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Glossary

difference in functional representation: differences in which language functions are dealt with.
processed in parallel: with several operations taking place at one and the same time.
ego: sense of self, in relation to the external world.
id: instincts and innate needs.
representation: distribution.
As language abilities . . . Deacon argues that we need to do two things in order to achieve understanding. We need to analyse what we hear in terms of phrase and sentence structure (i.e. syntax). This demands 'one rapid interpretation followed by another'. At the same time, we need to build up meaning on a larger scale, adding what we have just heard to our understanding of the whole conversation so far. These simultaneous demands potentially conflict. But, because the left hemisphere deals primarily with syntactic processing and the right hemisphere deals primarily with larger-scale representation, we are able to keep them apart.
prosodic features of speech: intonation, rhythm, stress.
prosodic and phonemic processes: a speaker has to supply an overall intonation pattern. At the same time he/she has to produce the basic sounds of the language. These two are seen as potentially in conflict.
asymmetry of auditory input: heavy reliance on one ear rather than the other.
sensorimotor: related to movement or sensation.
neural substrates: nerve connections.

D4 FORMING LEXICAL CATEGORIES

Activity

One of the easiest ways of getting to grips with the notion of a lexical category is to look at what we know of how infants acquire such categories when they are in the process of developing their first language. Suggest how an infant might form the concept associated with the word DUCK. Remember that the infant has to learn to relate the word to a whole class of entities in the real world, not just to a single example.

How children learn the meaning of words

Jean Aitchison (from *Words in the Mind*, Chapter 15, London: Blackwell, 2nd edn., 1994, pp. 169–180, Abridged with permission of the author.)

Essentially, children are faced with three different but related tasks: a labelling task, a packaging task and a network-building task. In the labelling task, youngsters

must discover that sequences of sound can be used as names for things. In the packaging task, they must find out which things can be packaged together under one label. In the network-building task, they must work out how words relate to one another. . . .

The packaging task

There is quite a lot of difference between applying a label such as *penguin* to one toy penguin and the ability to use that label correctly in all circumstances. How does a child come to apply the name *penguin* to a wider range of penguins? And how does she learn to restrict it to penguins alone, and not use it for puffins and pandas, which are also black and white? . . . By adult standards, both underextensions and overextensions occur: sometimes children assume that a word refers to a narrower range of things than it in fact does, whereas at other times they include far too much under a single name.

Underextensions seem quite understandable, as when 20-month-old Hildegard refused to accept that the word *white* could be used of blank pages, since she herself associated it only with snow [Leopold in Bar-Adon & Leopold, 1971: 98]. She had acquired the word in a particular context, and it took time for her to realize that the word had a wider application. Similarly, a child quizzed on the words *deep* and *shallow* 'might respond correctly if he happens to be probed about ends of swimming pools. . . . But if shown a picture of a deep puddle . . . and asked "Is this a deep puddle?" the child might answer, "No, a big one"' [Carey, 1978: 288]. And in cases where words have abstract as well as concrete physical applications, it may be years before the child fully understands the range of meaning covered: in one experiment three- and four-year-olds readily called milk *cold*, water *deep*, boxes *hard* and trees *crooked*, but had no idea that these words could be extended to people, and some even denied that it was possible: 'I never heard of deep people anyway!' 'No people are cold!' [Asch & Nerlove, 1960]. A period of underextension for a word, then, is quite normal, and the gradual enlarging of meaning to include an increasingly wide range does not seem particularly puzzling.

Overextensions are less common than underextensions, but are more noticeable, as the effects may be bizarre. . . . Three main types of explanation have been proposed for overextensions: gap-filling, 'mental fog' and wrong analysis. The first of these suggests that . . . [the child] might recognize the difference between [a] duck and a peacock but say *duck* for both because he doesn't yet know the word *peacock*. Or she might know the name *peacock*, but be unable to pronounce it, since some children consciously avoid sounds they find difficult to cope with. Gap-filling explanations are possibly correct for some overextensions, but are unlikely to account for all of them, especially the more bizarre ones such as using the same word for a duck and a mug of milk.

'The child unquestionably perceives the world through a mental fog. But as the sun of experience rises higher and higher these boundaries are beaten back.' This statement by [Chambers] an early twentieth-century psychologist typifies the 'mental fog' viewpoint. Its proponents argue that meanings are necessarily hazy

Jean Aitchison

and vague in the early stages, and that they gradually become more precise as children learn to discriminate more finely. . . .

A more recent version of this theory suggests that 'when the child first begins to use identifiable words, he does not know their full (adult) meaning: he has only partial entries for them in the lexicon. . . . The acquisition of semantic knowledge, then, will consist of adding . . . to the lexical entry of the word until the child . . . entry for that word corresponds to the adult's' [Clark, 1973: 72]. The child might have learnt the word *dog* but only noticed certain outline characteristics. 'dogginess' might have been identified with 'being four-legged'. In that case, cows, sheep, zebras and llamas would wrongly be included in the category *dog*. But each of these lexical items would gradually be narrowed down. To the lexical entry for *dog* the child might attach the additional specifications 'makes barking sounds', 'is fairly small', while to *zebra* it might add 'striped' and 'fairly large', so distinguishing one from the other. Eventually, the child's lexical entries would have all the details filled in, and so be comparable to those of an adult.

This gradual narrowing down may apply to some words. But there are two facts which this type of theory does not explain. First, relatively few words are overextended – perhaps less than a third. If the mental fog viewpoint was correct, one would expect many more words to start out by being too wide in their application. Second, many of the overextensions are bizarre and cannot easily be related to a lack of subdivisions in the adult word. This suggests that the child is not simply operating in a mental fog, in which he can only see broad outlines. Instead, he has made an analysis of the items concerned, but a wrong one by adult standards.

The Russian psychologist Vygotsky [1962: 70] discusses a child who used *qua* ('quack') for a duck swimming on a pond, a cup of milk, a coin with an eagle on it and a teddy bear's eye. In his view, children are perfectly capable of analysis, but they tend to focus on only one aspect of a situation at a time and to generalize that alone. The child began with *qua* as a duck on a pond. Then the liquid element caught the youngster's attention, and the word was generalized to a cup of milk. But the duck had not been forgotten, and this surfaced in *qua* used to refer to a coin with an eagle on it. But then the child appeared to ignore the bird-like portion of the meaning and focus only on the roundness of the coin, so reapplied the word *qua* to a teddy-bear's eye. Vygotsky calls this a 'chain-complex', because all the usages of *qua* are linked together in a chain. Each one is attached to the next, with no overall structure.

A more recent 'wrong analysis' theory suggests that children are working from prototypes. Like adults, they learn the meaning of words by picking on a typical example or 'prototype' which they analyse. They then match other possible examples of a category against the characteristics of the prototype, and if there is sufficient agreement, they assign the new object to the same category. According to this viewpoint, discrepancies between child and adult language occur because children analyse the prototype differently from adults. For example, between the ages of 16 months and 2 years, Eva used the word *moon* to refer not only to the moon but also to a slice of lemon, a shiny green leaf, curved cow horns, a crescent-shaped piece of paper and pictures of yellow and green vegetables on the wall of

a store [Bowerman, 1980]. Most of these objects are crescent-shaped, which seemed to be an important property of moonhood for Eva. At first sight this observation supports mental fog theories: perhaps Eva simply thinks that *moon* means 'crescent'. But on examination there is more to it than this. First, Eva was able to recognize the moon in all its phases, when it was a full moon, a half moon or a quarter moon. So moons were not inevitably crescents, they were just typically crescents. Second, each of the objects labelled *moon* had something else apart from shape in common with the moon, though something different. The lemon slice shared its colour with the moon. The shiny green leaf shared the property of being shiny. The curved cow horns were seen from below. The green and yellow vegetables on the chart were seen against a broad expanse of background. So Eva had apparently identified several characteristics of the moon, the most crucial of which is its shape. Something was likely to be labelled *moon* if it shared both the shape and one other characteristic with the real moon.

Similarly, at around the same age, Eva took someone kicking a ball as a prototype for the word *kick* [Bowerman, 1978]. She seems to have analysed this action as possessing three main characteristics: first, a waving limb, second, sudden sharp contact between part of the body and an object, third, propulsion forward of the object. This analysis could account for her labelling as *kick* a kitten with a ball of wool near its paw, dancers doing the can-can, a moth fluttering on a table, pushing a bottle with her feet and pushing a teddy bear's stomach against her sister's chest. All these things share characteristics with the prototypical *kick* but not the same ones. . . .

Prototype theory therefore accounts for children's broad mental fog-type generalizations as well as the strange chain-complex ones. And it ties in with the way in which adults assign words to categories. Children, like adults, look for clusters of properties which belong to a prototype.

Children differ from adults, however, in that they may not focus on the same features when they analyse words. In the early stages, they are over-influenced by appearance, especially shape. When asked to name an object that was a crayon shaped like a car, younger children tended to call it a *car*, and older ones a *crayon* [Merriman *et al.*, 1993].

Kindergarten-age children concentrate on superficial characteristics. A child was asked if a friendly and cheerful woman who disconnected and removed a toilet bowl could be a robber. The reply was: 'No . . . 'cause robbers, they have to have guns and they do stickups, and this woman didn't do that, and she didn't have a gun, she didn't do a stickup' [Keil & Batterman, 1984]. Another child argued that a hut containing dirty clothes which people paid to see couldn't be a museum, because 'a museum is something with dinosaur bones'. As children get older, they gradually alter their analyses to fit in with those of the people around them – though this can go on into the teenage years. . . .

Network building

Somehow, words have to be fitted together into a semantic network. How does this happen?

Jean Aitchison

The evidence is sometimes confusing. . . . Brian [at two and a half] would not believe that a horse was an animal [Macnamara, 1982]. . . . This seemed to be the reaction of around half of the two-year-olds tested. They reserved the word *animal* for a bunch of assorted animals. And the 'one name only' preference has been confirmed by other researchers.

The evidence, then, can be difficult to interpret. Apparent backward steps may be the best guide that network-building is taking place. Two-year-old Christie used the words *put* and *give* appropriately, as in 'I *put* it somewhere', '*Gimme* more gum'. Then, when she was three, she started to use them interchangeably: 'You *put* ("give") me bread and butter', 'Whenever Eva doesn't need her towel, she *gives* ("puts") it on my table' [Bowerman, 1978]. Perhaps, suggested Christie's mother, she had suddenly discovered that *put* and *give* had very similar meanings, but had not yet realized that one *puts* something on to a thing, but *gives* something to a person. Two more years elapsed before Christie used *put* and *give* correctly by adult standards.

Network-building takes place slowly. . . . Words which an adult would regard as related take time to get linked in the child's mind. This fits with the evidence from underextensions, the fact that children often learn a word in a particular context and only gradually extend it to a wider situation. Even fairly old children may find it hard to detach words from specific contexts. A group aged between eight-and-a-half and ten-and-a-half correctly guessed that the nonsense word *lidber* meant 'collect' from the sentence 'Jimmy lidbered stamps from all countries'. But when asked to interpret 'The police did not allow the people to lidber on the street', a typical response was that the police did not allow people to collect stamps on the street [Werner & Kaplan, 1950]. . . .

The tortoise-like progress of network-building is confirmed by the literally dozens of studies which have explored how children cope with overlapping words, such as *tall, big, fat, high* and opposites, such as *big–small, deep–shallow, tall–short* [Richards, 1979]. All the studies reported that these words acquire their adult meaning only gradually, sometimes with backward steps. . . .

Collocational links appear to have priority for children, while those between co-ordinates lag behind. This is shown by word association experiments: young children are likely to respond to 'table' with *eat*, to 'dark' with *night*, to 'send' with *letter* and to 'deep' with *hole*, whereas typical adult responses to these would be *chair, light, receive* and *shallow*. As children get older, the more likely they are to give an adult-like response. A suggested explanation is that 'this change in word associations is a consequence of the child's gradual organization of his vocabulary into the syntactic classes called parts-of-speech' (Brown and Berko 1960: 14). Another explanation is that children may take time to discover the criteria by which adults classify items as co-ordinates. A study conducted with a group of three- to five-year-olds showed that they were quite happy to agree that prototypical birds, such as sparrows or robins, were birds, but often argued that ducks or hens were not birds, they were ducks and hens [White, 1982]. It is unclear whether the children had come to this conclusion by themselves or whether they were simply reflecting the speech of their parents, since the same experimenter noted that

parents tended to refer to typical birds as *birds* more often than atypical ones: 'Oh, look there's a bird, it's a robin'; 'That's a turkey, like the ones we saw at the turkey farm'.

Efficient retrieval may be another explanation for the importance of co-ordinates in adult speech. Fast word-finding is a skill that has to be acquired, and young children can be quite slow at naming objects such as *ice-cream, lion* and *bed*, whose names they know very well. Perhaps the gradual shift-over comes in response to a need to organize and retrieve words quickly as the overall vocabulary gets larger.

LEXICAL PROCESSING

D5

Activity

You may find this extract quite challenging. First skim it to find out:

- what are the four parallel sources of information in a connectionist model?
- what is a logogen?
- what two features characterise a connectionist model?
- what is the author's chief argument in favour of a lexical search theory?

Before reading the article as a whole, look through it and gather more information about

- logogens
- connectionism
- search models

Lexical processing

Kenneth I. Forster (in Oscherson, D. N. and Lasnik, H. (eds), *An Invitation to Cognitive Science: Volume 1, Language*, Cambridge, Mass: MIT, 1990. Abridged with permission of the author).

5.3.1 Word-Detector Circuits

It may be useful to begin by considering how we might design a simple circuit that could perform the lexical decision task. Suppose we had six switches, a battery, and 32 light bulbs. The light bulbs correspond to word detectors, and the switches correspond to letters (for instance, switch 1 being ON means the letter A is present). With six switches, we have 64 possible combinations, of which [let us say] only 32 correspond to actual words. The task is to design the circuit so that a different bulb lights up whenever one of the 32 'permissible' combinations of switches is selected; otherwise, nothing happens. The system could now be used for [word recognition]. We observe which letters are present in the target