(for example, in terms of the contents of their vocabularies, and in terms of the quantitative growth of the early lexicon).

As we saw at the beginning of this chapter, by the time that children are aged two to two and a half years old, they have usually managed to acquire modest vocabularies containing perhaps 500 words or more. However, this is still nowhere near the size of an adult's lexicon, which has been estimated to contain between 50,000 and 250,000 words (Seashore and Eckerson, 1940; Aitchison, 1987). The subsequent developments which enable children to go on to achieve this prodigious number of words form the focus of chapter 14 by Clark in the present volume.

14 Later Lexical Development and Word Formation

EVE V. CLARK

Words are indispensable. Without words, speakers are tongue-tied. Without them, they can't exemplify syntactic patterns, morphological structure, or even the sound patterns of their language. Words, in short, offer the primary linguistic means for conveying meaning. English-speaking adults, for example, make use of a production lexicon of anywhere from 20,000 to 50,000 wordforms; their comprehension lexicon is even larger. Learning words, then, is a major part of learning language, and it is inextricably linked to the acquisition of syntax, of morphology, and of phonology. By age two, children may be able to produce anywhere from 50 to 500 or 600 words. They add steadily to this stock at a rate estimated at around ten words a day, to reach a vocabulary of some 14,000 by age six (Carey, 1978; Templin, 1957). From then on, children average at least 3,000 new words a year through age 17. It has also been estimated that, from about age ten on, schoolchildren are exposed to about 10,000 new words a year; so by age 15, they have been exposed to some 85,000 word roots and as many as 100,000 distinct word meanings in school texts alone (Nagy and Anderson, 1984; Nagy and Herman, 1987).

How do children acquire new words? How do they store them? What kinds of information must children represent about each word so they can identify and understand it when they hear it from someone else, and so they can retrieve and produce it when they speak? In this chapter, I focus on lexical development in children from about age two on, after the initial steps in word learning have occurred (Barrett, chapter 13, this volume). First, I consider some pragmatic principles that guide children's acquisition as they map meanings onto forms, and consider the speed with which children assign some meaning to an unfamiliar word. I then look at the kinds of semantic domains children have by age two, and how they elaborate these as they add more words to their vocabularies. I turn next to children's exploitation of word formation - their analysis of words into parts (roots and affixes), and their coining of words for objects, actions, and properties. I look at the means children
Conventionality and Contrast

What must children do when they learn the words of a language? First, they must learn to isolate words from the stream of speech so they can identify words when they hear them on other occasions, and they must also begin to analyze parts of words so they can identify roots, inflections, and eventually affixes. Second, they must identify potential meanings, and here they appear to draw on the kinds of ontological categories they have already set up in representing the world around them — categories of objects, of actions and events, of relations, and of properties (e.g., Clark, 1993). Third, they must map possible meanings onto the forms they have identified. Their initial mappings may overlap only slightly with the adult mapping and so require considerable adjustment. These adjustments, in fact, are what result in the patterns of early word usage, with over- and underextensions, partial overlaps, and even, on occasion, total mismatches (see chapter 13).

In mapping meanings onto forms, children appear to be guided by pragmatic principles. Two in particular play a major role for child and adult speakers alike — conventionality and contrast. These two principles capture two essential design features of languages. First, speakers must agree on which forms convey which meanings. Without such agreements or conventions, it would be much harder for addressees to work out what a speaker meant on any particular occasion. Conventionality offers a shortcut in the form of consistency over time: “For certain meanings, there is a form that speakers expect to be used in the language community.” Second, speakers practice a certain economy in their assumptions about forms and meanings. The assumption here is one of contrast: “Speakers take every difference in form to mark a difference in meaning.” That is, if speakers use a form different from the one that might have been expected, they must mean something different.

Conventionality and contrast together place certain constraints on speakers’ uses of the lexicon. First, established words — those with a conventional meaning — take priority. If a form is already captured by a conventional form-meaning combination, that is the form that must be used. Conventional words therefore preempt other forms with the same meaning that might have been used in their place but that are not conventional for the meaning intended. Conventionality and contrast together capture the fact that speakers do not tolerate full synonyms in a language. If two expressions would have exactly the same meaning, speakers always give preference to the conventional one over any innovation. If one of the two terms has been borrowed from another language or dialect, its meaning is then typically differentiated in some way from the other established term so as to avoid synonymy (e.g., Bolinger, 1977; Breal, 1897).

For children, conventionality and contrast have essentially the same consequences as for adults, but since children start out with a much more limited conventional lexicon, they do not always apply these pragmatic principles with the same effects as adult speakers (Clark, 1990a, 1993). Children begin by taking as their targets the conventional words they hear in the input around them. But as they talk more and more about what is happening around them, they become more likely to encounter gaps where they lack conventional words for what they want to talk about. At this point, children may stretch the resources available, and extend a word they already know. Or they may coin a new word for that occasion to carry the necessary meaning.

Rapid Mapping and Bootstrapping

Children need only minimal exposure to a new form, it appears, before they assign some meaning to it. This rapid mapping may follow as little as one exposure to the unfamiliar word. For example, when three-year-olds heard an unfamiliar word form, *chromium*, alongside other words for color, only once or twice, they assumed that it too picked out a color (Carey, 1978; Heilbeck and Markman, 1987). That is, children appear to map some meaning almost immediately onto any form they isolate. It is possible that any meaning associated with a form helps to make that form more memorable. That in turn should make it easier to recognize the next time it’s heard in adult input.

Rapid mapping may capture only a fraction of the conventional meaning of a form. And working out the full meaning may take years. Yet children often manage to overlap with enough of the adult meaning both for some uses to seem appropriate, and for them to recognize the same form on subsequent occasions: in fact, rapid mapping lets children set up large numbers of lexical entries in memory, with partial meanings, in a short time. Once children have some form in memory, they can gradually adjust the information associated with it — its meaning — as they find out more about how it is used. This more detailed mapping of meaning onto form may take months or even years.

Words once identified must also be assigned to the relevant syntactic category. How do children discover grammatical entities like “Noun” or “Verb”? Although such entities do not have semantic definitions, nouns and verbs do typically refer to distinct, identifiable semantic classes in parental speech. Notions like physical object, agent, and action are thereby made available to children in the input language they hear. Adults talk about things, actions, properties, and relations. When they use a noun or a verb, they do so with the
relevant formal information that goes with each syntactic word class — noun inflections, on the one hand (a cat, two cats, the cat’s ear), and verb inflections, on the other (we push, he pushes, they are pushing, you pushed, they have pushed). Adult usage, then, presents a strong correlation of category type and word class. This input offers children a potential route into syntax.

If they assume different word classes for their mappings of different ontological types, children should be able to bootstrap themselves into the syntactic categories such as “Noun” and “Verb.” Once they make a preliminary assignment of words to word classes, they can then start to make use of inflectional details to assign unfamiliar words to a grammatical type. Such semantic bootstrapping would offer a way in to the syntactic categories needed for the acquisition of syntax (see Pinker, 1984, 1989).

Could children start from syntactic information instead, and use it to make inferences about certain aspects of meaning? For example, once they have registered that hat takes the plural ending, and that pull takes past tense -ed, can they use inflectional information to decide that a new word is a verb or a noun? Although syntactic class cannot yield specific noun or verb meanings, it can offer hints about the general type of meaning — action, object, or substance (Brown, 1987). And young children can use inflectional cues to distinguish words by syntactic type. Reliance on such syntactic bootstrapping could be important in assigning preliminary meanings to unfamiliar words. For example, they could use information about word order and arguments to decide whether a new verb was transitive or not: compare The boy chased the cat and The boy sat down. In fact, three-year-olds seem to do just this when dealing with unfamiliar words from a “puppet language”: they treat terms with two noun phrases as transitive verbs, and terms with one noun phrase as intransitives (see Gleitman, 1990; Naigles, 1990).

Children surely take advantage of any and all available clues to meaning. Structural clues from inflections, word order, and argument structure should complement children’s reliance on conceptual categories as they map meanings onto word forms. But the extent to which they can bootstrap their way into syntax as a whole is not yet clear (see chapter 15).

Adding Words to One’s Vocabulary

I will look first at children’s elaboration of semantic domains as they add more words to their lexicon, and then turn to the kinds of coinages they favor as they fill semantic gaps.

Elaborating semantic domains

By age two to two and a half, children can typically produce somewhere between 50 and 600 words. In their first few months of speaking, children talk

| Table 14.1 Animal terms in D’s speech |
|-----------------------------|---------------|
| **A Initial repertoire (1,0,29–1,11,30)** |
| 1,0,29 doggie, 1,1,15 dog, 1,3,3 mouse, 1,3,23 cat, 1,4,28 horse, 1,6,13 cow, 1,6,28 rabbit, 1,11,30 goat |
| 1,1,26 bear, 1,7,19 lion, 1,8,8 alligator, 1,11,16 gorilla, 1,10,24 seal |
| 1,2,0 bird, 1,3,0 duck, -1,4 chicken, 1,7,2 goose |
| 1,5,6 turtle, 1,6,4 fish, 1,8,7 frog, 1,8,8 snake, 1,8,22 crab, 1,10,19 ladybug |
| 1,7,20 animal |
| **B Elaborating the repertoire (2,0–3,0)** |
| 2,0,8 puppy-dog <toy dog>, 2,2,24 baby-rabbit, 2,5,21 mummy-bunny <toy rabbit>, 2,7,27 sheep, 2,11,1 cattle, 2,11,1 baby-cattle, 2,11,1 daddy-cattles, 2,11,3 bronce-horse, 2,11,10 bucking-horse |
| 2,0,11 hippo, 2,1,7 camel, 2,4,10 baboon, 2,4,16 tiger, 2,5,21 monkey, 2,7,15 wolf, 2,7,15 raccoon, 2,8,8 armadillo, 2,8,8 fox, 2,8,17 beaver |
| 2,3,21 stork, 2,3,21 ostrich, 2,4,6 robin, 2,4,17 sparrow, 2,4,19 flamingo, 2,4,20 dove, 2,5,10 grous, 2,5,14 woodpecker, 2,8,6 owl |
| 2,5,1 trout, 2,5,4 flounder, 2,5,6 spider, 2,5,6 grasshopper, 2,7,2 fly, 2,7,2 bee, 2,8,14 butterfly, 2,9,21 lizard-animal <live>, 2,9,21 frog-animal <live> |

Source: Clark, diary data

about people and animals, toys and household utensils, food and eating, everyday routines and activities (e.g., Clark, 1979; Dromi, 1987; Nelson, 1973). As they add further words to their vocabularies, they elaborate each semantic domain, subdividing some and reorganizing others as they add superordinate and subordinate terms in production. Let’s take animal terms: by age 2,0, one child, D, produced some 24 terms, starting with doggie, his first one (later dog), at 1,0,29. In the next year, between age 2,0 and 3,0, he added a further 38 terms, as shown in table 14.1 (see also Clark, 1978a; Smith, 1973). The animal terms he produced in the first year (1,0,29 to 1,11,30) fall into several clusters: words for domestic animals and pets, for wild animals, for birds, and for fish, reptiles, and insects. At 1,7,20 D produced his first use of animal. This term was used from then on in two ways: as a superordinate, especially when
**Table 14.2** Food terms in D’s speech

A Initial repertoire (1:1,10–1:11,27)

1:1,10 bottle, 1:1,17 cup, 1:2,0 [meme] *<food>*

1:2,17 banana, 1:3,1 cheese, 1:3,18 nut, 1:3,23 cracker, 1:6,9 bread, 1:6,13 egg, 1:6,4 pea, 1:7,1 cereal, 1:7,4 carrot, 1:7,6 cookie, 1:7,8 apple, 1:7,21 ring *<cheesio>*; 1:7,15 raisin, 1:7,22 orange, 1:7,61 jam, 1:8,23 rhubarb, 1:8,29 crumb, 1:9,1 yoghurt, 1:9,23 sugar, 1:10,14 flake, 1:10,15 salt, 1:10,16 Graham-cracker; 1:11,13 toast, 1:11,27 cornflakes

1:2,23 juice, 1:4,6 water, 1:4,20 tea, 1:6,9 milk, 1:5,25 [meme] *<meme>*

1:8,1 orange-juice, 1:11,3 apple-juice

1:7,0 food, 1:7,6 drink [verb], 1:7,21 eat [verb], 1:10,12 taste [verb]

B Elaborating the repertoire (2:0–3:0)

2:0,18 strawberry, 2:2,28 tangerine, 2:6,5 nuts


2:1,25 cake, 2:1,27 oatmeal, 2:2,5 spaghetti, 2:2,17 sandwich, 2:3,3 pie, 2:5,17 pancakes, 2:8,13 birthday-cake, 2:9,13 brioche, 2:9,19 ice-cream, 2:9,2 finger-breads *<straws>*; 2:9,24 lavender-pastry *<fantasy food>*; 2:10,5 crumb-cookie *<hazelnut cookies>*; 2:10,18 ices *<cubes>*; 2:10,29 licker-pop *<lollipop>*

2:4,5 candy, 2:6,19 popcorn, 2:8,4 pretzel, 2:8,11 peanuts 2:9,20 chocolate

2:1,30 butter, 2:4,0 sauce, 2:6,2 cream, 2:7,0 marmalade, 2:8,11 peanut-butter, 2:8,18 pickle, 2:9,2 pepper, 2:9,2 honey

2:3,1 milk-shake, 2:4,12 wines *<bottles of>*; 2:6,19 coffee, 2:6,20 grapefruit-juice, 2:6,24 hot chocolate, 2:8,1 beer, 2:11,6 tomato-juice, 2:11,9 iced-tea

2:2,23 breakfast, 2:6,21 supper, 2:9,25 picnic

Words in angle brackets identify the referent of the term

Source: Clark, diary data

Later Lexical Development and Word Formation

Talking about several different kinds at the same time, and also, for several weeks, as a general-purpose term for any animals where, as yet, he had no other label.

In his second year of production (2:0–3:0), D added terms to each of the earlier groupings. For example, he added 10 terms for wild animals to the five from his first year; he added nine terms for birds to the four already known; and he added nine more fish, reptile, and insect terms (see table 14.1).

Other domains are elaborated in much the same way: children begin with just one or two terms, add two or three more, and then elaborate each part of the overall domain still further, using newly added words to mark finer and finer distinctions. This holds just as much for other domains, as can be seen in table 14.2 for food terms, and table 14.3 for vehicle terms.

With food terms, D initially relied on a general request for food, /meme/, and on bottle and cup, used as requests for milk or juice. He then added more specific terms for different kinds of food, for a total of 38 food words by age two. By age 1½, these included two superordinate terms, food – used for bananas, rings [cheesio], cereal, cheese, jelly, bread, oranges – and juice – used for juice, water, milk, and tea. In the next year, D added a further 21 terms for kinds of food, plus three meal terms (breakfast, supper, picnic) (see table 14.2).

The domain of vehicle terms grew at a similar pace. In his first year of talking, D acquired some 25 terms for vehicles, including two part terms (wheel, steering-wheel). In the next year, he added another 58 terms, mainly for subtypes of vehicle, and also a variety of words for parts of vehicles (e.g. mast, engine, pedals, tooter, ears), as shown in table 14.3. These three domains — animals, food, and vehicles — are representative of how children add to and elaborate their vocabulary after they learn to produce their first words.

This general pattern of elaboration appears to hold as much for relational terms as for object labels. In talking about location, for example, English-speaking children may at first produce only a neutral vowel sound (a schwa) to mark the position in their utterance of a missing locative preposition. They then gradually adjust their pronunciation towards a syllabic /n/ sound, and only some months later begin to produce distinct forms for prepositions like in, on, near, above, or under (e.g. Clark, 1993b; Peters and Menn, 1993). Children follow much the same path when they talk about dimensionality. At first, they use only the relational terms big or little (tiny, wee); then they add other terms like high and long, then tall, wide, and deep over the course of two or more years (see Clark, 1972a; Donaldson and Wales, 1970). But despite the rapid addition of so many conventional terms in each domain, children often try to talk about things, actions, and qualities for which they lack the conventional words.

**Filling semantic gaps**

Children have a much smaller vocabulary than the adults around them, so they are often faced with semantic gaps and have to find some means to fill
Table 14.3 Vehicle terms in D's speech

A Initial repertoire (1;3,11–1;11,30)

-1;4,0 car, 1;5,10 (air)plane, 1;6,8 truck, 1;6,8 train, 1;6,9 bicycle, 1;6,23 airplane, 1;7,0 (motor)bike, 1;7,10 bike <motorbikes, child bikes>, 1;7,24 cart, 1;8,7 helicopter, 1;8,22 sled, 1;8,31 fire-truck, 1;9,17 bus, 1;10,8 garbage-truck, 1;10,14 motorcycle-car <3-wheeler>, 1;10,20 fire-engine, 1;10,29 boat, 1;10,30 choo-choo train, 1;11,16 BIRTHDAY-you-you car <toy Rolls-Royce>, 1;11,17 race-car, 1;11,30 push-chair, 1;11,30 baby-bus

1;3,11 wheel, 1;8,27 steering-wheel

1;10,23 drive [verb]

B Elaborating the repertoire (2;0–3;0)

2;0,9 cickycle <baby bicycle>, motocickycle <motorbike>, 2;2,15 rolls-roycyle <toy>, 2;2,16 fire-truck, 2;3,22 tractor, 2;4,3 motor-car, 2;4,5 ferry-boat, 2;4,10 jet-plane, 2;4,18 snow-car <white car>, 2;4,24 snow bike <baby bicycle>, 2;4,24 bicycle <adult bicycle>, 2;5,1 light-cars <with headlights on>, 2;5,11 school-bus, 2;5,11 car-truck <transporter>, 2;5,11 cow-truck <animal-transport>, 2;5,11 shovel-truck <earth-mover>, 2;5,15 flying fortress, 2;5,13 airplane-spacehip, 2;5,13 pillow-spacehip, 2;6,10 house-truck <truck with high cab>, 2;6,20 snow-plough, 2;6,20 farmyard-truck <with animals in>, 2;7,12 farmyard-wagon <cart with animals>, 2;7,15 street-sweepers, 2;7,15 building-ship <large liner>, 2;7,25 police-boat <destroyer with turrets>, 2;8,22 police-garbage-truck <with siren>, 2;9,3 volvo-car, 2;9,11 taxi, 2;9,17 London-bus <red>, 2;9,18 mixing-truck <cement-mixer>, 2;9,13 upstairs-boat <double-decker>, 2;9,24 digger-shovel <earth-mover>, 2;10,22 bump-car <bump-car>, 2;10,26 logger-truck <with logs>, 2;10,28 ambulances, 2;11,3 police-car, 2;11,4 motor-boat, 2;11,21 puller <low-truck>, 2;11,28 fighter <cars as crashed them>

2;0,25 mast, 2;4,3 motor, 2;4,5 smoke-stack, 2;4,18 engine, 2;4,24 pedals, 2;5,6 brakes <brakes>, 2;6,22 seat, 2;6,27 drivers, 2;7,22 peep <car horn>, 2;7,25 siren, 2;7,27 tooter, 2;8,1 clean-wipers <windshield-wipers>, 2;8,7 pilot, 2;8,11 gas, 2;9,10 oars, 2;10,28 steers <steering-wheels>, 2;11,2 windshield, 2;11,4 car-seat

Words in angle brackets identify the referent of the term
Source: Clark, diary data

Table 14.4 Some novel nouns coined by two to five-year-olds

(1) GR (1;7, of a picture in a book): There crow-bird.
(2) HL (1;11, spoon for her cod-liver oil): Oi-spoon.
(3) EP (2;0, seeing her father's colleague who worked in the rat lab): There comes the rat-man.
(4) EP (2;0, seeing a coffee-grinder): Coffee-churn.
(5) GR (2;1, torn picture of a jungle tribe holding spears): Mommy just fixed this spear-page.
(6) GR (2;4, and I'm the gunner).
(7) SC (2;5,14): I want a butterfly-shirt.
(8) MW (2;5,24, talking about a ladder): That is a climber against the wall.
(9) AG (2;6,20, having fixed a raisin box onto a red pen): Candycone-flag.
(10) SC (2;8, of a bean-bag chair): Dat's a ball-chair.
(11) FR (2;8, pretending): I was the firetruck-man.
(12) CC (2;11,21, talking about one of her books): That's a duck-story.
(13) CR (3;6): You be the storer, dady.
(14) BS (3;9, putting a feather in the screen door): Look at this door-feather.
(15) BS (3;11, hanging a drawing with Scotch-tape): Am I a good hanger?
(16) JP (4;4, of a model pump): It's supposed to be a pumper. You pump it.
(17) BS (4;7): You're a copy-caller, dady. You say what I say.
(18) BS (4;8, watching the parakeet climbing the bars of its cage): He is like a tight-rope.
(19) CS (4;8, after complaining about a playmate): I didn't show my angerness.

Source: Clark, collection of spontaneous child coinages

them. The first recourse may be to rely on known lexical options. Children can make use of deictic terms like this or that to pick out as-yet unlabeled objects. They can also use a general purpose noun like thing. When they lack words for particular actions, they can rely on general purpose verbs like do, make, go, or put (Clark, 1983). But on many occasions, they instead coin their own words—new nouns for objects, new verbs for actions, and new adjectives for states or qualities. Some representative examples of such spontaneous child coinages are given in tables 14.4, 14.5, and 14.6.

From as young as age two, children coin novel nouns when they need them. The earliest such coinages in a language like English are typically root compounds, formed from two nouns, as in crow-bird or taxi-car (both from young-year-olds). Note that many such compound nouns in fact identify subkinds of a kind already known and labeled by the child, as in crow-bird used of a kind of bird (see Berman and Clark, 1989; Clark, Gelman, and Lane, 1985). Soon after age two, children start to use some derivational suffixes as well when they construct new nouns. The first noun suffix used in English is generally the agentive -er, as in sworder (for someone who uses a sword) or hanger (for
Table 14.5 Some novel verbs coined by two to five-year-olds

(1) SC (2;4, as his mother prepared to brush his hair): Don’t hair me.
(2) JA (2;6, seated in a rocking chair): Rock me, mommy.
(3) SC (2;7, hitting baby sister with toy-broom): I broomed her.
(4) SC (2;9, playing with a toy lawn mower): I’m lawning.
(5) RG (3;0, of a bell): Make it bell.
(6) DM (3;6, pretending to be Superman): I’m supermanishing.
(7) SC (3;1, watching a cement truck revolving, not pouring): That truck is cementing.
(8) SC (3;2, putting on his cowboy hat with a string-and-bead fastening): String me up, mommy.
(9) JM (3;2, realizing his father was teasing): Daddy, you joked me.
(10) FR (3;3, of a doll that disappeared): I guess she magicreed.
(11) AG (3;7, of food on his plate): I’m gonna fork this.
(12) KA (4;0, pretending to be a doctor fixing a broken arm): We’re gonna cast that.
(13) BS (4;0): Maybe it rained or it fogged yesterday.
(14) RT (4;0): Is Anna going to babysitter me?
(15) CE (4;11): We already decorationed our tree.
(16) KA (5;0): Will you chocolate my milk?

Source: Clark, collection of spontaneous child coinages

Table 14.6 Some novel adjectives coined by two to five-year-olds

(1) EL (2;2, for “too damp”): Too dampy.
(2) MB (2;6, of a door that was banging): It’s bumpy.
(3) GR (3;5, of a dinosaur he’d just drawn): That looks growly, doesn’t it?
(4) DM (4;0, for something with a point on it): It’s pointy.
(5) GS (4;0, of a parasol blown by the wind): . . . a windy parasol.
(6) GE (4;5, of a dog running round and round the room): What a runny dog!
(7) DM (4;0,7, when asked how he felt one morning): Toothachey.
(8) SB (4;0, to his mother): Try to be more rememberful, mom.
(9) SB (4;2): I am a scienetical boy.
(10) CG (c. 4;0, of a box of cocomus): And about what time will they be flyable?
(11) JW (5;9, of a model Batman dressed as Batman): I wish he was changable.
RW (9;6): What do you mean?
JW: I wish he could change into Bruce Wayne and back again.
(12) YV (5;9, of a tree she had seen a boy climbing): . . . an unsafee tree.

Source: Clark, collection of spontaneous child coinages

How do children choose which word forms to use in constructing new words? Why do they acquire some affixes and compounding patterns before others? As children analyze the internal structure of conventional words, they learn to identify roots and affixes, and to attend to how these are combined. At times, they comment spontaneously on their analyses of word parts, even as young as age two. Their comments reveal that transparency of meaning is one important dimension in their analyses. For example, they offer explanations of word meanings based on their identification of specific roots. Some examples of spontaneous analyses from one child are given in table 14.7.

Children also depend in their coinages on simplicity of form. That is, it is easier for them to discern a root in a complex word form if its shape remains unchanged by affixation or any adjacent roots. In their construction of new word forms, children observe both transparency and simplicity. They build with already familiar elements – roots and affixes – when they coin words. And they make the least possible change in any roots being used. They are also sensitive to the relative productivity of each option in the adult language around them. The first affixes they produce are the most productive ones available for expressing the pertinent meaning. For example, English-speaking children produce agentive -er in innovative agent nouns long before agentive -ist or -ian, and they produce root compounds formed from two nouns before they progress to any synthetic compounds where the constituent noun or verb roots are combined with affixes. In short, when children coin new words, they attend not only to conventionality and contrast, but also to transparency, simplicity, and productivity (see Clark, 1993).
Table 14.7 Some explicit analyses of word forms from D

(1) Mo (pointing at a picture of a ladybug): What’s that?
  D (2;4,13): A ladybug! That like “lady.”
(2) D (2;6,20, to Fa, about a stick): This is a running-stick.
  Fa: A running-stick?
  D: Yes, because I run with it.
(3) D (2;9,10): You know why this is a HIGH-chair? Because it is high.
(4) D (2;9,24) Eve, you know what you do on runways? You run on them
    because they start with “run.”
(5) Mo: We’re going to a place called Sundance.
  D (2;11,0): And you dance there. If there is music, we will dance there.
(6) D (2;11,2): Windshield! Wind goes on it. That’s why it’s called a windshield.
(7) D (2;11,25, asking about a road): What’s it called?
  Mo: King’s Mountain Road.
  D: Do kings live in it?
(8) D (2;11,28, looking at flowering ice-plants): What’s that called?
  Mo: That’s ice-plant.
  D: Does it grow ice?
(9) D (3;2,15): Egg-nog comes from egg!
(10) D (3;2,20, as he climbed into the car, holding both index fingers up to
    his head): D’you know what headlights are?
    Mo: No.
    D: They’re lights that go on in your head.

Source: Clark, diary data

Children’s reliance on such factors allows for some general predictions about
the kinds of word forms they will construct when they fill semantic gaps. For
example, in a language that allows verb formation either with or without
affixation, children should opt for the simplest form type first. And they do:
young English-speaking children rely only on zero derivation to form new
verbs from nouns. And in a language that allows both compounding and
derivation with affixes, children should prefer some compounding patterns
before any affixes in their coinages. And they do: English-speaking rely on
root compounds from age two or younger, and only rather later begin to use
some derivational affixes. The patterns observable in child and adult coinages
depend critically on what is available and productive in each language. For
example, compounding is not productive in Hebrew, and children rarely pro-
duce novel compounds before age six or seven. The same holds for French,
where again compounding in general is not a productive option. This con-
trasts with Germanic languages where compounding is highly productive.
There, children consistently begin to exploit this option from around age two
(see further Clark, 1993; Clark and Berman, 1984; Chmura-Klektowa, 1971;

MacWhinney, 1976). The typology of each language and the nature of the
input children hear, then, interacts with transparency, simplicity, and produc-
tivity, to produce particular developmental patterns in children’s coinage types
at different ages.

Children’s coinages appear to have a function similar to that of adult coin-
ages. They fill lexical gaps, gaps where children know no conventional word
for just the meaning they wish to express. Coinage offers a valuable resource
for extending the lexicon whenever necessary. This resource is available to
adults too, but the greater size of the adult lexicon tempers the degree to
which speakers need to construct new words.

Taking a Perspective

As children add to their lexical repertoires, they also come to realize that one
can convey much the same information from a variety of perspectives. The
particular words chosen convey what the speaker wants to pick out about
each entity or each event. One can pick out an entity, for example, as the dog,
the family pet, the hunter, the hearth rug, or the box. Each set of choices rep-
resents a different perspective on the animal in question. One can also present
actions from different perspectives, as in The door opened (with the object
affected being of main interest), The key opened the door (with the mediating
instrument identified), or Rod opened the door with the key (with the agent and
instrument explicitly identified as participants in the action). Here, the tran-
sitivity of the verb and the number of arguments allow the speaker to present
the same event from different perspectives by picking out particular partici-
pants or combinations of participants. Speakers can also make use of voice in
the verb to present different perspectives on an event, as in Kate lit the fire
versus The fire was lit by Kate, or They washed the shirts versus The shirts was
washed well (Clark, 1990b).

Children learn that the same referent may be talked about in a number of
ways, depending on the perspective chosen by the speaker. And they begin to
learn this very early during acquisition. For example, two-year-olds can cat-
egorize objects at least two levels: basic and subordinate. That is, they can
refer to something with a basic-level term, as in the tree or the dog, and they can
refer to the same entities with more specific, subordinate terms, such as the
snow-tree (for a fir tree) or the Dalmatian-dog. When they need to distinguish
subcategories of a familiar category, children as young as two are able to shift
perspective and produce subordinate labels such as the speer-page versus the
duck-page (pages in a book designated by the relevant illustrations), or the
snow-car versus the race-car (two toy cars, one with whitewall windows, the
other a convertible). When two and three-year-olds need subordinate labels
for subcategories, they typically identify the basic category and add some
modifying noun to it in a novel compound such as car-smoke (smoke from cars,
utterances like I’m gonna touch it on your pants (3:0). I’m gonna cover a screen over me (4:5). She’s gonna pinch it on my foot (4:9); or Can I fill some salt into the bear? (5:0).

They make the opposite error too, when they choose the “container” as the direct object with verbs like spill, as in I don’t want it [toast] because I spilled it of orange-juice (4:11). Learning which verb exemplifies which perspective, and which verbs allow both perspectives (where the direct object can be realized as either the “contents” or the “container”) takes time (Cipolletta, Pinker, Hollander, and Goldberg, 1993).

Children must also learn which verbs allow two or only one perspective in other domains too. In English, for example, the verb to give allows the speaker to focus on the recipient, as in Jan gave the boy a doughnut, or on the object being transferred, as in Jan gave the doughnut to the boy. But close relatives of give may allow only one perspective, as in He donated the sculpture to the gallery (but not *He donated the gallery the sculpture). Similar differences hold for benefactive verbs: compare They baked a cake for her/baked her a cake with She designed a house for them/designed them a house. Although children begin to produce verbs like give, show, read, and buy as early as age two, they typically use only one of two possible forms for each verb for several months. And they make errors of perspective by producing alternations that are not conventional, as in Don’t say me that or you’ll make me cry (3:6, “to me”), You ate me my cracker (3:3, “for me”), Button me the rest (3:4, “for me”), and Pick me up all these things (5:2, “for me”). Bowerman (1987), Groen, Pinker, Hollander, Goldberg, and Wilson (1989). They continue to make errors as they get older, notably with Latinate verbs that do not allow alternation, as in Mattia demonstrated me that yesterday (5:0, “to me”). Learning which verbs can and can’t alternate takes a long time: many 12-year-olds still judge nonconventional alternations to be acceptable (Mazurkiewicz and White, 1984).

Perspective can also be marked by voice. In English, this is usually realized in the contrast between active and passive forms of the verb, as in The child threw the ball versus The ball was thrown by the child. The passive voice here serves to shift the perspective away from the prototypical transitive event described with the active voice, by making the object affected, instead of the agent, the topic of the utterance. Children begin to produce passive verb forms soon after age two, and by three produce both get and be passives. These seem to differ in that get passives, as in We will get starved by lightning (3:6), are more likely to have animate subjects than be passives (59 percent versus 32 percent). They are also more likely to express some adverse consequence for the entity affected; 65 percent versus 18 percent for be passives. In fact, be passives are much more likely to be neutral in the effect they describe; 74 percent versus 26 percent for get passives. This contrast can be seen in utterances like Does the cream of wheat need to be cooled? (2:8) or I want these pancakes to be sugared (4:2) compared to I just got pinched from these pointed stuff (3:3). Because of this difference (adverse versus neutral), there is little overlap between the verbs that appear in get passives and those in be passives. Children not only use two
forms of passive to focus on the patient or object affected of the action, they also distinguish kinds of entity affected – animate versus inanimate – and kinds of outcome – adverse versus neutral (see Budwig, 1990b).

Children exploit syntax to indicate their perspective on an event from an early age. When they wish to talk about the object affected by an action, they either omit the agent altogether or they demote it from the subject slot while promoting the phrase for the entity affected. But two-year-olds often lack the conventional syntactic means (a by phrase) to do this, so they have to find some consistent way to mark such denoted entities. They typically treat denoted agents as sources of actions and, like sources of motion, they mark them with the preposition from, as in I took my temperature from the doctor (2;2, meaning “had my temperature taken by”) or These fell down from me (2;2,3, meaning “were knocked down by”). Denoted possessors, causes, and standards of comparison are also marked as sources in the same way, as in That’s a finger from him (3;0,13, “belonging to”), Then I cried a bit from you got him (2;6,12, “cried because you went”), and See? This ear is longer from the other ear (3;1,15, “longer than”) (see Clark and Carpenter, 1989).

Children attend, from early on, to the perspective marked both lexically and syntactically in the utterances of others. They are consistent, for example, in choosing different pictures in response to active versus passive utterances when they are asked to show what the speaker is talking about. With The boy is riding the bicycle, they choose a picture of a boy over that of a bicycle, but for The bicycle’s being ridden by the boy, they choose the picture of the bicycle (see Hornby, 1971; Turner and Rommetveit, 1967). Their decision about the topic of an utterance is a critical ingredient in their identification of the perspective being taken by the speaker.

Finally, perspective is also marked by the different deictic devices in a language. Speakers can use pronouns to mark whether an action is attributable to the speaker (I), the addressee (you), or to a third person (he, she, they). While children begin early on the perspective shifts inherent in the I–you contrast (Loveland, 1984), they take time to master the details of perspective marking in locative, demonstrative, and verbal forms. For example, it is only around age four that English-speaking children consistently take here, roughly “where the speaker is,” to contrast deictically with there, roughly “somewhere where the speaker is not.” The analogous deictic contrast between this and that is mastered even later, and the contrast between verbs in pairs like come/go and bring/take in English, later still (Clark, 1978b). In each case, children must learn the many conditions for using proximal versus distal terms to mark particular perspectives.

In summary, much of later lexical learning involves the acquisition of lexical relations among word meanings, and how specific meanings mark one or another perspective on an activity or on the participants in an event. Shifts in perspective may involve both lexical choice and constructional shifts that exploit word order as well as morphological changes in word forms. Later lexical acquisition is inseparable from the acquisition of both syntax and morphology.

Idioms and Figurative Language

Learning the lexicon involves more than learning words. The lexicon also contains numerous idioms. Some of these typically appear in just one syntactic form (e.g., sitting on pins and needles, while others can appear in a variety of syntactic forms (e.g., make up your mind). The fixed or frozen form idioms might be easier to learn initially just because they remain in a single chunk or phrase when they appear. Flexible idioms may be harder to discern as idioms just because they can appear in a variety of syntactic forms, e.g., make up my/your/minds, are our minds made up, did she make up her mind, and so on. Some idioms have meanings that are relatively close to the literal meanings of the relevant phrase, as in hold your tongue; others are much less close and the connection between the literal and idiomatic interpretations may have become opaque, as in hold around the bush.

Both syntax and transparency have an effect on acquisition: when five and six-year-olds are asked to explain the meanings of idioms or choose the intended interpretation from sentence alternatives, they consistently do better on fixed than on flexible idioms (Gibbs, 1987). But as they get older, there is little difference between the two types, whether in stories or in isolation. And, at all ages (from five to ten), they do better on phrases whose idiomatic and literal interpretations are closely related (as in hold your tongues) than on idioms where the two are not close (as in hold around the bush). Overall, children (like adults) have a harder time glossing opaque idioms than relatively transparent ones. Finally, children do better at interpreting idioms as they get older, and they do better on idioms in stories than on idioms presented in isolation.

Idioms span a continuum from opaque (where the motivation for the original idiom has been lost) to transparent where modern-day speakers can still relate the idiomatic and nonidiomatic senses of the relevant phrases. One result of that frequency of exposure to idioms appears to have little effect on acquisition. But exposure to idioms in rich contexts – stories that offer multiple clues to the meaning of an idiom – facilitate idiom comprehension at all ages. In production, children use few idioms and, at age seven, offer completions only for highly familiar ones (Levorato and Cacciari, 1992). In short, children appear to understand and produce few idioms before age five or six. But by age nine to ten, they understand a number of idioms and can come up with interpretations for idioms heard in contexts that provide them with clues. They probably find syntactically frozen idioms easier to interpret because these are identified as idioms (lexical chunks with a single meaning) earlier than idioms with greater syntactic flexibility.

Children also have to learn that language can be used figuratively, that expressions may be intended as metaphors rather than as literal descriptions. But for a child use to be identified as metaphorical, one needs to be able to distinguish conventional uses of languages from metaphorical ones. For example, a child should be able to apply the conventional label for a category
before being given credit for figurative usage in the application of a nonconventional label, e.g. as when a child uses my tall for a piece of string earlier called string. "Renaming" like this is common in symbolic play and is often accompanied by gestures that redefine the object in question, as when a child put his foot into a wastebasket and said root. One child, A, produced 215 such renamings in 112 hours of tape transcripts (Winn, 1988). What is striking here is that figurative uses typically require a shift in perspective: the object or activity is presented from a new point of view, as a member of a different category. Such symbolic play metaphors have been distinguished from sensory metaphors, which are based on physical similarities, as when A called a big pencil needle or a red balloon attached to a green tube apple on a tree. At age two, A produced more symbolic than sensory metaphors (62 percent to 25 percent), but by age four, these proportions had reversed, and he produced sensory metaphors more often than symbolic ones (76 percent to 10 percent). Data from two other children, though, suggest that some children may produce more sensory than symbolic metaphors from the start (Winn, 1988).

To produce either type of metaphor, children must be able to perceive similarities and map the relevant properties from one object to another. In symbolic play metaphors, there is little emphasis on physical similarities so almost any object can stand in for another: a ladder for a pair of scissors, as the child pretends to cut his mother's hair and says scissors, or a blanket for ice-cream as the child "dipped" his spoon in and raised it to his mouth saying ice-cream. At what point can children map one domain onto another, while preserving the pertinent properties and relations? In one study, four-year-olds and adults were asked to map the human body, while preserving the relations among body parts, onto such objects as trees and mountains. They answered questions like "If a tree had a knee, where would it be?" about both body parts and facial features. Four-year-olds did very well and were equally good at mapping onto trees and mountains. In another task, four and six-year-olds were presented with trees that were upright, horizontal, or inverted, and again asked about body parts, and again they did very well. They were also asked about facial features for mountains drawn with local details that were compatible or not with the features being asked about. Here children were better than adults at ignoring the local detail when they answered questions about where the mouth or eyes would be (Gentner, 1977). In short, the basic analogical ability needed for simile and metaphor appears to be well established for this domain by age four. Familiarity with the domain to be mapped is, of course, a prerequisite for any figurative uses.

In summary, children must learn not only the meanings of individual words but also the meanings of idioms. And building up a repertoire of idioms takes time. Children produce few idioms before age six, but begin to show some comprehension of them earlier than that. But this aspect of lexical acquisition is one that probably lasts through adulthood. We continually encounter new idioms, from different registers, different dialects, and from different eras. And the acquisition of idioms appears more complicated when the nonidiomatic meanings of the pertinent expressions are not transparently relatable to their idiomatic meanings.

Children must also learn how to use language figuratively, and that requires that they learn how to map one set of terms and their meanings onto a second domain. This requires first that they be familiar with the conventional meanings of terms in both domains, and second that they know how to preserve the mapping relations from the first domain to the second. While children can do this for certain domains as young as age four, much of their skill in figurative language interpretation and use develops later, since it is built on prior acquisition of the conventional meanings and their semantic relations within each domain.

Conclusions

Children learning a language undertake one massive task, that of learning a lexicon. Lexical acquisition goes on for many years. As children move from the few hundred words acquired in their first year of speech, they elaborate each semantic domain. They add more words, they organize them to reflect the myriad ways of slicing up each domain, and even subdivide domains into further domains as they acquire yet more words (see tables 14.1–14.3 for some typical elaborations). Children start with the conventional words they hear in the input, but they often have to go beyond these when they lack a word for the meaning they wish to express. They fill semantic gaps by coining words to express just the desired meaning. These coinages show that children have not only analyzed the internal structure of conventional words but also that they rely on such factors as transparency of meaning, simplicity of form, and productivity in their own coinages: they use transparent options (familiar roots and affixes), they favor simple over complex changes (minimal changes in form), and, all else being equal, they opt for the most productive of the options available (Clark, 1993).

Lexical acquisition continues with some intensity through the school years, but then the rate probably slows considerably. As adults, we may only be aware of learning new words when we enter new domains and need a vocabulary for anatomy, photography, boat building, or picture restoration. Otherwise, outside of cross-puzzles, we seldom meet words that demand a dictionary. Yet we encounter unfamiliar words every time we hear words just for the occasion. And we then have recourse to all we already know about the lexicon and to any other knowledge we share with the speaker; together these allow us to compute the pertinent meaning, typically without even being conscious that the word in question is new.

Finally, lexical acquisition is inextricably linked to the acquisition of morphology and syntax. The morphological structure of unfamiliar words offers important clues to word meaning and to word class; and inflections on words
further identify their word classes. Many words are restricted in the syntactic structures they can appear in, and so syntax too can offer certain clues to the meanings of unfamiliar words. But neither morphology nor syntax can supply the full conventional meanings children have to learn. They offer clues that may confirm or disconfirm hypotheses based on children's ontological categories, their inferences in context, and any earlier attempts to assign meaning.

The focus in this chapter has been on some aspects of later lexical acquisition. Children continue to learn massive numbers of new words for many years. They also analyze the internal structure of words to identify roots and affixes. And, from an early age, they use what they know about word formation when they themselves coin words. Words also indicate what perspective the speaker has chosen in presenting an event or an object to the addressee. Here too, children seem to become aware that lexical choices reflect different perspectives, and they begin to make use of this knowledge from around age two on. But learning which options are available in a language again takes a long time. The lexicon is not simply a list of words. It also encompasses a vast number of idioms – phrases and constructions whose meanings are not necessarily computable from the parts. And it also includes a large range of figurative use. These too make up a major component of lexical acquisition. Studies of early lexical acquisition have revealed a good deal about how children start acquiring a lexicon. But, as yet, we know relatively little about how children build on their first insights as they add thousands more words and idiomatic expressions over the years.

NOTE

Preparation of this chapter was supported in part by a Seed Grant from the Center for the Study of Language and Information, Stanford University.

15 The Role of Syntax in Verb Learning

LILA R. GLEITMAN AND JANE GILLETTE

We discuss here the mapping problem for vocabulary acquisition: how word-level concepts are matched with their phonological realizations in the target language. Traditional approaches to this problem assume that, at least at early stages in the acquisition process, children try to line up the utterance of single words with their contingencies in the world. Thus, their task would be to discover that *elephant* is most often said in the presence of elephants and rarely said in their absence (Locke, 1690, and many modern sources).

Our recent investigations (Gillette and Gleitman, forthcoming) show how well such a procedure could work in practice for the case of concrete nouns. Adult subjects are shown videotapes of mothers playing with their infants (aged about 18 months, MLU < 2;0) but with the audio turned off. These film clips are long enough for subjects to pick up the pragmatics of the conversation, e.g., of a mother showing and describing an elephant puppet to the child, who then takes it and manipulates it. The subjects are told that whenever the mother is uttering the target noun, a beep will sound; their task is to identify the word that she uttered. Subjects have no trouble with this task, guessing correctly about 50 percent of the time even on the first video-beep exposure, and improving with the addition of more instances. And if any of the maternal usages are deictic, the subjects are even better in guessing what noun she was saying.

This laboratory situation is radically reduced from the problem that infants face in assigning interpretations to novel words. The subjects are made aware in advance that the target is a noun. These nouns all describe concrete objects that are present in the videotaped scenario, and are foci of the mother–child conversation. In light of the task as set for them, the subjects also know that there exists in English a single common word that will fit their observations of these objects in these scenes. Moreover, they are solving for one target noun at a time; their exposures to this item are not complicated by the intervention of any other novel items, so they have no memory problem. In contrast, a child learner might reencounter the new item only after the passage of considerable time, and mingled with other new words.