Lexical development is the study of changes that occur in vocabulary knowledge over childhood. It concerns children’s first steps in building a vocabulary, how children of different ages assign meanings to words, and how these meanings change in response to various experiences.

First Words

Across many cultures, children tend to produce their first words at 12 or 13 months. These words have a simple structure (e.g., ba for bottle or kiki for kitty), and are composed of sounds heard in the children’s babbling. The words have a consistent meaning and a sound form that is derived from a word heard in apparent connection with that meaning. Many first words are initially uttered only in very specific contexts, often the one in which child has most frequently heard the word used. A few are initially produced in more than one context and generalized to new objects or events, however.

Deaf children of parents who use American Sign Language tend to produce their first sign at around 8 months old, well before hearing children produce their first word. This observation has been interpreted as evidence that hearing infants’ difficulty compiling and executing speech motor programs prevents them from producing words before their first birthday. However, deaf children’s first signs tend to be imitations or parts of routines, and are not generalized to new entities until about the same age as spoken words are generalized to new entities. Thus, the cognitive challenge of using a general referential symbol in communication may be the main reason that children do not use words or signs as categorical representations for various aspects of the world until after their first birthday.

Other evidence supports this cognitive developmental view. For both hearing and deaf children, the first referential sign or word is not produced until after the child has been observed to spontaneously point to an object in a communicative exchange. Also, children tend to perform their first acts of symbolic pretense (e.g., playfully drinking from an empty bottle) around the same time as they produce their first referential word or sign.

Children do have some understanding of the categorical representations conveyed by various words or signs before their first birthday, however. By 9 or 10 months of age most children tend to comprehend at least a few words in ways that are not bound to specific routines or contexts. For example, if asked “Where is the bottle?” they will search for a bottle in the environment, and if they find one, will fix their gaze upon it. Thus, the difficulty of retrieving and/or producing an appropriate word or sign may be the reason that first productions of words and signs lag behind first instances of their comprehension.

Early Vocabularies

Production continues to lag behind comprehension after children have begun to produce words in a decontextualized manner. In one large scale study using the Macarthur-Bates Communicative Development Inventories, the median number of words comprehended by 16 month olds was 169, whereas the median number produced was only 40. This trend has been confirmed by controlled tests of comprehension and production. Because word recall is more
difficult than word recognition, productive vocabulary remains smaller than comprehension vocabulary over the lifespan.

Once children have begun to utter words, they add new ones to their productive vocabularies at a slow rate, typically one or two per week. For the average English-speaking child, about half of these words are general nominals (e.g., doggie, milk, ball), and the next most common types are specific nominals (e.g., Mommy) and action words (e.g., out [as a request], eat). The child also adds a small number of modifiers (e.g., dirty, mine), function words (e.g., what), and personal-social words (e.g., bye-bye, no).

Early comprehension vocabularies show a similar composition, except that action words are more frequent. It is not uncommon for younger 1-year-olds to be able to respond to requests to give or look at, for example, but not produce these words themselves. One explanation is that they initially represent the words’ meanings solely in terms of self-produced action. Also, although 1-year-olds are commonly asked to name things, as when looking at picture books, they are rarely prompted to name an action. Most verbs they hear are used to either request or anticipate their performance of an action.

Although nouns tend to outnumber verbs in early productive vocabularies, there is considerable individual and cross-linguistic variability. For example, toddlers acquiring English, Italian, and Hebrew tend to produce more nouns than verbs, whereas those acquiring Mandarin, Korean, and Japanese tend to produce similar numbers of nouns and verbs. Even in the languages in which nouns tend to dominate early vocabularies, some children initially learn to produce as many verbs as nouns.

According to Dedre Gentner, nouns often dominate because universal perceptual processes make the reference and meaning of object labels clearer than the reference and meaning of most verbs. On the other hand, the considerable individual and cross-linguistic variation in noun-to-verb ratios is likely attributable to variation in input. For example, child-directed speech in English tends to contain a greater frequency and greater variety of nouns than verbs, fewer morphological markings on nouns than on verbs, and more utterances that end with a noun than with a verb. In contrast, child-directed speech in Mandarin favors verbs on all these dimensions. Regarding individual differences within English, one study found that the frequency of noun types and tokens in a mother’s speech during toy play with her 1-year-old was positively correlated with the proportion of nouns in the child’s vocabulary.

The rate at which children add words to their productive vocabulary typically accelerates over the second year. The acceleration is so sharp for most children that it has come to be known as the vocabulary spurt. However, a substantial minority shows only a gradual increase in acquisition rate, or none at all. There is evidence that nearly all of those who show a spurt in word production also show one in comprehension of object names at roughly the same time.

Researchers disagree about why the acquisition rate increases. Several have proposed that the increase is at least partially due to children having an insight about the way language works. For example, the child may realize ala Helen Keller that every object has a categorical name, which in turn, motivates learning what these names are. On the other hand, an accelerating acquisition rate can be modeled by computer simulations that do not posit such an insight. One model, developed by Bob McMurray, simply assumes a normal distribution of the amounts of time needed to learn various words. Acquisition accelerates because there are fewer words in the left tail than toward the middle of such a distribution.

*The Whole Object Bias*
When a speaker’s gaze or pointing indicate that he or she could be using a novel word to refer to an object, the child must decide whether the word is actually a name for the whole object rather than a name for its substance, one of its parts, or something else altogether. From an early age, a strong bias to interpret the word as a name for the whole object is evident. Children are more likely to misinterpret names for properties (e.g., “This is a daxish one”) or substances (e.g., “This is some dax.”) as names for objects than to make the opposite error. This whole object bias may derive from the salience of individual objects in perception or thought, or may just be the result of learning the kinds of situations in which words for different kinds of entities are used. For example, children may learn that when one encounters an unfamiliar kind of object, the first novel word that is heard in apparent reference to it is almost always a name for the whole object.

As already noted, object labels and acts of object labeling are more prominent in the input to children in some cultures than in others. This variability affects the range of the whole object bias. For example, although Korean- and Japanese-speaking children show as strong a bias as English-speaking children when the object involved has a complex structure, they are more likely to make substance interpretations when the object is simple and made of moldable material.

The Categorical Interpretation of Object Labels

The child who decides that some novel label is a name for some novel object must decide how to represent the label’s meaning. That is, he or she must determine what about the object is highlighted or expressed by the label. From an early age, children tend to take object labels to denote categories rather than single individuals. They may even disregard linguistic cues supporting the latter kind of interpretation (e.g., “This is Dax.”). The very presentation of a label has been shown to increase the tendency of infants to think about an object as representative of a category rather than as an individual thing. Labeling “invites” categorical thinking about an object.

Children need to align the categories that they assign to various object labels with the labels’ conventional categories. This process involves adjusting a label’s extension, or set of all things to which the label can be applied, as well as its intension, or the properties that determine, or are at least diagnostic of, membership in the category. These two types of adjustments are related. For example, a child who is corrected for calling a wolf doggie is not only likely to correct his or her beliefs about the extensions of dog and wolf, but also to increase the importance of properties that the child believes may distinguish dogs from wolves (e.g., whether it can be tamed) in the intensions of these terms.

From an early age, children are disposed to generalize a hidden property from one object to another if they determine, based on labeling or other information, that the objects belong to the same category. For example, if told that a novel object is a zav and shown that squeezing it makes it squeak, 1-year-olds’ are unlikely to squeak a dissimilar-looking object unless they are told that this object is also a zav. Susan Gelman and colleagues have made several important discoveries about this effect of labeling/categorization. The effect is generally stronger for natural kinds than artifacts, and does not hold for properties unrelated to category membership (e.g., fell on the floor, dusty). The reverse effect is not as strong, that is, telling children or adults
that two objects have the same hidden property only causes a small increase in their tendency to
decide that the objects have the same name.

Young children are more likely than older ones to make label extension errors, sometimes
overextending (e.g., calling a van *car*) and sometimes underextending (e.g., not accepting that a
butterfly is an *animal*). However, even 2-year-olds’ correct acts of label production or
comprehension greatly outnumber their incorrect acts. One reason is that when interpreting a
novel object label, they tend to focus on many of the properties that are important in the
conventional interpretations of object labels. For example, for common artifact categories (e.g.,
*shoe, fork, ball*), members tend to have the same shape, but not the same texture. In contrast, for
common animal categories (e.g., *dog, fish, bird*), members tend to have both shape and texture in
common. When generalizing a novel label, 2-year-olds tend to rely more on shape than texture if
the object is an artifact, but not if it is an animal. The tendency for a child’s interpretation of an
object label to depend on ontological category (e.g., artifact vs. animal) increases over the
preschool years.

Considerable research has focused on the role that shape and function play in children’s
interpretation of labels for artifacts. One paradigm involves teaching a novel label for a novel
artifact while demonstrating its function, and then asking the child to decide whether the label
can be applied to an object of the same shape that cannot perform the function versus an object
of a different shape that can perform the function. Generally, the older the child, the more likely
he or she is to choose the function match. A similar trend is evident in children’s decisions about
the extension of familiar labels (e.g., *hammer*).

Explanations for this developmental trend differ. Some argue that young children have
learned to rely more heavily on shape because it is more easily detected than the function that an
object has been designed to serve. Only shape may be apparent from a quick glance at an object.
Older children give greater weight to designed function because they have learned that this
property is a more reliable indicator of whether a familiar label applies to an artifact. Others
propose that even very young children consider designed function to be more important than
shape to the meaning of artifact labels, but tend to fail to show this in label generalization
experiments for other reasons, such as not accepting that a demonstrated function is the function
that an object was designed to serve, failing to represent the functions of test objects accurately,
or making generalization decisions impulsively.

*The Category Boundary Problem for Object Labels*

Category boundaries pose a problem that cannot be solved by children’s general biases
for interpreting object labels. For example, when deciding whether a particular sea creature is “a
fish”, a young child will focus on how similar the shape, texture, and behavior of the creature are
to those of known fish. However, the child is likely to be uncertain whether some borderline
creatures are similar enough with respect to these properties to be considered fish. Bayesian
theorists have proposed that children solve this problem by keeping track of how variable these
properties are in the things that they hear called by a label (i.e., the label’s attested exemplars).
By inferring the variability of a feature in a population from its variability in a sample, children
could develop broad label extensions for general terms (e.g., *animal* or *tool*) and narrow label
extensions for specific terms (e.g., *cardinal* or *ball peen hammer*).

Children’s resolution of the category boundary problem may be guided by
overhypotheses, or general ideas about how words and their meanings are organized. According
to Ellen Markman and William Merriman, one such overhypothesis is the Mutual Exclusivity principle, which stipulates that words tend not to have exemplars in common. A related claim advanced by Eve Clark is the Contrast principle, which posits that different words never have exactly the same meaning. The latter follows from a more general pragmatic principle that a speaker who uses two different forms, even for the same referent, never intends the forms to convey exactly the same message. Consistent with these proposals, several studies have shown that introducing a novel label for an object that is on the boundary of a familiar category reduces children’s tendency to accept the familiar label for it. Also, if shown an unfamiliar and a familiar kind of object and asked which one is called by a novel label (e.g., “Which one is a zav?”), even very young children tend to select the unfamiliar object.

Children may keep an object in a familiar label’s category even after hearing it called by a novel label if other factors favor keeping it there. For example, from an early age, if told outright that a novel and a familiar label overlap (e.g., “An eel is a fish”), they will accept both labels for the object. However, if not told about the relation between the labels, and the object looks like a typical exemplar of the familiar label, they may accept the familiar label and reject the novel one, or at least have difficulty retaining the information about the novel label. Children are more likely to accept and retain the novel label information if some property of the object that has never been observed in exemplars of the familiar label is highlighted. In one study, for example, toddlers who insisted that a funnel was “a cup, not a funnel (a new label)” were persuaded otherwise when they saw what happened when liquid was poured into it.

Acquisition of Nouns that are not Categorical Object Labels

Even though young children sometimes misinterpret names for parts or substances as names for objects, and misinterpret proper names as categorical names, they do not always make these errors. Also, when these errors occur, they do not last long. The Mutual Exclusivity bias may help them to avoid such errors. Several studies have shown that young children are more likely to interpret a novel label as a name for an object’s part or substance, or as a proper name, if they already know a categorical label for the object. Secondly, as Paul Bloom and colleagues have emphasized, children learn the differences between mass noun, count noun, and proper noun syntax, which can help them to infer whether a novel name is a name for a category of stuff (e.g., wood, rice), a name for a category of individuals (e.g., car, puddle), or a proper name. In English, for example, the syntactic frames “piece of ___” or “some ___” are reserved for categorical names for stuff, “part of a/an ___” or “some ____ + [plural inflection]” are reserved for categorical names for individuals, and “____ [verb] [sentence complement]” (e.g., “____ knows that tomorrow is Christmas.”) is reserved for pronouns and proper names. The process of inferring information about the meaning of a word from its syntactic context is known as syntactic bootstrapping. Even 1- and 2-year-olds show some ability to draw such inferences. Finally, children eventually learn how to interpret language that directly expresses the relation between an object and a part (e.g., “It has an antenna.”), an object and its substance (e.g., “It is made of Styrofoam.”), or an object’s categorical identity and its proper name (e.g., “This boy’s name is Sam.”)

Relational nouns, such as uncle, barrier, or island, do pose a problem. These are nouns that denote a category of entities that are each involved in the same kind of relation to other entities. For example, barrier refers to an entity that blocks some object or actor from a goal. It may be an object, but need not be (e.g., sound barrier). According to Dedre Gentner and
colleagues, learning a relational noun is difficult because children tend to consider an object’s intrinsic properties, such as its shape or texture, to be more relevant to the meaning of a noun than the object’s external relations. Young children often misinterpret relational nouns as expressing intrinsic properties (e.g., believing that any man who is older and kindly is an uncle).

Exposure to uses of a relational noun that do not fit the child’s understanding of it may help the child to discover the noun’s correct meaning. For example, a child may revise his interpretation of uncle after finding out that a classmate has an uncle who is only 10 years old. Such experiences are likely to be even more helpful if someone justifies the unexpected use (e.g., “He [the classmate’s ten-year-old uncle] is the Mom’s younger brother.”) Hearing a relational noun used for entities that are not objects may also be instructive. For example, being told things such as “Failure to go to college is a barrier to success” may help a child to understand the abstract relation that barrier expresses.

Collective nouns, such as team, family, and group, refer to groups of entities rather than individuals. Children’s whole object bias can undermine their acquisition of such terms. In one investigation, after hearing a novel collective noun used for a group of objects (e.g., “This is a fendle”), then asked to decide whether the noun applied to an individual from the group or to the group itself, preschoolers chose the individual on about a third of the trials. Other children who were given this test after hearing a novel count noun used in plural form for the group (e.g., “These are fendles”) did not show as great a tendency to make the opposite error of mapping the singular form of the noun to the group. Exposure to language that clearly distinguishes the identity of a group from the identity(ies) of its members (e.g., “Our family has two girls and one boy.”) may help children to interpret collective nouns correctly.

Acquisition of Verbs

Novel object labels are commonly introduced as part of ostensive definitions, which are easy for even toddlers to understand. Someone establishes joint attention with the child regarding an object and says, “That is a(n) ___.” In contrast, ostensive definitions of action verbs (e.g., jointly attending to an action and saying “He/she/it is ___-ing”) are quite rare in input. Novel verbs are presented in a variety of speech acts, and the intended referent of the verb is often not even present when the verb is uttered. In fact, 2-year-olds tend to find it easier to learn a verb when it is presented for an impending or completed action rather than an ongoing action, perhaps because the latter requires dividing attention between simultaneous events (i.e., the action and the utterance about it).

Pragmatic theorists such as Michael Tomasello and Jerome Bruner have argued that social routines help children to identify the action that a verb is intended to designate. For example, many infants develop a representation of the events that typically occur whenever Mom announces, “It’s bath time!” This representation may help to interpret verbs such as wash, splash, and dry off, which occur in predictable spots in the routine. Also, once the child has learned words for predictable aspects of the routine, these can be used to identify the unpredicted aspects that are being denoted by novel words. For example, suppose soap gets in the child’s eyes, and Mom says, “Did you get soap in your eyes? That stings, doesn’t it?” Assuming the child knows what soap and eyes are, the child is likely to get some sense of what sting and get (something) in mean.

Even 2-year-olds can draw inferences about the reference and meaning of a verb from various social cues. In one study, an adult held up an object and announced, “Let’s go plunk it.”
In one condition, she performed a deliberate action on the object and said “There!”; then performed a clumsy action on it and said, “Whoops!” In another condition, the order of actions was reversed. In both conditions, when asked to plunk the object, the toddlers performed the action that had been marked as intentional. Another study demonstrated that toddlers can determine whether a novel word refers to an action or an object by applying their knowledge that people tend to comment on whatever is new in discourse. An adult said, “Modi!” just as she performed a novel action on a novel object. In one condition, only the action was new to discourse because the adult had just performed several other actions on the object. In another condition, only the object was new to discourse because the adult had just performed the target action on several other objects. In both conditions, the toddlers took modi to refer to whichever element was new to discourse.

A major source of information that helps children decipher the meaning of a verb is the syntactic or morphological structure in which the verb occurs. In a classic demonstration, 2-year-olds watched a video in which a duck and a rabbit repeatedly moved their left hands in unison as the duck forced the rabbit to squat. In one condition, a novel verb was presented in a transitive sentence (“The duck is gorping the bunny.”) In another condition, it was presented in an intransitive sentence (“The duck and the bunny are gorping.”) The two actions were then separated so that one screen showed the duck forcing the bunny to squat and the other showed the duck and bunny moving their left hands in unison. When asked to find gorping, children in the transitive condition looked mostly at the causal (forcing) action whereas those in the intransitive condition looked mostly at the synchronous action. Subsequent research has shown presentation of a novel verb in multiple syntactic constructions can help young children to further pinpoint the meaning of the verb.

Syntactic bootstrapping processes are so powerful that the presentation of a familiar verb in a structure that is only grammatical for related verbs can compel young children to reinterpret the verb. For example, if asked to use toy animals to demonstrate “The camel comes the elephant to the ramp”, preschool children will have the camel bring the elephant to the ramp, but older children will not. There are limits on this effect, however. Presentation of a familiar action verb in a syntactic frame reserved for cognitive verbs (e.g., “The camel comes that the elephant is going to the ramp.”) would not cause a preschooler to reinterpret the verb.

**Acquisition of Adjectives**

By 24 months, most children have not only acquired adjectives for physical properties (e.g., big, dirty), but also ones for psychological qualities (e.g., bad, happy). They can also learn the meaning of a novel adjective for a physical property from a brief exposure when the adjective either modifies a familiar object name (e.g., “This is a blick horse.”) or is predicated of one (e.g., “This horse is blick.”) The familiarity of the name for the object helps to convey that the adjective refers to a property of the object, not to the object itself. Also, the name can offer guidance in identifying the property that the adjective denotes. This property is likely to be one that distinguishes the object from other members of the named category. For example, the property of a horse that is picked out by blick horse is unlikely to be that of having four legs or a mane.

Although they have some ability to identify the property that a novel adjective denotes, children under 4 years have difficulty generalizing an adjective that they have heard applied to only a single, isolated object. For example, if told that a cup with holes in it is a drin cup, and
then asked to decide which of two other objects is *drin*, they will tend to select the one with holes if both objects are cups, but not if both are instances of another category (e.g., plates).

The opportunity to compare or contrast exemplars can help children to identify and generalize the property denoted by an adjective. For example, if shown two objects that differ only in a single property (e.g., texture), and told that one is *blick*, even very young children will tend to decide that *blick* refers to the distinguishing property. Likewise, if shown three objects that share only one property (e.g., a white toy car, a white cup, and a white toy pig), and each is described by the same novel adjective (e.g., someone tells them, “This is a *blick* car/cup/pig.”), even 2-year-olds will tend to decide that *blick* refers to the shared property. Similar processes have been demonstrated in their verb learning (e.g., noting that the various actions referenced by some verb involved the same manner of motion.) Just as with object labels, these compare and contrast experiences tend to be less effective if a child already uses some other word to express a novel word’s meaning.

By age 3, children interpret common adjectives appropriately in a variety of contexts. For example, they will judge that a small glass is big for a tiny doll, but little for a large doll. They will pick out the larger of two objects when asked “Which is big?”, even if both are small in a normative sense (e.g., both are small socks). They also understand that not all adjectives work this way. For example, if two objects have spots, but one has more spots than the other, they will not favor one over the other when asked, “Which is spotted?” However, they are prone to certain errors, such as picking the taller, but smaller of two rectangles when asked for the “big one” or picking the longer, but less numerous row of beads when asked for the row that has “more”. These types of errors become less frequent as children acquire a better grasp of the conceptual differences between related physical dimensions (e.g., an object’s overall extent versus its vertical extent).

**Acquisition of Other Types of Words**

Children’s acquisition of adverbs, prepositions, pronouns, quantifiers, and other types of words is influenced by many of the processes already described. Given the relational nature of these words’ meanings, their acquisition is particularly affected by processes such as syntactic bootstrapping, reasoning about speaker intention, comparing and contrasting the attested exemplars of a word, and assuming that novel words express new meanings.

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See Also: First Words; Word Learning: Constraints; Bayesian Inference in Word Learning; Conceptual Foundations of Early Word Learning; Syntactic Bootstrapping

Further Readings  
