Below is the unedited draft of:


This is the unedited précis of a book that is being accorded BBS multiple book review (Copyright 2000: Cambridge University Press U.K./U.S.) The précis is for inspection only, to help prospective book reviewers decide whether or not they wish to prepare a formal review. The review is of the book, not the précis. Please do not prepare a review unless you have received a hard copy of the invitation, instructions and deadline information. (Please also let us know whether you already have a copy of the book or would require one.)

For information on becoming a commentator on this or other BBS target articles, write to: bbs@bbsonline.org

For information about subscribing or purchasing offprints of the published version, with commentaries and author’s response, write to: journals_subscriptions@cup.org (North America) or journals_marketing@cup.cam.ac.uk (All other countries).

Precis of: HOW CHILDREN LEARN THE MEANINGS OF WORDS

Cambridge, MA: MIT Press 2000 (312 pp.)

Paul Bloom

Department of Psychology

Yale University

P.O. Box 208205

New Haven, CT 06520

Paul.Bloom@yale.edu

http://pantheon.yale.edu/~pb85

Paul Bloom is Professor of Psychology at Yale University. He is the author of over 50 scientific publications in psychology, linguistics, and cognitive science, and has written or edited four books. He serves as Associate Editor for Developmental Psychology and Language and Cognitive Processes. His research explores the nature of language and thought, primarily from a developmental perspective.
Short abstract: Normal children learn tens of thousands of words, and do so quickly and efficiently, often in highly impoverished environments. In *How children learn the meanings of words*, I argue that word learning is the product of a set of cognitive and linguistic abilities that include the ability to acquire concepts, an appreciation of syntactic cues to meaning, and a rich understanding of the mental states of other people. These capacities are powerful, early emerging, and to some extent uniquely human.

Long abstract: Normal children learn tens of thousands of words, and do so quickly and efficiently, often in highly impoverished environments. In *How children learn the meanings of words*, I argue that word learning is the product of certain cognitive and linguistic abilities that include the ability to acquire concepts, an appreciation of syntactic cues to meaning, and a rich understanding of the mental states of other people. These capacities are powerful, early emerging, and to some extent uniquely human, but they are not special to word learning. This proposal is an alternative to the view that word learning is the result of simple associative learning mechanisms, and it rejects as well the notion that children possess constraints, either innate or learned, that are specifically earmarked for word learning. This theory is extended to account for how children learn names for objects, substances, and abstract entities, pronouns and proper names, verbs, determiners, prepositions, and number words. Several related topics are also discussed, including naïve essentialism, children’s understanding of representational art, the nature of numerical and spatial reasoning, and the role of words in the shaping of mental life.

Keywords cognitive development, concepts, meaning, social cognition, semantics, syntax, theory of mind, word learning

"When [my elders] named any thing, and as they spoke turned towards it, I saw and remembered that they called what they would point out by the name they uttered. And that they meant this thing and no other was plain from the motion of their body, the natural language, as it were, of all nations, expressed by the countenance, glances of the eye, gestures of the limbs, and tones of the voice, indicating the affections of the mind, as it pursues, possesses, rejects, or shuns. And thus by constantly hearing words, as they occurred in various sentences, I collected gradually for what they stood; and having broken in my mouth to these signs, I thereby gave utterance to my will."

-- St. Augustine

The average English-speaking 17-year-old knows more than 60,000 words. Since children start learning their first words by about their first birthday, this comes to over ten new words per day. These can be acquired without any training or feedback; children can grasp much of a word’s meaning after hearing it in the course of a passing conversation. Deaf and blind children learn words, as do those who are neglected and abused. In some cultures, parents make no efforts to teach their children to talk, but these children nonetheless also learn words. There is nothing else — not a computer simulation, and not a trained chimpanzee — that has close to the word learning abilities of a normal 2-year-old child.

Here is how they do it: Young children can parse adult speech (or sign) into distinct words. They think of the world as containing entities, properties, events, and processes; most important, they see the world as containing objects. They know enough about the minds of others to figure out what they...
are intending to refer to when they use words. They can generalize; and so when they learn that an
object is called "bottle" and an action is called "drinking", they can extend the words to different
objects and actions. They can also make sense of pronouns and proper names, which refer to distinct
individuals, not to categories; and so they understand that "Fido" refers to a particular dog, not to
dogs in general.

These capacities improve in the course of development. Children become better at parsing utterances
into words, at dividing the world into candidate referents for these words, and at figuring out what
other people are thinking about when they speak. Months after their first words, they possess enough
understanding of the language to learn from linguistic context, exploiting the syntactic and semantic
properties of the utterances that new words belong to. This enables the learning of many more words,
including those that could only be acquired through this sort of linguistic scaffolding.

This is how children learn the meanings of words. Although some of this might sound obvious, it is
not the received view in developmental psychology. Many scholars would argue that some critical
components are missing; an adequate account requires special constraints, biases, or principles that
exist to make word learning possible. Others would argue that I have attributed far too much to
children; simpler mechanisms suffice. Even those who are sympathetic to this approach can justly
complain that it is terribly vague. What is meant by "object"? How important is children’s
understanding of other’s intentions? What sorts of words are learned through syntactic support?
Under what circumstances are children capable of word learning? And so on.

The goal of How Children Learn the Meanings of Words (henceforth HCLMW) is to fill out the
details of the above account, to provide a substantive and explanatory account of word learning.
More specifically, HCLMW is an extended defense of the claim that word learning emerges from the
interaction of different capacities that humans possess — social, conceptual, and linguistic. These
capacities are powerful, early emerging, and to some extent uniquely human, but they are not special
to word learning. What I’ll do here is illustrate this perspective by showing how it addresses some
fundamental questions about words and how they are learned.

1. What determines the sorts of words that children first learn?

Whether a child is raised in the highlands of Papua New Guinea or the cafes of Harvard Square, first
words have a similar flavor. They include proper names for people and animals, and common nouns
such as ball and milk. They include names for parts, like nose, modifiers, like hot, words that refer to
actions, such as up, and words that are linked to social interactions, such as goodbye. To give a
feeling for this, at the age of 15 months, my son Max knew the following words: airplane, apple,
banana, belly-button, book, bottle, bye bye, car, daddy, diaper, dog, eye, kitty, light, mommy and uh
oh. This is a conservative list; these are the words he used many times in different circumstances,
without the need for any prompting.¹

At first blush, there isn’t anything to explain here. These are the words he heard, after all. And, not
coincidentally, they correspond to notions that a child would be expected to understand. You
wouldn’t expect a 1-year-old to start off with the words mortgage and conference. Children don’t
often hear such words and don’t understand what mortgages and conferences are. Bottles and diapers
are often discussed, and easily understood, and so names for these things are the sorts of words that
are first learned.

But it is not that simple. The character of children’s vocabularies cannot be predicted solely on the
basis of the words they hear and the concepts they possess. For instance, children’s vocabularies
contain more names for objects, words such as dog, cup, and ball, than are present in the speech that
is directed to them. This is true across languages and cultures. And when taught a new word in the
presence of an object, children are prone to interpret it as labeling the entire object, not a part of the object, a property of the object, or the action that the object is taking part in. These facts have led many scholars to conclude that children possess a whole object bias, a preference to interpret novel words as referring to object categories (e.g., Macnamara, 1972; Markman, 1989).

Where could such a bias come from? It might be a constraint on learning, either innate or learned, that applies specifically to the interpretation of novel words. It might be a bias of mentalistic interpretation; that is, children assume that word-users are prone to refer to whole objects. Or the roots of this bias could be syntactic: children might assume that nominals (or nouns, or count nouns—theories differ) refer to kinds of whole objects.

Each of these proposals has its supporters, but they are all too narrow in scope. The whole object bias is not limited to words, or to nominals; it does not apply only to our inferences about the thoughts of others. Elizabeth Spelke and others (e.g., Spelke, 1994) have found that prelinguistic infants are strongly biased to parse the world into discrete bounded entities; these entities correspond precisely to the notion of "object" used in theories of language acquisition. Similarly, there is a strong object bias in linguistic counting, and, earlier, in children’s non-linguistic enumeration of entities in the world. In fact, the number data motivated Stanislas Dehaene (1997) to present his own version of the whole object bias: "The maxim ‘Number is a property of sets of discrete physical objects’ is deeply embedded in [babies’] brains". In light of these findings from outside the domain of language, the bias towards objects is best seen as a general stance towards the world, one that is manifested in several areas, including perception, numerical cognition … and word learning.

Objects are special, but this doesn’t mean that object names are all that children can learn. In fact, such names typically constitute a minority of a child’s vocabulary. (Max was a bit unusual in this regard). Young children also possess words that refer to actions, properties, and substances, as well as to parts, collections, holes, and other non-object individuals. Children’s bias towards objects reflects a bias, not a conceptual limitation. In fact, adults show precisely the same bias; when placed in an experiment involving the interpretation of a new word, you would also tend to favor the object interpretation, even though you are fully capable of reasoning about parts, properties, collections, and so on.

How do children overcome this bias? They can learn a name for a non-object individual, such as nose or family, with little trouble, so long as the word is used when a candidate whole object is not present, when pragmatic cues dictate the word is not an object name, or if other individuals are made salient enough. Chapter 4 goes into some detail as to what makes some individuals more cognitively natural than others, for both children and adults (see also Giralt & Bloom, in press).

When children hear a new word that refers to a specific object, such as a dog, they are faced with a choice. Does the word refer to a kind, as with common nouns such as dog and animal, or does it refer to an individual, as with a pronoun such as he or a proper name such as Fido. This information is not present in the input in any direct sense, and yet children always seem to get it right. Chapter 5 explains how they do this. They attend to certain key differences between these types of words; such as their syntax ("I saw the dog" vs. "I saw Fido/him"), and the type of entities they refer to (proper names and personal pronouns tend to refer to animate entities; common nouns and other pronouns have no such restriction). Once a child knows whether a name refers to a kind or to an individual, there is the further problem of understanding the word’s precise meaning, a topic that is pursued in Chapter 5 (for pronouns and proper names) and Chapter 6 (common nouns).

Some words will never show up in children’s early vocabularies. This is in part for the banal reason that children don’t hear the words and don’t possess the corresponding concepts. But it is also because there exist logical dependencies within language learning. No child will start off learning the meanings of many, the, and some, even if they hear these words and possess the corresponding notions. This is because in order to understand what these words mean, the child needs some inkling
of the meanings of the common nouns that surround them. One can learn *dog* just by hearing it in isolation, but *many* requires a grasp of the larger semantic context it belongs to. (The extent to which this is true of other types of words is a question we will turn to below.)

It turns out that the character of children’s first words has little to do with the fact that they are children. It is instead because they are people who don’t know the language. Imagine being transported, with all your intelligence and memories intact, into the body of a 12-month-old raised in a foreign country. Like a normal child, you would have a whole object bias. You would be limited to learning only the words you hear. And you would be subject to the logical dependencies inherent within a language. So your first words might well be: *diaper, bottle, kitty*, and so on. (Your sole advantage would be your conceptual sophistication, so if you saw someone point to a modem and say the word for it, you might, unlike a normal child, learn the word *modem*.) In support of this, when adults are shown videos of parents interacting with toddlers, in which the words that the parents are using are replaced with beeps, adults tend to learn (and fail to learn) the very same words that the toddlers do (Gillette et al., 1999).

2. What determines the time-course of word learning?

If you read a textbook summary of word learning, you will learn the following: Children's first words have bizarre, non-adult meanings, and are learned slowly. Then, at about 16 months, or after learning about 50 words, there is a sudden acceleration in the rate of word learning. This is known as a naming explosion, vocabulary explosion, vocabulary spurt, or word spurt. Children now have a knack for word learning; and learn five, ten, or even twenty new words a day.

In Chapter 2 of HCLMW, I suggest that none of this is true. I am not denying that young children use words in odd ways. For instance, Melissa Bowerman (1978) notes that her daughter Eva used *moon* to talk about, among other things, a half grapefruit, the dial of a dishwasher, and a hangnail. Eve Clark (1973) gives the example of a child who called a doorknob *apple*. And Max would put objects on his head and happily describe them as "Hat!" Adults don’t talk this way.

But such examples can be explained without positing any qualitative difference between children and adults. Some might be speech errors, slips of the tongue. Others might not be errors at all. When a child calls a doorknob "apple", it could mean that the doorknob is *like* an apple. This is especially likely if children don’t know the right word for what they wish to talk about, and lack the linguistic resources to use phrases such as "is like a". And children are prone to mischief — when Max put a slice of green pepper on his head and called it a hat, he found the situation hilarious, much more so than normal hat-naming. Furthermore, these odd usages are the exception. Large-scale studies of early language suggest that errors are rare and when they do occur, they can be explained in terms of immature understanding, as when a child thinks that a cat should be called ‘dog” (e.g., Huttenlocher & Smiley, 1987).

Two other facts attest to the sophistication of children’s first words. First, one sign that children have a mature understanding of the referential nature of words is when they point at things and ask about their names. Two-year-olds can ask “What’s that?”, but younger children can ask the same question by pointing and saying something like "Wha?", "Tha", or "Eh?". (Max said "Doh?"). In Katherine Nelson’s (1973) seminal study of 18 children’s first words, she found that most had a word that was used in just this way before they learned 50 words—and six of the children had one among their first ten words.

Second, even very young children are surprisingly good at learning words. In one study by Woodward et al. (1994), 13-month-olds were told the name of a novel object nine times in a five minute session ("That’s a tukey. See, it’s a tukey. Look, it’s a tukey ..."). Another novel object was
present and was also commented on ("Oooo, look at that. yeah, see it? Wow, look at that. ..."), but
was not named. When later asked to point out "the tukey", they could do so better than chance --
even after a 24-hour delay.

What about the word spurt? Does such a thing actually exist? There are countless studies that discuss
this event, but these define it as a point at which children learn words at a certain rate, typically about
10 or more words in a 2-3-week period. By this definition, a spurt does exist and usually occurs in
the second year of life. Given the size of the adult vocabulary, its existence is a mathematical
necessity—in order to end up with tens of thousands of words, children must go through a lengthy
period in which they are learning more than three words per week.

The problem with this definition is that it has nothing to do with a spurt (or burst or explosion) in any
normal sense of the term. Instead of a sudden transition in word learning, children might reach this
point of word learning as the result of a gradual increase in rate. Jeffrey Elman and his colleagues
(1996) suggest that this is what happens in normal development: the pace of vocabulary development
exhibits a gradual linear increase. The data I summarize in Chapter 2, as well as more recent analyses
(Ganger & Brent, under review), support the conclusion that this is true for most if not all children.

This is more than a pedantic point about the proper use of words such as "spurt"; it means that a
common view of word learning should be abandoned. It is not that children start off learning words
slowly and — boom! — they speed up to an adult rate. All the theories that posit some special event
at this point in development — some nominal insight, conceptual change, restructuring of
phonological memory, or shift to the use of syntactic cues — are explaining a phenomenon that does
not exist. The real story of the course of word learning is more pedestrian: children start off slow and
gradually get faster. As best we know, this continues until puberty: A 2-year-old is learning words
faster than a 1-year-old, a 3-year-old faster than a 2-year-old … and a 9-year-old is learning words
faster than an 8-year-old (see Anglin, 1993). There is no evidence for a qualitative shift.

Why does the rate of word learning increase as children get older? This is in part due to increasing
experience with the language, which opens up the space of possible words that can be learned. A
young child — like an adult learning a second language — is restricted to words whose meanings can
be inferred through perceptual experience. As she learns more of the language, she gains access to
linguistic information relevant to word learning. Later on, literacy exposes children to more words,
and it is likely that the gargantuan vocabularies of some adults (over 100,000 words) could not arise
without the ability to read.

But some of the reasons for the increase in rate have to do with developmental differences that would
not apply for an adult learning a second language. As children get older, they get better at picking up
words from context, at figuring out what people are intending to say when they use words, and at
understanding the meanings of such words. Like any other skill, word learning is more efficient after
several years of practice. And older children and adults are better in general at tasks that involve
demands on attentional resources. For all of these reasons, 2-year-olds are slower word learners than
5-year-olds, and 5-year-olds are slower than 10-year-olds.

The rate of word learning has to stop sometime; adults are not learning dozens of words a day. This
is not because of some "critical period" for word learning; there is no evidence that children learn
words quicker or more efficiently than adults. It is because we run out of words. Unless we learn a
new language, our only opportunities for word learning are proper names, archaic or technical terms,
or new words that enter the language. Most 5-year-olds are exposed to many new words in the course
of a day; most 25-year-olds are not.

3. How can we explain individual differences?
The above generalizations about the character and rate of early word learning might make some people uncomfortable, since I am talking as if all children use the same words, and develop in the same way. In fact, even if we restrict our focus to normally developing children raised in Western cultures, children do differ. Some learn words early and quickly; there are 18-month-olds who produce hundreds of words. And there are those who hardly speak at all until their third birthdays, and yet end up normal language users. Some adopt a referential style — first learning single words, mostly nouns, and then combining them into sentences and phrases. Other children are more expressive, starting off with memorized routines, such as I want it, and using them for social purposes.

The mere existence of individual differences tells us nothing about word learning. There is variation in any aspect of human psychology and physiology that can be measured on a continuous scale. It would be a different story if there were nothing but individual differences -- if there were no generalizations that one could make about word learning — but nobody thinks that this is the case; the individual differences that exist can be seen as constrained variations on a universal theme.

This isn’t to deny that the study of individual differences can be of value. There is the obvious clinical question of what sort of development is a cause for alarm. And studies of individual differences might inform us about the nature of word learning: one could explore the dimensions of variation as a way to determine the number and type of distinct mechanisms that underpin normal word learning. For instance, if children learn words through different capacities than those involved in the learning of syntax, then one might expect to find dissociations between the two types of learning. There should be children who are good at word learning but bad at syntax, and vice-versa. Or one might find that the age of onset of certain syntactic milestones is highly heritable, while this is not the case for milestones of word learning — or vice-versa.

Some of this work has generated interesting results (e.g., Fenson et al., 1994; Ganger, Pinker, & Wallis, 1997), but I want to end on a dour note. Nobody knows how to explain individual differences. We don’t yet know why they exist, and we don’t know what causes them. The usual suspects in developmental psychology — sex, birth order, social class — have only small predictive power when it comes to explaining variation in early word learning (see Fenson et al., 1994). The only good predictor of children’s rate of vocabulary learning is the vocabulary size of their parents, and this can be explained in several ways -- direct and indirect effects, child-adult causation or adult-child causation. I don’t think we will learn more by collecting more data. The real problem here is that the dimensions of variation that we look at are crude — we count words, measure the length of sentences, compare the ratio of nouns to verbs, and so on. We do this because we don’t know what else to do. We will only come to understand individual differences in the context of a mature theory of how word learning works in general.

4. What is the role of the input in word learning?

Children who are raised in situations in which nobody is trying to teach them language nonetheless come to know the meanings of words. Even in the happiest and most supportive families, words are not always used to refer to what children are attending to, and yet mapping errors are virtually non-existent. And there is abundant experimental evidence that children can learn object names when they are not attending to the object that is being named by the adult. Children learn words, but they don’t need to be taught words.

On the other hand, many Western parents do try to teach their children new words. They engage in "follow-in" labeling, in which they notice what their children are looking at and name it. They have an implicit understanding that children assume new nouns will be basic-level names, such as dog or shoe, and so when presenting children with nouns that are not basic-level names, they use linguistic
cues to make it clear that the words have a different status. For instance, when adults present part names to children, they hardly ever simply point and say "Look at the ears". Instead, they typically begin by talking about the whole object ("This is a rabbit...") and then introduce the part name with a possessive construction ("... and these are his ears"). Similar linguistic support occurs for subordinates ("A pug is a kind of dog") and superordinates ("These are animals. Dogs and cats are kinds of animals")

It would be perverse to say that all of this careful behavior on the part of adults is a waste of time. The argument that runs through HCLMW (see especially Chapter 3) is that children are remarkably good at figuring out the thoughts of adults. Does it make sense to claim that adults are so comically inept at figuring out the thoughts of their children that they go through elaborate, useless, efforts? It is more likely that parents know what they are doing. And in fact, there is considerable evidence that children do learn words best when the words are presented in just the circumstances that parents tend to teach them.

The natural conclusion here is that these naming patterns on the part of adults really are useful, they just aren’t necessary. Environments differ in how supportive they are, and word learning is easier when speakers make the effort to clarify their intent and exclude alternative interpretations. But children are good enough at word learning that they can succeed without such support. (In this regard, as in many others, first language learning by children is similar to second language learning by adults.) This leads to the obvious prediction that children raised in environments in which this support is present should learn words faster than those in which it isn’t absent. Although there is some anecdotal evidence that children raised in societies without object labeling are somewhat slower at word learning than those raised in most Western societies (Lieven, 1994), there is as yet no systematic research into this issue.

5. What is fast mapping?

One striking fact about word learning is that young children can grasp aspects of the meaning of a new word on the basis of a few incidental exposures, without any explicit training or feedback. The classic study was done by Susan Carey & Elsa Bartlett (1978). They casually asked 3- and 4-year-olds to walk over to two trays, a blue one and an olive one, and to "Bring me the chromium tray, not the blue one, the chromium one." All of the children retrieved the olive tray, correctly inferring that the experimenter intended "chromium" to refer to this new color. Even six weeks after hearing the new word, children typically retained some understanding of its meaning, if only that it was a color term. This process of quick initial learning has been dubbed "fast mapping".

Fast mapping is cited as evidence for the power, and uniqueness, of children’s word learning. But does the same ability show up when children are learning items other than words? Lori Markson and I have pursued this question in a series of studies designed to be similar to the original Carey & Bartlett study. In one part of the study, three-year-olds, four-year-olds and adults were exposed to ten objects, and participated in a sequence of activities in which they were asked to use some of objects to measure other objects. For one of the objects, they were told: "Let's use the koba to measure which is longer ... We can put the koba away now." Subjects were not asked to repeat the word, and there was no effort made to ascertain whether they even noticed that a new word was being introduced. During the test phase, subjects were presented with the original array of ten items, and asked to recall which object was the koba ("Is there a koba here? Can you show me a koba?"). We found that even after a month, subjects tended to remember which object was the "koba", replicating and extending the original fast mapping findings.

The second part of the study involved the learning of a non-lexical fact. We told them: "Let's use the thing my uncle gave to me to measure which is longer ... We can put the thing my uncle gave to me
away now." Then they were tested with: "Is there something here that my uncle gave to me? Can you show me something that my uncle gave to me?" The results here are basically identical. All age groups again performed significantly better than chance even after a month, remembering which object was given to the experimenter by her uncle.

Further studies found that children do equally well when a fact is combined with a new word: "This came from a place called Koba". We also found that children retain the precise word or fact that they have been taught. If taught "koba" or "given by uncle", and later asked Where’s the modi?" or "Where the one given by my sister?", they do not point to the object that was originally taught. Other studies suggest that 2-year-olds can also fast map words and facts, and that, as with older children and adults, there is no advantage for words.

It is conceivable that there are two distinct capacities or mechanisms explaining our results, one underlying the new word task, the other underlying the non-lexical "Uncle" task. But given two patterns of learning that are virtually identical, it is more parsimonious to see them as emerging from one mechanism, and not two. This suggests that, as with the object bias, fast mapping applies across domains, with words as just one instance of this. Ongoing studies, discussed in Chapter 3, are exploring the nature and scope of this learning mechanism.

6. What is the role of theory of mind in word learning?

A good way to teach children what dog means to is to point to a dog and say "Look at the dog!" Why does this work so well? One proposal, advanced by Locke, Hume, and many contemporary associationists, is that children learn words through a sensitivity to the statistical co-occurrence between what they hear and what they see. Because of this, the best way to teach a child an object name is to make sure the child is observing the referent of the name at the moment you say it. In this way, the sound "dog" will become reliably associated with the perception of dogs, and the meaning will be quickly and accurately learned.

The alternative theory is presented most eloquently by St. Augustine in the quote that begins this article. This is that children learn words through their sensitivity to the referential intentions of other people, through use of "theory of mind". Because of this, the best way to teach a child an object name is to make it as clear as possible that you are intending to refer to the referent of that name; and the best way to do this is to point and say the word. In this way, the child can infer that the speaker means to pick out the dog when using this new word, "dog", and the meaning will be quickly and accurately learned.

Much of HCLMW is a defense of this Augustinian theory. Consider first the circumstances under which children learn words. As discussed above, words are not always used when the child is attending to what the word refers to. Some of the time a child hears "dog", she will be looking at a dog; but some other times, she will be looking at her foot. If children were simply attending to associations, one of two things should happen. Either they should make silly mistakes, and think dog means foot, or they should be extremely cautious, and only guess the meaning of a word when there has been enough instances of word use so that the child could be confident that the mapping is the correct one. But children do not make silly mistakes and they are not cautious; despite the noisiness of the input, they never think dog means foot, and they do not need multiple trials to learn the word. This suggests that children attend to an information source that is more robust and reliable than spatio-temporal contiguity.

Furthermore, there is a rich body of research suggesting that young children are exceptionally good at using mentalistic cues — such as eye gaze and emotional expression — to learn nouns and verbs, and can do so even when these cues conflict with information provided by the statistics in the scene.
To take an example from a classic study by Dare Baldwin (1991), imagine a child who is staring at a novel object when hearing a speaker say "Toma! There’s a toma!". One might imagine, following Locke, that the child would naturally hook up the word with the object she’s looking at. And she will — but only if the speaker is looking at that object. If the speaker is gazing in another direction, at another object, the child will follow the speakers’ gaze and assume that this different object is the referent of the word. It is presumably through such a process that children avoid serious mapping errors.

Theory of mind does more for the child than solving the mapping problem. In Chapter 3, I propose that some of children’s basic assumptions about word learning, such as the belief that words will be arbitrary and bi-directional ("Sausserian") signs, or that words do not have overlapping reference ("mutual exclusivity"; Markman, 1989) follow from their understanding of the mental states of people who use words. A further role of theory of mind concerns children’s understanding and naming of human-made creations. One example of this, discussed in Chapter 7, concerns representational art. When young children name pictures, by themselves and by others, they name them based on the intent of the artist, and do not rely on what the picture looks like. Even something as apparently simple as a 2-year-old pointing to a scribble and calling it “Mommy” involves an impressive act of mentalistic attribution.

To appreciate the importance of theory of mind, consider what happens when it is missing. In HCLMW, I discuss three populations who do not learn words — non-human primates, autistic children, and pre-linguistic children. I suggest that in all of these cases, the problem in word learning lies in the failure to appreciate the representational intentions of other people. For babies and chimpanzees, this deficit is so extreme that it entirely precludes word learning. The autism example is more nuanced, as autistic individuals differ in the ability to learn language. Most don’t speak at all, a few speak normally, and many fall in between. Following Uta Frith and Francesca Happé (e.g., Frith & Happé, 1994), I argue that the extent of an autistic individual’s problems in word learning is a direct consequence of the extent of his or her impairment in theory of mind. With only a mild impairment, word learning is largely successful. With more of an impairment, there are problems in word learning, including bizarre mapping errors and confusions in pronoun usage. And with a severe impairment in theory of mind, there is no word learning at all.

7. What is the role of linguistic cues in word learning?

Let’s return to children’s first words. These are learnable through observation of the world and attention to the intentional acts of word users, and include nouns such as ball and verbs such as kiss. But a child’s first word couldn’t be a determiner, modal, conjunction, or preposition. It couldn’t be a verb such as dreaming, an adjective such as former, or a noun such as tenure. The meanings of these words are not accessible in the same way.

Children learn these words through the support of language. This might happen by having someone explicitly tell the child the meaning of a word, though definitions and examples. But such intentional teaching applies to a small minority of words at best. Nobody has ever learned what the means by having someone define it, because it is virtually impossible to define. Instead children learn its meaning from understanding phrases such as "the big dog" and inferring the semantic contribution that this morpheme makes towards the meaning of the entire phrase (see Chapter 3). For content words, other sources help. For instance, a child might hear a sentence like "I’m really annoyed that you kicked the dog", and could use the (non-linguistic) fact that the speaker is quivering with anger to guess that the verb annoyed has a negative connotation, as well as the (linguistic) fact that the verb takes a sentential complement to infer that it is likely to refer to a mental state.

One can distinguish two sources of linguistic information — semantic context and syntactic context.
Semantic context is provided by the meanings of the individual words and of the utterance as a whole. A child hearing "Do you want me to buy some lobster for dinner?" can infer from the semantics that lobster refers to the sort of stuff that one might willingly eat. Syntactic context is information provided by the syntactic category of the word. A child hearing "I would like you to clean your room" could infer from the syntax that clean refers to an action that one entity does to another entity.

In HCLMW, I have little to say about learning from semantic context; there is little work on the topic, despite its obvious importance. Such learning seems to be the result of some general intelligence that has little to do with language per se. The research focus of many developmental psychologists has instead been on a far more encapsulated (and tractable) issue—the role of syntactic cues in word learning. This is the main topic of Chapter 8.

In the first study to explore the use of syntactic cues in word learning, Roger Brown (1957) showed 3- and 4-year-olds a picture of an action performed upon a substance with an object. Some children were told "Do you know what it means to sib? In this picture, you can see sibbing" (verb syntax), others were told "Do you know what a sib is? In this picture, you can see a sib" (count noun syntax), and others were told "Have you seen any sib? In this picture, you can see sib" (mass noun syntax). The children were then shown three pictures, one depicting the same action, another depicting the same object, and a third depicting the same substance. They were asked, according to what they were initially told, "show me another picture of sibbing" (verb syntax), "another picture of a sib" (count noun syntax), or "another picture of sib" (mass noun syntax). Brown found that the preschoolers tended to construe the verb as referring to the action, the count noun as referring to the object, and the mass noun as referring to the substance, and he concluded: "young English-speaking children take the part-of-speech membership of a new word as a clue to the meaning of a new word" (p. 26).

Since this paper, there have been dozens of studies showing that young children can use syntactic cues to determine the aspects of the meanings of a word; some of this research is summarized in the table below. (For the purpose of illustration, English words are used in the examples, but the experiments themselves would use nonsense words; for instance, a child might hear "He feps the dog", and then be tested as to what she thinks "feps" means.)

<table>
<thead>
<tr>
<th>Example … Syntactic Cue … Usual Type of Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is a cat … Singular count noun … Individual member of a category</td>
</tr>
<tr>
<td>There are cats … Plural count noun … Multiple members of a category</td>
</tr>
<tr>
<td>I see John … Lexical NounPhrase … Specific individual</td>
</tr>
<tr>
<td>Here is some water … Mass noun … Non-individuated stuff</td>
</tr>
<tr>
<td>He sleeps … Intransitive verb … Action with one participant</td>
</tr>
<tr>
<td>He kisses the dog … Transitive verb … Action with two participants</td>
</tr>
<tr>
<td>This is a big thing … Adjective … Property</td>
</tr>
<tr>
<td>The dog is on the table … Preposition … Spatial relationship</td>
</tr>
</tbody>
</table>

The fact that children can use syntax to learn aspects of the meanings of words in an experimental context raises the question of precisely what role syntax plays in real-world word learning. We can quickly dismiss the idea that children can learn words solely through attention to this informational
source. Syntax is far too crude; it can help the learner make broad distinctions, such as whether a word refers to individual vs. to a property, or to an event with one participant vs. an event with two participants. Word meanings are much more fine-grained. Children have to learn the difference between cup and dog (both count nouns), good and evil (both adjectives), and two and six (both quantifiers of precise numerosity). For this, syntax is no help at all.

Is syntax ever necessary? Plainly, some words can be learned without linguistic support. You can point to a rabbit and grunt "Rabbit!" and the word will be learned. But Lila Gleitman and her colleagues (e.g., Gleitman, 1990) have argued that syntax plays a significant role for the acquisition of certain other words, including many verbs. While a noun like rabbit can be learned through perceptual information and an attention to the actions of others, these information sources are inadequate for learning a verb like thinking. Even if children know what thinking is, the support of syntax is necessary in order to establish the mapping from this notion to the English word "thinking". This proposal is supported by experiments in which adults are exposed to much the same input as toddlers are, and have to guess the meanings of words. Adults find it harder to learn verbs such as thinking than nouns such as rabbit; and linguistic support is a large help for the verbs and no help at all for the nouns (Gillette et al., 1999).

It would be a mistake, however, to conclude that there are two types of words: those learned through non-linguistic cues, and those learned through linguistic cues, syntactic and otherwise. Many words that are acquired through multiple mechanisms. Karen Wynn and I have looked at number words (discussed in Chapter 9) as a case-study of such learning. Number words are interesting because they are learned in two distinct stages. In the first, children learn that they correspond to numerosities of sets, but they don’t know which numerosities they correspond to. For instance, a child might not know whether two applies to two entities as opposed to five entities or a hundred entities. This limited understanding emerges from a sensitivity to linguistic cues that tell the child that two is a number word — but nothing else. In the second stage, which can occur much later, children learn the precise meanings of the number words — they learn that two means two — and they do so through a developing sensitivity to extra-linguistic cues to number word meaning.

8. What are word meanings?

The assumption throughout HCLMW is that to know the meaning of a word is to have:

i) a certain mental representation, or concept, that

ii) is associated with a certain form

This is the sense of "knowing the meaning of a word" implicit in most discussions of language development, both scientific and informal. Saying, for instance, that a 2-year-old has mixed up the meanings of cat and dog implies that the child has the right concepts but has mapped them onto the wrong forms. Although there are no word meanings without corresponding concepts, there can be concepts that are not associated with forms. A child might have the concept of cat, but not yet know the word, and even proficient adult users of a language might have concepts that they don’t have words for.

But what are concepts? Chapter 6 of HCLMW defends an essentialist theory of concept learning and representation. This differs from certain alternative accounts which posit that the mature understanding of dogs and chairs is best captured either in terms of a weighted set of features (as in prototype theories) or as a set of points in a multidimensional feature space (as in exemplar theories). While such representations might exist, I argue that any theory of concepts is incomplete if it doesn’t acknowledge the essentialist bias that is central to our understanding of categories — the tacit belief
that members of a category share their properties by dint of deeper properties that the members possess.

"Essentialist" is an epithet in some circles, but the sort of essentialism that children naturally endorse is adaptive and sensible. It is adaptive and sensible because it is true. Objects in the world are not randomly distributed with regard to the properties they possess; instead they fall into categories. These categories, such as mountains, tigers, and chairs, are the products of physical law, biological evolution and intentional design. Such categories tend to be inductively rich, in the sense that once you know that something is a member of such a category, you know other relevant things about that entity. Compare this to an unnatural category such as "things that are not cows". Such a category is inductively poor; the only common property that members of this category share is that they are not cows — and so it is useless from a cognitive or scientific point of view (see also Bedford, 1997).

Concepts are useful only insofar as they correspond to the inductively rich categories. Perceptual similarity is an excellent guide to the formation of such concepts, but it is not enough. To make sense of the world, to categorize entities in a maximally useful way, the child has to grasp that the category that an object falls into is governed by deeper properties of the object (such as its internal structure), not solely what it looks like. This proposal does not entail that people actually know what these deeper properties are. For instance, to be an essentialist about tigers does not require that you know the internal properties that make something a tiger, just that you believe some such properties exist. Hence an essentialist can entertain the possibility that something might resemble a tiger but not actually be a tiger, or not resemble a tiger but be a tiger nonetheless. Some scholars suggest that essentialism arose only as the result of a scientific world-view (e.g., Fodor, 1988), but the opposite is more likely: the belief that certain entities have essences is what motivates scientific inquiry in the first place.

There is a large body of evidence suggesting that children’s categorization, and their use of words, is governed by an essentialist conceptual system. Children believe that if two animals fall into the same category, they are likely to share the same hidden properties, even if they don’t look alike (e.g., Gelman & Markman, 1986). They know that category membership is not solely determined by appearance, and so a porcupine that has been transformed so that it looks like a cactus is still a porcupine, a tiger that is put into a lion suit is still a tiger (Keil, 1989). They know that if you remove the insides of a dog (its blood and bones) it is no longer a dog and cannot do typical dog things such as bark and eat dog food, but if you remove the outside of a dog (its fur), it remains a dog, retaining these dog properties (Gelman & Wellman, 1991).

Most of the research into essentialism has focused on children’s understanding of animals and animal names; in large part because essentialism within philosophy is typically restricted to so-called "natural kinds". But I argue in HCLMW that the same sort of essentialism holds for human-made entities, for artifacts. Here the essence is not internal, it instead concerns the intention of the creator. This predicts that when children name and categorize artifacts they should be sensitive to what the artifact was created to be; something might not look like a typical clock, for instance, but if its design reflects the intention for it to be a clock, children will call it "a clock". In Chapters 6 and 7, I review the evidence in support of this extension of essentialism (see also Gelman & Bloom, in press).

As noted above, the proposal here is that word meanings are just those concepts that happen to have word forms associated with them. Under this view, there is no "lexical semantics" separate from conceptual structure. If so, then the constraints and biases that hold for word meanings should not be lexically specific; they should instead follow from pragmatic knowledge, from cognitive and perceptual biases, and from properties of concepts themselves. In HCLMW, I suggest that two fundamental biases of word learning follow in a direct fashion from how concepts are understood.

The first is the bias to treat new words as referring to basic-level categories. Roger Brown (1958) noted that some names are more frequently used than others when talking about objects. For
instance, we usually call Fido "a dog", not "an animal" or "a terrier". And when children learn new words, they most naturally treat them as falling into this intermediate level of abstraction, not too general (animal), and not too specific (terrier). What makes these basic-level meanings so special?

Brown speculated that we describe things at the basic-level, "so as to categorize them in a maximally useful way" (1958, p.20). Subsequent work, by Eleanor Rosch and others, has led to more explicit formulations of this insight. One promising analysis is from Murphy & Lassaline (1997), who propose that the basic level is an optimal compromise between informativeness and distinctiveness: you can infer many unobserved properties once you know which basic-level category something belongs to and it is also relatively easy to make this categorization. Hence the focus on the basic-level reflects a conceptual bias towards carving the world into inductively rich categories; this bias, then, has its origin in conceptual structure (Markman, 1989; but see Mandler & McDonough, 1996, for a different perspective).

A second example is the shape bias: Many investigators have found that when given a new count noun that refers to a rigid object, children will typically extend that noun to other rigid objects of the same shape, not those of the same size, color, or texture. It has been argued that this bias is special to word learning, and exists because children note the correlation between words used in a certain context and words that are extended on the basis of shape (e.g., Landau et al., 1988). The alternative, defended in HCLMW, is that shape is important for object names because shape is important for object categories: if two objects are the same shape, they are likely to belong to the same category.

If this is right, then people should categorize the world into shape-based categories even when not learning words. When a child first sees a dog, for instance, she would be more likely to attribute properties of that dog to other objects of the same shape than other objects of the same size, color, or texture. It should also follow that the shape should be sensitive to top-down information. (For instance, if two objects are the same shape, but this sameness of shape is clearly due to some factor independent of category membership, then children should not extend a new word from one object to the other.) Much of Chapter 6 defends the view that children’s generalization of words on the basis of shape emerges from the essentialist nature of concepts, and is not special to the learning of words.

One final point about concepts: The theory presented in HCLMW rejects the notion that the conceptual system is undifferentiated prior to language learning, and that many concepts emerge through exposure to words. As I review in Chapter 10, there is surprisingly little support for this Whorfian claim, and plenty of evidence for the alternative -- much of word learning involves mapping words onto pre-existing concepts. This isn’t to deny the banal fact that exposure to language can affect our thoughts (if not, why would you be reading this?) nor is to deny that concepts might change over the course of development, sometimes radically. But words are, in the end, a tool for the expression of thought, not a tool for creating it.

9. How does this theory differ from alternatives?

"Make everything as simple as possible, but no simpler".

-- Albert Einstein

HCLMW is largely a synthesis of theory and research done by many people, and so I can be confident that at least some people will agree with at least some of what I say. But the broader conclusions that I draw are not consistent with the dominant theories in the field. As I have discussed above, many researchers believe that word learning, at least early on, can be explained in simpler terms. Simple associative mechanisms suffice. Children who hear the word "bottle", for instance, learn the word through foundational mechanisms of learning that associate this word with what is
perceived at the time that it is used. Other scholars argue that the capacities I have discussed above are not enough. Instead, children must possess special constraints, assumptions, or biases that are earmarked for word learning. Children who hear the word "bottle" are guided by a constraint on word meaning that leads them to assume that the word refers to the whole bottle, and another constraint that guides them to extend the word to other objects of the same kind.

I discuss these proposals — the associationist view, and the special constraints view — in some detail in HCLMW, and I argue that they are mistaken. My arguments are not abstract; I’m not worried that the associationist approach is too empiricist, or that the constraints approach is too nativist. The problem with these views is that they fail to adequately explain certain facts about the nature and course of word learning.

What about other theories? The proposal in HCLMW is consistent with the spirit of "cognitive", "syntactic", and "socio-pragmatic" theories; disagreements lie in the relative emphasis that is given to these different processes, and the specific claims as to their nature. I have nothing critical to say about connectionist theories of word learning except insofar as such theories assume that children learn words through associative learning, without theory of mind. (Unfortunately all existing connectionist theories make this assumption.) Finally, there is some recent excitement over the claim that children exploit multiple converging cues in the course of word learning. I agree this "multiple cues" approach is the right one; but I don’t know if anyone has ever doubted it. Current theories along these lines are interesting not because they insist on multiple cues, but because they make substantive claims about the precise nature of the cues and how they interact (e.g., Golinkoff, Mervis, & Hirsh-Pasek, 1994).

HCLMW ends with a discussion of what special constraint theories and associationist theories have in common. They share the view that word learning proceeds in a reflexive manner, through "dumb associative mechanisms" or through the operation of encapsulated and specialized principles. In HCLMW, I defend an alternative that could best be called "Rationalist" — children learn words through the exercise of reason. They figure out what people are intending to say when they use words, and they bring all of their knowledge to bear when figuring out how a word should be understood. Word learning sometimes looks automatic, but only because children quickly become very good at this sort of reasoning. And it sometimes looks dumb, but only because, as researchers, we often put children in situations where the only right answer is the dumb one.

A careful examination of the facts of word learning reveals that the mechanisms underlying this process are rich and varied, and, at this point of time, largely mysterious. This might not be good news from the standpoint of research into this area, and this Rationalist account might be more complicated than the alternatives, but it is nonetheless the proposal that is most consistent with how children learn the meanings of words.

References


Bloom, P. & German, T. (in press). Two reasons to abolish the false belief task as a test of theory of mind, *Cognition*.


Gelman, S. and Bloom, P. (in press). Young children are sensitive to how an object was created when deciding what to name it, *Cognition*. 


Acknowledgements

I would like to thank Frank Keil, Gil Diesendruck, and Karen Wynn for providing helpful comments on an earlier draft of this precis.

Endnotes

1. As with most parents and researchers, I am adopting what Lois Bloom has called "rich interpretation", and so I should admit that Max didn’t actually say any of these words -- instead of "kitty", he said "gid-duh"; instead of "belly-button", he said "beh-buh", and so on. Return to text

2. Children do sometime use words like Mommy and Daddy to refer to people other than their parents. But this isn’t actually an error, since such words are also used as nouns, as in "my mommy" or "John’s daddy". Return to text

3. The term "theory of mind" is chosen to make explicit the connection with the autism literature, but no commitment is made as to the precise nature of this capacity (such as whether it really is a theory). Also, it is sometimes said that children only have theory of mind when they can pass the notorious false belief task. I think this is mistaken (see Bloom & German, in press), but in any case, this isn’t how I’m using the term here; children could have "theory of mind" even if they could not reason about beliefs that are false. Return to text

4. But not entirely successful -- even high functioning autistic individuals use and understand words in subtly different ways from normal children, especially with regard to names for representations (Bloom et al, 2000). Return to text

5. Some scholars would reject this semantic/syntactic distinction, arguing that these examples are better viewed as falling on opposite ends of a continuum. Even if one accepts that these types of context are distinct, it is difficult in practice to change the syntax without changing the semantics, and so there is controversy over the interpretation of certain experiments that purport to show that children use syntactic cues, as opposed to other linguistic information, to infer aspects of word meaning. Return to text

6. It also raises the question of how children learn the syntactic categories of words. The solution adopted in HCLMW is a variant of "semantic bootstrapping" (Pinker, 1984); children use the meanings of some words, such as object names, to learn their syntactic category, and to learn the syntactic rules of their language. These rules enable the syntactic categorization of other words, and at this point, syntactic cues to word meaning can apply (see also Bloom, 1999). Return to text

7. More speculatively, it might be that certain puzzling facts about how people use words such as water are due to an artifact-like understanding of the category that includes considerations of design and intent (Bloom, 2000; see also Chomsky, 1995; Malt, 1994). Return to text

8. These two examples are related, because members of a basic-level object kind will tend to have the same shape. But the shape bias is narrower in scope than the basic-level bias (applying only to rigid objects). Also, a child who only had a shape bias would tend to favor subordinate categories (terrier, rocking chair) over basic-level categories (dog, chair). Return to text