included *vehicle* (n = 21), *insect* (n = 56), *jewelry* (n = 21), and *furniture* (n = 73). After conducting our main analysis, we nevertheless did consider other superordinate-basic pairs not included in the original set such as *food* (n = 3,081)-*cheese* (n = 1,909) and *clothes* (n = 1,255)-*pants* (n = 700) and found consistent patterns as our main set.

[2]Extraction and identification of noun phrases was conducted via the SpaCy dependency parser (Honnibal et al. 2020). This was the only step in the text processing pipeline for which we recruited the parser.

Table 2. Linguistic contexts and examples from the corpus (Study 1).

Context	Examples
Plural	"Oh, look at these *animals* here." "Go pick up your *toys* please."
some/all + NP	"Wanna go in the garden and pick *some vegetables*?" "That's where *all the tools* go."
what/which + N	"*What animals* do you want to play with?" "*Which toy* do you like the best?"
type/kind of + NP	"What *kind of building* is it?" "No, I'll get you a different *kind of fork*."
another/other + N	"Carrots, beets, what *other vegetable* do you like?" "Let Mommy get you *another toy*."
this/that/these/those + BE + NP (comparison)	"Oh, *that is a cat*." "*This is a ball*."
the + N (comparison)	"Where are *the animals*?" "Let's pet *the cat*."

Abbreviations: N = Noun; NP = Noun Phrase.

we predict that these target contexts would co-occur more often with superordinate nouns than their basic-level counterparts in the input.

In addition to the five target contexts, the analysis also included two comparison contexts: ostensive labelling (e.g., "This is an animal"; *this/that/these/those* + BE + N) and definite articles (e.g., "Look at the cat"; *the* + N). These contexts were chosen because they were not expected to co-occur with superordinate nouns; they thus serve as points of comparison against the target contexts which we predicted to show a strong bias for hosting superordinate (vs. basic-level) nouns in the input. Furthermore, we suspected that superordinate nouns would in fact disprefer the ostensive labelling context, specifically, as the act of identifying and naming an object (for which this linguistic context is often used) places a strong constraint on pragmatic informativeness (Callanan 1985, Clark & Wong 2002). Table 2 describes the syntactic environment for each cue included in the analysis, along with qualifying examples from the corpus.

2.2. *Results*

We compared the distribution of the superordinate nouns versus their basic-level counterparts within each context, as shown in Figure 1. We found that all target contexts hosted the superordinate nouns more frequently than the basic-level nouns. For example, the lexical frame "type/kind of X" was nearly five times more likely to host a superordinate noun (e.g., "kind of animal") than its basic-level counterpart (e.g., "kind of cat"), and the size of this effect was similar across all five target contexts analyzed. In contrast, we found no bias for hosting superordinate nouns among the two comparison contexts. Note that since the superordinate and basic-level nouns chosen for the analysis were frequency matched, these distributional patterns are not reducible to simple frequency effects.

A logistic mixed-effects regression model (Bates & Alday 2024) was fitted to the proportion of superordinate nouns with by-domain and by-child random intercepts and slopes, and full dummy-coding for the contexts; this tested whether the bias for superordinate (vs. basic-level) nouns was significantly different from an equal bias (i.e., log odds of zero). The model (Table 3) confirmed the pattern observed in the figure: all five target contexts co-occurred with superordinate nouns significantly more often than they did with the frequency-matched basic-level nouns. In contrast, the two comparison contexts appeared to slightly favor basic-level nouns over superordinate nouns in the aggregate: this opposite direction of effect was significant for ostensive labelling contexts ($\beta = -1.159$, $SE = 0.584$, $p = 0.047$) but not for the definite article *the* ($\beta = -0.163$, $SE = 0.581$, $p = 0.779$) after

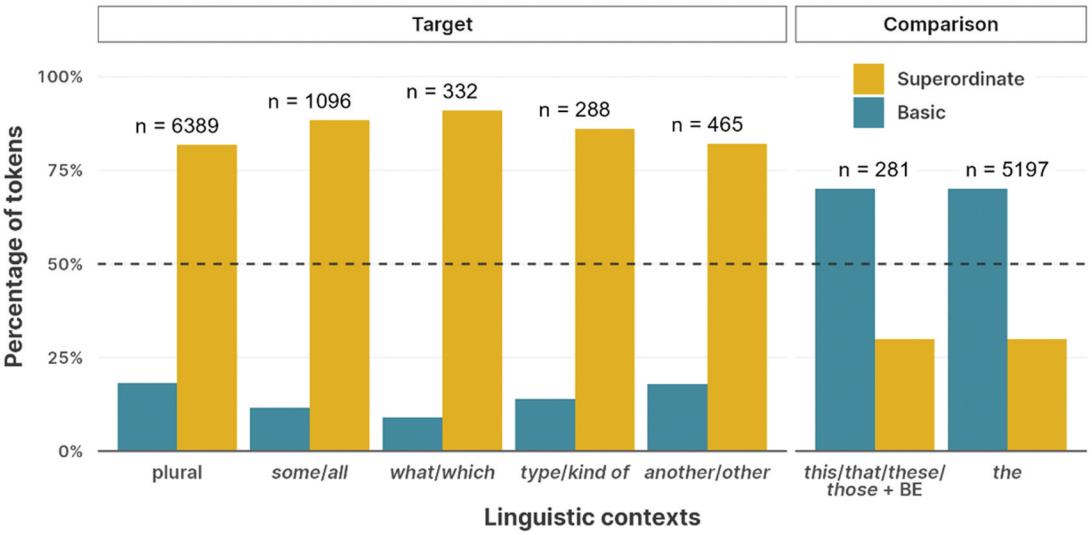

Figure 1. The percentage of superordinate versus basic-level nouns within each linguistic context in Study 1. Within each context, the bars for Basic and Superordinate nouns add up to 100%, with the dotted horizontal line representing equal bias.

Table 3. Logistic mixed-effects model fitted to the proportion of superordinate nouns (Study 1).

Context	*β*	*SE*	*t*	*p*
plural	1.765	0.817	2.16	0.031
some/all	2.577	0.634	4.06	<0.001
what/which	2.686	0.610	4.41	<0.001
kind/type of	4.838	1.244	3.89	0.001
another/other	2.445	1.124	2.17	0.030
this/that/these/those + BE (comparison)	-1.159	0.584	-1.98	0.047
the (comparison)	-0.163	0.581	-0.28	0.779

controlling for individual variation across children and noun domains. By comparison, the target contexts were more robust to such variation in their tendency to host superordinate nouns.

One might wonder whether this finding is representative of the contrast between superordinate and basic-level nouns, as there are many basic-level nouns to a superordinate noun. Therefore, in a supplemental analysis, we repeated the analysis using a different set of basic-level nouns that were the *second-closest* frequency matches to the same set of superordinates: *cat, kiwi, hammer, barn, carrot, pancake*, and *doll*. Whereas the original set of basic-level nouns showed an average count ratio of 1.05 (i.e., basic-level nouns slightly outnumbering superordinate nouns in the aggregate) to their superordinate matches, the replication set showed a more pronounced ratio of 1.32. Table 4 reports the frequency of basic-level nouns in the replication set, as well as the count ratio of each basic-level noun to their corresponding superordinate noun.

Table 4. Token frequency of basic-level nouns in the replication set and the count ratio to the corresponding superordinate nouns (Study 1).

Superordinate	Basic	Basic-level token frequency (and ratio to superordinate)
toy	*doll*	2,299 (0.69)
animal	*bear*	3,067 (1.08)
tool	*hammer*	544 (1.27)
building	*barn*	534 (1.63)
fruit	*kiwi*	295 (0.79)
vegetable	*carrot*	702 (2.24)
dessert	*pancake*	359 (1.51)

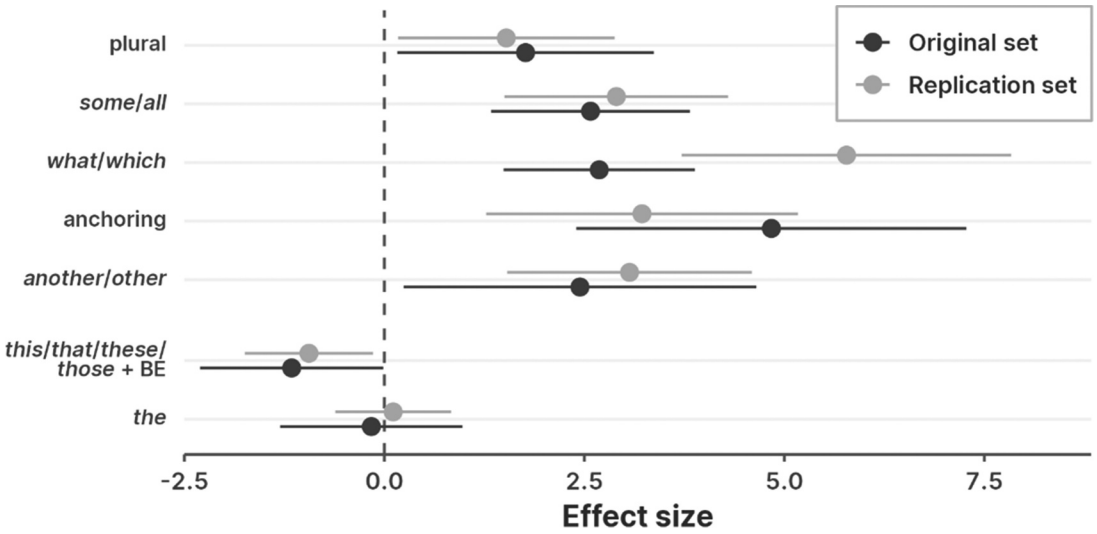

Figure 2. Logistic regression model point estimates and confidence intervals for the effect of each linguistic context (Study 1). Results from the original set and replication set are plotted in pairs.

A mixed-effects regression model with the same specifications as the original analysis was fitted to the second set of items. For ease of comparison between the results from the original analysis and the replication analysis, Figure 2 plots the point estimates and confidence intervals for the effect of each context from the two models side-by-side (the full model output for the replication analysis can be found in the Appendix). Broadly, we find a similar pattern of effects for the target contexts: plurals, *some/all, what/which, kind/type of*, and *another/other* were all significantly biased towards hosting superordinate nouns versus basic-level nouns. As for the two comparison contexts, definite articles (*the*) remained equi-biased (effect size near zero) and thus did not significantly favor either level of word meaning. Ostensive labelling contexts (*this/that/these/those* + BE) replicated the originally estimated size and direction of the effect (favoring basic-level nouns over superordinate nouns) and again emerged as significant; this possibility was not unexpected given our prior discussion (recall that such contexts have traditionally been observed to promote basic-level meanings in caregivers' speech).

2.3. *Discussion*

We proposed that superordinate nouns show distinct distributional signatures in child-directed speech, preferring to appear in environments that invoke a broader kind vs. its instances. Consistent with our prediction, we found that a certain set of linguistic contexts in the input are more likely to host superordinate nouns than their frequency-matched basic-level counterparts; for example, children are more likely to hear "kind of an animal" or "another animal" than they are to hear "kind of a dog" or "another dog." Of course, this distribution does not arise entirely from the lexical semantics of superordinate and basic-level nouns: one could just as naturally talk about different kinds of dogs as about different kinds of animals. However, superordinate nouns strongly favor these generalization-friendly environments. This finding is in accordance with our pragmatic account and the fact that superordinate nouns are generally underinformative for reference (e.g., Cruse 1977, Levinson 2000, Frisson & Murphy 2020) and inappropriate for naming (e.g., Shipley et al. 1983, Callanan 1985, Nelson et al. 1993). Such a pattern complements the findings from prior experimental work on superordinate-level nouns in children, and can also partly explain the mechanism for their eventual acquisition.

To be sure, the fact that superordinate nouns favor certain contexts of use in child-directed speech does not guarantee that this pattern is discoverable by the learner and leveraged in the process of

acquiring superordinate noun meanings. Although some of these linguistic contexts have been studied in prior word learning experiments, they were often accompanied by additional evidence for word meaning in the referential world (i.e., the specific pictures or toys receiving the label) as well as in the broader discourse context (such as the kind of generalizing property that was mentioned or the specific goals of the task). This leaves open the extent to which these linguistic contexts *individually* and *in isolation from other cues* contribute to superordinate-level conjectures. Study 2 was designed to answer this question.

3. Study 2: Word learning experiment

To isolate the unique contribution of distributional cues in facilitating superordinate-level conjectures for word meaning, we conducted an experiment akin to the "human simulation paradigm" of vocabulary learning (HSP; Gillette et al. 1999). In traditional implementations of HSP, adult participants are exposed to a series of visual cues (e.g., vignettes of parent-child interactions) or linguistic cues (e.g., full sentences taken from those interactions) that serve as the learning context for a 'mystery' word. By analyzing participants' success at guessing the word, the task probes the conditions under which the learner can successfully recover different types of word meanings.

Here, we adopt an "extreme HSP" version that, in critical trials, only provides learners with *one* of the linguistic contexts that we have previously found to frequently host superordinate nouns in the input (Study 1) embedded within an otherwise skeletal sentence containing a mystery word ("___ ___ ___ kind of *zoke* ___ ___."). Of interest is whether, as we predict, participants will later choose a superordinate over a basic-level meaning for the mystery word when explicitly given the choice between them.

3.1. *Participants*

A hundred-and-thirty English speaking adults were recruited from the undergraduate subject pool at the University of Pennsylvania. The experiment was hosted and conducted online on the PCIbex platform for web-based experiments (Zehr & Schwarz 2018).

3.2. *Materials and procedure*

Participants were informed of a game where the players took turns building up a story together by writing down a sentence at a time on a flash card and replacing one word in the sentence with a mystery word. The participants were told that the game had already played out, producing a set of flashcards with a different mystery word in each. Their task was to determine the identity of the mystery word in each card. Critically, all cards had some portions of the sentence blacked out; participants were told that this was done to increase the challenge of the task.

There were six between-subject critical conditions varying in the cue presented to participants on the critical trials: one condition for each of the five target contexts from Study 1 (plurals, *some/all, what/which, kind/type of* and *another/other*), plus one control condition. For each condition, we prepared 7 items (corresponding to the 7 pairs of nouns analyzed in Study 1) as follows. We first sampled utterances from the corpus that were previously tagged for the presence of each target context in Study 1. For each of the five target contexts, we randomly selected seven sentences, one from each semantic domain analyzed in Study 1 (*toy-ball, animal-cat, tool-fork, building-hospital, fruit-strawberry, vegetable-pepper, desert-waffle*). We placed each sentence on a card and replaced all words with black spaces of appropriate length with the exception of the target word which was replaced by a 'mystery' word. The mystery word appeared in plural form in the plural condition (e.g., *zokes*) and in either the singular or the plural form in the remaining critical conditions depending on the original sentence in the corpus.

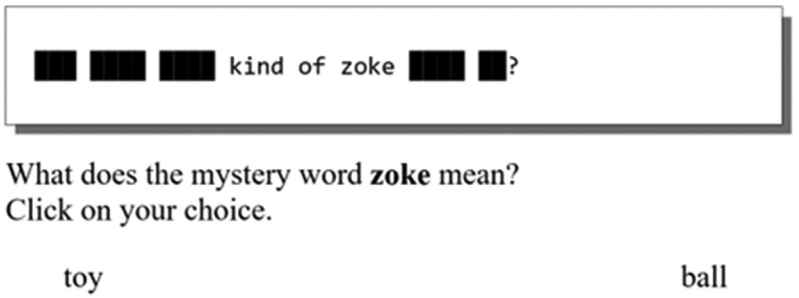

Figure 3. An example critical trial in the *kind/type of* condition of Study 2.

Next, participants were given a forced-choice task about the meaning of the mystery word and had to click on either the superordinate or the basic level choice within the noun pairs of Study 1 (e.g., *animal* vs. *cat, toy* vs. *ball*). This forced-choice design served to simulate circumstances of ambiguity in the specificity in meaning – this was done to both isolate the problem of lexical choice (as opposed to, e.g., the choice of referent) in the task and also to align the experiment to how the subset problem is typically characterized and studied in the literature (as particularly challenging for acquisition because the problem persists even when the referent has been ascertained; Quine 1960). With the obvious exception of the plural condition, the choices alternated in appearing in either singular or plural form to match the form of the mystery word. An example trial is shown in Figure 3.

Lastly, in the control (Singular) condition, only the mystery word (e.g., *zorg*) was visible, surrounded by blacked-out slots of random number and length, and the choices were presented in singular form (e.g., "animal" vs. "cat"). This served as the baseline (i.e., "no context") condition where participants simply had to guess the identity of the word in the absence of any accompanying cues to its meaning and usage. Thus, we did not have a directional expectation about the preference for basic vs. superordinate meanings for this condition.

In addition, participants saw 40 filler trials (the same set of trials for all conditions) interspersed between the critical trials. Unlike critical trials, these included English phrases with a single 'mystery' word among blacked-out sections; the amount of blacked-out context around the phrase was five words long on average. Mystery words in the filler trials appeared in high-frequency n-grams and idiomatic phrases (e.g., "the eggs *bune* side up", with the choices *sunny* vs. *dirty*), in completely ambiguous contexts (e.g., "a *vate* TV", with the choices *new* vs. *old*), and in contexts where the answer was given by either unambiguous syntactic cues (e.g., "a *wube* mess", with the choices *small* vs. *run*) or semantic plausibility (e.g., "*jarm* the door", with the choices *close* vs. *melt*). Within each condition, the presentation order of all 47 items was randomized across participants. Additionally, the position of the two choices (left or right) for word meaning in the critical trials (basic-level or superordinate) was counterbalanced across items and participants.

3.3. *Results*

Four participants who performed at chance (40%–60% accuracy range) on the unambiguous-syntax filler trials (e.g., " . . . a *wube* mess . . . ", with the mystery word choices of *small* vs. *run*) were excluded from the analysis since those trials had a clear correct answer on the basis of syntax (the remaining participants had an average accuracy rate of 98.6% on such unambiguous trials). Six additional participants were dropped in an under-sampling procedure to balance the number of participants in each between-participant condition (n = 20) for comparability of effects in the statistical model. Data from the remaining 120 participants entered the analysis. Results are shown in Figure 4.

A logistic mixed-effects regression was fitted to the proportion of superordinate noun choices, with the linguistic context as the predictor and random intercepts and slopes by subjects and items

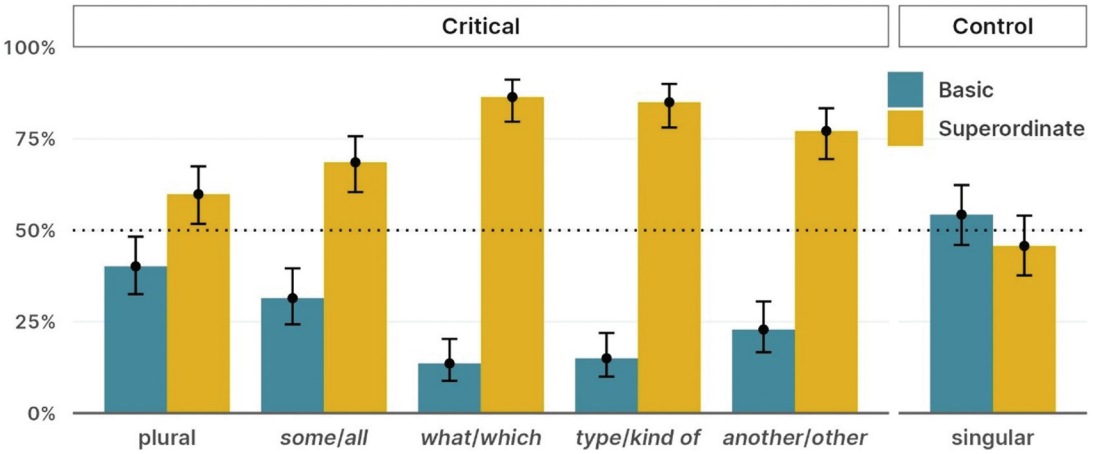

Figure 4. The percentage of superordinate vs. basic-level choices in each condition of Study 2.

Table 5. Logistic mixed-effects model fitted to the proportion of superordinate responses (Study 2).

Condition	β	*SE*	*t*	*p*
plural	0.409	0.211	1.94	0.052
some/all	0.801	0.243	3.30	<0.001
what/which	2.398	0.446	5.61	<0.001
kind/type of	1.735	0.237	7.33	<0.001
another/other	1.411	0.343	4.11	<0.001
singular (control)	–0.149	0.193	–0.77	0.441

(Table 5). As in Study 1, the predictor was again fully dummy-coded; this tested whether the choice of superordinate vs. basic-level meanings for the mystery word was different from chance, within each of the six conditions. Results show that the proportion of superordinate responses in the singular (control) condition was not significantly different from chance ($\beta = -0.149$, $SE = 0.193$, $p = 0.441$); participants were equally likely to pick the superordinate or the basic-level meaning for the mystery word when it was presented in singular form in isolation. The plural condition revealed a marginally significant effect, showing a numerical trend in the expected direction ($\beta = 0.409$, $SE = 0.211$, $p = 0.052$). For the remaining four critical conditions (*some/all, another/other, what/which*, and *kind/type of*), participants were significantly more likely to choose the superordinate-level versus the basic-level meaning for the mystery word (all $p < 0.001$).[3]

3.4. *Discussion*

We hypothesized that distributional regularities in contexts of use of superordinate nouns in the child's input can act as cues to superordinate-level meanings. In a variant of the human simulation paradigm with adults, this hypothesis was confirmed: the surrounding linguistic environments in the *some/all, what/which, kind/type of*, and *another/other* (and marginally, the plural) conditions created an expectation for superordinate-level meanings, even in the absence of accompanying discourse and referential information. In contrast, there was neither a superordinate- nor a basic-level bias in the control (singular) condition (i.e., where a single form was presented in the absence of any linguistic

[3]For these four critical conditions, the rate of superordinate responses was similar regardless of whether the mystery word (and the choices for its meaning) were presented in singular (79.1%) or plural (78.8%) form.

cues, including plural marking).[4] These data complement prior experimental evidence for the role of linguistic cues in the acquisition of superordinate nouns and highlight the strength of these cues even in the present severely impoverished context. Combined, our findings lend support to the hypothesis that expectations for both basic- and non-basic-level meanings emerge in part from the role of various linguistic devices in highlighting the semantic breadth of a noun.

4. General discussion

4.1. *Distributional cues in the acquisition of superordinate nouns*

Superordinate nouns have long been thought to present a challenge for acquisition, in large part due to the belief that superordinate-level categories are absent or immature within the child's conceptual system, and thus not available for mapping onto language until later childhood (e.g., Moran et al. 1964, Sinclair 1986, Nelson 1988). Recent word learning models building off of this assumption have treated superordinate nouns as trivial to acquire once those categories become available for mapping; the child only needs to observe evidence against the basic-level (and narrower) hypothesis, for instance, by seeing both a dog and a cat labelled *animal*, to commit to the broader superordinate-level conjecture for the word's meaning (e.g., Xu & Tenenbaum 2007, cf. Liu et al. 2001). Under this framing, the problem of mapping superordinate nouns to their corresponding concepts is not experienced in the earliest stages of acquisition because children simply cannot or do not entertain superordinate-level conjectures for word meaning (e.g., Markman 1987, Landau et al. 1988).

In this study, we focused on an alternative proposal, according to which the acquisition of superordinate nouns in part presents a distinct mapping problem, even under the assumption that the corresponding concepts are available. Drawing on prior accounts of conceptual development in early infancy (e.g., Mandler & Bauer 1988, Mandler 2008) and distributional word learning (e.g., Gleitman 1990, Gleitman et al. 2005) we proposed that superordinate nouns such as *animal, fruit, toy*, and so on form a class of meanings on the basis of their semantic breadth, and so prefer to emerge in certain contexts of use over others. Consistent with this proposal, our corpus analysis shows that superordinate nouns frequently appear in environments that highlight the broader category from a set of instances; these include plural morphology, quantifiers such as *some/all*, wh-phrases such as *what/which*, and the anchoring cues *kind/type of* and *another/other*. Our analysis affirms and extends similar findings from prior work on caretakers' speech to children during play (e.g., White 1982, Shipley et al. 1983, Callanan 1985, Lucariello & Nelson 1986). Thus, when considering formal aspects of linguistic distribution, a superordinate noun such as *animal* behaves more like another superordinate noun such as *fruit* than a basic-level noun from the same semantic domain such as *cat*.

We further hypothesized that these language-internal cues that reflect the presence of superordinate-level nouns should in turn offer some clues to their meaning for the learner. In other words, while the sparse and restrictive use of superordinate nouns in the input may at first present a unique challenge for their acquisition compared to subordinate and basic-level nouns, this challenge may be overcome at least in part by attending to the distributional patterns in their contexts of use. In an extremely impoverished variant of the Human Simulation Paradigm, we found that adults took quantifiers such as *some/all*, wh-phrases such as *what/which*, and the anchoring cues *kind/type of* and *another/other* (and, marginally, plurals) as cues to a superordinate-level (versus a basic-level) meaning of the word. Furthermore, these cues exerted their influence independently (of one another) and in isolation (decoupled from other referential or discourse information; cf. Waxman et al. 1997).

[4]Note that the superordinate and basic-level pairs of nouns used in the experiment were matched on token *stem* frequency, that is, counting both singular and plural form. Given the finding that superordinate nouns infrequently appear in singular form (in Study 1 as well as in prior studies), one might expect a bias for basic-level nouns in the control (singular) condition. However, no such bias for the basic-level (vs. superordinate) meaning was observed when the mystery word was presented in singular form and in isolation.

These findings thus add to prior work on the role of some of these cues for children's superordinate noun learning (e.g., Callanan 1989, Woodward & Markman 1998) and offer further evidence for the view that early difficulties for their acquisition are not reducible to immature conceptual representations (e.g., Mandler & McDonough 2000, Kako 2005).

4.2. *Access to distributional cues for learning superordinate nouns*

We have presented two complementary findings: (a) the distribution of superordinate nouns is well-characterized by their semantic-pragmatic properties, and (b) the meanings of such nouns are in turn discoverable from attending to their distributional regularities. One remaining question is whether the kinds of linguistic devices we have investigated here are available to young children at all, and (as we predict) are leveraged in the discovery of superordinate-level word meanings. While our present data do not address this question directly, existing evidence supports the conclusion that young learners around two-to-three-years of age can understand the form and function of the linguistic cues we have focused on and could plausibly rely on them to form superordinate-level meaning conjectures.

Beginning with plurals, although children across a wide age range sometimes reject statements involving a superordinate noun in the singular form such as "This is an animal" (while pointing to a dog) as false, they can be led to accept and even produce a plural statement such as "These are animals" to refer to an assortment of animals (Macnamara 1982, cf. Waxman & Hatch 1992). On one interpretation, children recognize the frequent function of superordinate nouns for referring to a set of multiple distinct individuals and thus encode this regularity in usage with the plural morphology (Callanan & Markman 1982, Blewitt et al. 2000). Similarly, regarding quantifiers, two- and three-year-olds have been shown to perform well in truth-value judgment tasks and *give*-quantifier tasks involving *some* and *all* (e.g., "Give him some/all of the cookies") (though their pragmatic understanding of *some* remains limited at this age; Hurewitz et al. 2006, Barner et al. 2009). The rates of children's production for *some* and *all* are also closely aligned with the most frequent superordinate nouns such as *toy* and *animal*, and presumably outpace less frequent superordinate nouns for which we lack such acquisition trajectory data entirely (Fenson et al. 2007, Frank et al. 2016).

With regard to wh-questions, children show an understanding of the form and function of questions from a very young age (e.g., Ervin-Tripp 1970, Tyack & Ingram 1977); relevant to the present account is the further observations that two-year-olds recognize the information seeking nature of wh-questions, the way such questions mark new and old information in the discourse, and the consequences for a speaker's lexical choice. For example, children themselves often respond at the basic or lower level of specificity when asked "What is this (called)?" and this behavior has been argued to reflect the input pattern of caretakers often mentioning the superordinate level only to mark it as insufficient for naming (e.g., "Gee, I don't know what this is. Some kind of mammal?"; Shipley et al. 1983, Clark & Wong 2002, Luce & Callanan 2010).

Turning to anchoring cues, three-year-olds have been shown to understand the function of the term "kind" and phrases like "kind of" for signaling subcategorization, especially when these frames were accompanied by further facts about the subclasses (Markman et al. 1980, Waxman et al. 1991, 1997). Similarly, the use of "(an)other" accompanying a noun as in "find another *dax*" has been extensively documented in word learning studies with children as young as two years of age (e.g., Markman & Hutchinson 1984, Waxman & Kosowski 1990). Additionally, as mentioned earlier, the use of frames such as "This is a wug. A wug is a kind of terval. This is another terval." has been found to facilitate superordinate-level generalizations of novel word meanings in children as young as three years of age (Callanan 1989). Combined, these demonstrations of children's understanding of the form and function of specific linguistic frames lend feasibility to our proposal: the mapping problem of superordinate nouns can be overcome by attending to the kinds of discourses that these nouns frequently appear in.

4.3. *Probabilistic distributional cues and semantic generalizations*

It must be noted that the contributions of distributional linguistic cues to superordinate meaning differ from traditional cases of syntactic bootstrapping, where the syntax often dictates a word's meaning in a deterministic manner. For example, verbs of transfer, owing to their semantics, cross-linguistically take three arguments: the English verb *give*, for instance, selects a giver, a givee, and an entity being given (e.g., *John gave a book to Mary*). This aspect of their meaning is in turn discoverable from, for example, "counting the nouns" in the argument structure (Fisher et al. 1991, Lederer et al. 1995, cf. Perkins et al. 2024). In contrast, the kinds of linguistic co-occurrences we have presented here are not determined by the semantics of superordinate nouns; for example, nothing about the fact of something being an animal makes a statement like "this is an animal" ungrammatical or false in reference to someone's dog. Nevertheless, there are clearly strong selectional pressures on when and how speakers talk about the superordinate level, which—we have argued—necessarily involves considerations of pragmatic informativeness. Moreover, to achieve adult-like competence, children must eventually come to understand why the superordinate level is more appropriate to name in some contexts than in others; thus, the convergence of various linguistic cues, in conjunction with information from the perceptual and social world, must help to reveal important aspects of superordinate-level word meanings that are also relevant in usage (Benelli 1988a, Callanan & Siegel 2014, Clark 2017).

More generally, our study highlights a predictable (though not deterministic) relationship between a word's meaning and its distribution, such that words will tend to find themselves in certain discourses that promote the expression of their core meaning. This perspective is shared with recent accounts for the distribution and acquisition of modals such as *can* and *must* (Hacquard 2023), universal quantifiers such as *each* and *every* (Knowlton et al. 2023) and subjective adjectives (Gotowski & Syrett 2024). Specifically, our account of the distribution and acquisition of superordinate nouns is reminiscent of how the literature has treated the mapping problem raised by the abstract and unobservable class of the so-called "hard words" in acquisition (Gleitman et al. 2005). For example, there are clear parallels between superordinate nouns as we have discussed them and the mental state verb *think*: thinking as an action and event is pervasive, but *think* is only used in situations where talking about thinking is pragmatically called for (e.g., contexts where an agent's belief is inferable and relevant; "He *thinks* that the cookies are all gone," Papafragou et al. 2007). In a similar manner, the superordinate-level category is always conceptually "present" in a referent by entailment, but the superordinate level is only *named* under contexts where that broader category (versus the specific individual) is relevant (for a similar perspective on other noun categories, see Kako 2005). We have argued that this in turn points to a uniquely linguistic-pragmatic (as opposed to merely conceptual) source of early difficulty in the acquisition of superordinate nouns.

5. Conclusion

In two studies, we investigated the distributional signatures of superordinate nouns as a way of addressing the challenge to acquisition posed by the various levels of semantic specificity in the domain of nominals. We find that overcoming the basic-level bias to learn nouns for broader categories such as *animal* or *toy* can benefit from attending to the language-internal cues to their meanings. The peculiar yet informative distribution of superordinate nouns should play a part in the story of how children discover superordinate-level meanings as candidates for mapping onto linguistic forms.

Data availability

The data and analysis scripts for this study are openly available on OSF: https://osf.io/uhpr2.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix. Logistic mixed-effects model fitted to the proportion of superordinate nouns using the replication set of noun pairs (Study 1)

Context	*β*	*SE*	*t*	*p*
plural	1.524	0.691	2.21	0.027
some/all	2.900	0.713	4.07	<0.001
what/which	5.777	1.051	5.50	<0.001
kind/type of	3.220	0.994	3.24	<0.001
another/other	3.065	0.780	3.93	<0.001
this/that/these/those + BE (control)	-0.943	0.409	-2.31	0.021
the (control)	0.110	0.369	0.30	0.765