Journal Club

Words help babies represent objects

How do infants learn that a bottle is different from a glass, and what is the role of language in this learning process? In a series of experiments, Xu takes one step towards answering these questions by investigating whether babies use words to individuate objects [1]. Nine-month old babies saw two objects being brought out from behind a screen and replaced, one at a time. In one condition, the objects were labeled with two different nouns ('*Look, Maggie, a ball … Look, Maggie, a duck*'). In another condition, only one word was used for both objects ('*Look, Maggie, a toy*'). This procedure was repeated several times. Next, the screen dropped revealing either both, or one of the objects. Babies looked longer at the one-object than the two-object display, but only in the two-word condition. This suggests that the babies used the different words to individuate the two objects, and were therefore more surprised when one rather than two objects remained. Similar results were obtained when nonsense words and nonsense objects were used, showing that previous exposure to the words and objects was not essential. By contrast, babies did not show more surprise at the one- compared with two-object outcome when the objects were labeled with two tones, two non-linguistic sounds or two emotional expressions (positive-sounding '*ah*', negative-sounding '*ewy*').

Apparently,then, nine-month old babies make use of linguistic labels to keep track of objects. It is as yet unclear whether babies use the words simply as mnemonic devices in this task, whether the linguistic cues draw more attention to the objects, or whether the use of two distinct words is a cue for the infant to set up 'placeholders' for two kinds of objects. If the last of these is true, words do indeed play an important role in the acquisition of object concepts.

1 Xu, F. (2002) The role of language in acquiring object kind concepts in infancy. *Cognition* 85, 223–250

Edith Kaan
kaan@biac.duke.edu

fMRI reveals processing streams in action

The dorsal and ventral visual streams, through which visual information about objects is processed, were first characterized in the macaque monkey and homologous pathways have also been identified in the human brain. The dorsal stream processes the 3-D location and movement of objects, and parietal lobe areas use this information to guide object-directed actions, such as reaching and grasping. The ventral stream processes the form and features of objects and temporal lobe areas use this information for perception and object recognition. Because of this functional division between the types of information processed by the two streams, they are often referred to as the 'how' and 'what' pathways.

When we go to grasp an object, the motor system uses information about the 3-D shape and orientation of the object to configure the fingers for an optimal grasp. The optimal grasp clearly changes with the orientation of asymmetrical objects, so the dorsal stream must preserve information about object orientation. In the ventral stream, however, object orientation must be effectively ignored so that objects can be recognized from a variety a viewing angles. The two streams must therefore process object orientations differently, and in a recent fMRI study with human subjects these differences in processing are revealed [1].

The study examined activity levels in dorsal and ventral visual areas while subjects were presented with two consecutive views of objects. Because of a well-known phenomenon known as priming, presenting the same object twice results in an attenuated response to the second presentation. Both dorsal and ventral streams exhibited priming when identical views of an object were presented. However, when the second presentation was a rotated view of the first object, only the ventral stream exhibited priming. This difference suggests that the ventral stream classified the rotated view as the same object, consistent with its role in object recognition, whereas the dorsal stream classified the rotated view as a different object, consistent with its role in object-directed action. The results therefore reveal an underlying difference in the representations of objects in the two streams: viewpoint-dependent representations for 'how' and viewpoint-independence representations for 'what'.

1 James, T.W. *et al.* (2002) Differential effects of viewpoint on object-driven activation in dorsal and ventral streams. *Neuron* 35, 793–801

James Ingram
j.ingram@ion.ucl.ac.uk

Mapping the way

During the recent boom in functional MRI, vision research has led the way in terms of detailed, quantitative analysis. The main focus of cognitive MRI research has been to identify 'blobs' that show significant activity in given cognitive circumstances. This is an essential first step, but does not address the nature of the processing that occurs in the areas so identified. By contrast, vision researchers knew already where to look (at the back of the brain), and have been mapping the surface of the visual cortex, almost millimetre by millimetre, addressing issues of functional organization on a much finer scale. This methodological lead has been made possible by the pre-existence of copious physiological and anatomical information about the visual system of other primates. Because of this lead, at a recent Royal Society meeting in London on 'the physiology of cognitive proesses' the presentations on vision were among the most eagerly received. One of these, presented by Wandell and now published [1] along with the other contributions, illustrates just how far into the visual cortex the fine-scale approach can be taken.

The visual world is mapped in an orderly fashion onto the surface of the human brain. But the received wisdom is that only the first three visual cortical areas (V1, V2 and V3) have clear and precise maps that are readily definable with fMRI. Beyond V3, a progressive and rapid degradation of retinotopic organization is believed to occur. In their paper, Wade *et al.* provide the

