IN THE NEWS

Mice show the way

How does a mouse find its way around in a field — a fairly homogeneous, bland environment with few clues? Simple — it makes its own landmarks, according to Pavel Stopka and David MacDonald from Oxford University, UK. After noticing that wood mice in the wild tended to make piles of objects such as leaves and then return to them frequently, Stopka and MacDonald (writing in *BMC Ecology*) tested the idea that the piles were artificial landmarks by bringing wood mice into the laboratory.

The researchers placed the mice in an unfamiliar environment and provided them with small white discs — potential landmarks. Sure enough, "The mice tended to collect the white discs, then move them to the more interesting area. The mice would then explore the area in the vicinity … continually returning to the disc," (*BBC News Online*, 29 April 2003). *Cordis News* (29 April 2003) notes that "These movements seemed to confirm that the mice were using the discs to orient themselves and to mark places of interest."

Why create these visible road-signs, rather than using scent markers? One explanation, according to the *New Scientist* (30 April 2003), is that wood mice are "wholly visual … they have very big eyes." Alternatively, *Cordis News* raises the possibility that "The mice may have chosen to use 'signposts' rather than scent marks as they can be moved about and cannot be detected by predators."

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Examples of the face pictures used in the study. The broad-spatial-frequency images (left panel of each set of three images) were filtered to produce images that contain only high (middle panel) or low (right panel) spatial frequencies. Reproduced with permission © (2003) Macmillan Magazines Ltd.

VISUAL PROCESSING

Face it

We humans are specialists at face processing. We can identify individual faces despite their similarities, and we can tell a lot about how a person is feeling from their facial expression. Vuilleumier *et al.*, writing in *Nature Neuroscience*, have found evidence that these two functions are carried out by different visual pathways in the brain, and that these pathways use different elements of the visual information contained by the image of a face.

Functional imaging techniques have added to our understanding of how the brain processes faces. We know, for example, that part of the fusiform cortex — the 'fusiform face area' (FFA) — is selectively activated by images of faces, and that images of fearful faces also activate the amygdala, which is important for processing emotion. Intriguingly, the amygdala, unlike the FFA, is activated by fearful faces even if those faces are not consciously perceived or attended.

There is indirect evidence that the amygdala receives visual information through a subcortical pathway, which might allow it to carry out 'quick and dirty' processing — for example, rapidly checking for danger signals (such as fearful expressions) without waiting for the cortex to carry out more detailed analysis. The same pathway, through the thalamus, is thought to mediate 'blindsight' — the residual visual abilities of cortically blind patients who can, for example, point accurately to a stimulus they cannot see. Vuilleumier *et al.* tested the idea that this subcortical pathway relies on low-frequency information extracted from the visual scene by the magnocellular channels, whereas the cortical processing of facial identity relies on high-frequency information extracted by parvocellular channels.

Subjects were asked to look at pictures of faces that contained either broad-spatial-frequency information (normal images), or just the high- or low-spatial-frequency elements. Their task was to identify the gender of the faces — a judgement that relies equally on high- and low-frequency data. Using event-related functional magnetic resonance imaging, the authors studied the activity of the brain in response to the different types of image.

As expected, normal pictures of faces reliably activated the FFA — and, if the faces were fearful, they also elicited the activation of the amygdala. Pictures that contained only high spatial frequencies were equally able to activate the FFA — but they did not activate the amygdala even if their expressions were fearful. By contrast, low-spatial-frequency pictures did not activate the FFA as strongly, but the amygdala responded well to fearful expressions in these pictures.

To see whether the lack of amygdala activation was because subjects could not discern the expressions of the high-spatial-frequency faces, the researchers asked another group to rate the pictures for fearfulness. The results showed that, at least when they were attending to expression, people could identify fearful expressions just as well in either type of picture. So it is likely that although the amygdala carries out fast processing of expression through subcortical inputs, a cortical visual pathway can also be used to identify fearful expressions.

The findings of this study are consistent with previous psychophysical results showing that low-spatial-frequency components of visual scenes convey global, configurational information that carries emotional cues, whereas high spatial frequencies are needed for detailed analysis of fine-grained information for tasks such as face recognition. A fast magnocellular–pulvinar–amygdala pathway might allow us to recognise danger or emotional cues rapidly and regardless of the focus of attention, and might also mediate the early visual abilities of babies, who can use low spatial frequencies to detect emotional cues before the cortical visual system matures.

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References and links

ORIGINAL RESEARCH PAPER Vuilleumier, P. *et al*. Distinct spatial frequency sensitivities for processing faces and emotional expressions. *Nature Neurosci.* 11 May 2003 (10.1038/nn1057)