Recent studies suggest that the amygdala, which resides in the temporal lobe of the human brain, plays a crucial role in processing the emotional valence conveyed by human facial expression. Moreover, functional imaging reveals that activation of the amygdala occurs when subjects are presented with facial expressions, most notably those that signal fear or anger. This哪怕 patient denies having seen the fearful face. The latter condition can occur under conditions of backward masking whereby the brief presentation of an emotional facial expression is rapidly followed by the presentation of a neutral expression. Although activation of the amygdala as a result of viewing emotional stimuli (either masked or unmasked) does not unequivocally identify its role in the recognition of facial expression, a recent study by de Gelder, Urcuioli, and Weiskrantz hints that the amygdala response might be capable of mediating discrimination among facial expressions without conscious awareness.

The study by de Gelder et al. was prompted by a report by Morris et al. who suggested that “unseen” facial expression might be processed via a subcortical route that need not involve primary visual cortex (visual-stimuli). The superior colliculus receives direct input from the retina and is involved in early visual processes. The amygdala is a midbrain structure that is centrally involved in emotional processes and receives input from the superior colliculus via the pulvinar. Morris et al. demonstrated positive correlations between photons of light presented to different areas of the retina and the superior colliculus. Although the amygdala has been implicated in the recognition of facial expression, it has been thought that the perception of some emotions than others. Neuroimaging studies have shown that patients with amygdala damage have some difficulty recognizing a range of emotions, although they are able to distinguish between the emotions presented. The amygdala is implicated in the recognition of facial expression, and it has been thought that it is more involved in the perception of some emotions than others. Neuroimaging studies have shown that patients with amygdala damage have some difficulty recognizing a range of emotions, although they are able to distinguish between the emotions presented.

The amygdala is involved in processes that need not involve primary visual cortex. Neurons in the superior colliculus are capable of responding to more complex visual stimuli than moving images. Nevertheless, by recording event related potentials, de Gelder et al. demonstrated that even these stationary images evoked neural responses in extrastriate cortex, although there was no suggestion that these responses differed according to facial expression. These data, however, indicate that the visual stimulii elicited responses in cortical areas beyond striate cortex, although they cannot indicate whether or not the collicular–amygdala route was activated.

There is ample evidence that abstract properties associated with unseen visual stimuli can influence behaviour, for example, unseen digits or number words affect subsequent number judgement. However, apart from one recent report, there has been little previous evidence that blind subjects can discriminate between simple shapes, let alone something as complex as facial expression. So, how did GY demonstrate ‘affective blindsight’?

One explanation could be that, because in the initial experiment the same stimulii were presented to GY’s intact and blind visual fields, GY could have implicitly learned associations between individual facial expressions and other simple visual properties of each stimulii, which could subsequently be used to discriminate between the four video clips. This explanation can be ruled out, however, because de Gelder et al.’s second experiment used four new video clips presented solely to the blind field. There was therefore no opportunity to learn such associations. One factor that might restrict the ability of blindsight subjects to discriminate shape is the relatively limited number of objects presented, which are consistently presented in their blind visual field despite denying any accompaniment conscious visual experience.

Blindsight may therefore be functionally akin to visual masking. Although the findings with blindsight patients so far have suggested that such residual ability applies only to the processing of relatively simple stimulii properties, de Gelder et al. set out to discover whether a blindsight subject (GY) could discriminate facial expression while remaining unaware of the faces to which he responded. In the latest experiment, GY was presented with short video clips of an actress showing sad, happy, fearful or angry expressions, both to his intact and to his blind fields. GY could distinguish between these expressions (performance was significantly better than that expected from random responding) even when the video clips were presented to his blind field. However, he did not discriminate similar expressions when these were presented as still rather than moving images. Nevertheless, by recording event related potentials, de Gelder et al. showed that even these stationary images evoked neural responses in extrastriate cortex, although there was no suggestion that these responses differed according to facial expression. These data do, however, indicate that the visual stimulii elicited responses in cortical areas beyond striate cortex, although they cannot indicate whether or not the collicular–amygdala route was activated.

Weiskrantz hints that the amygdala response to the facial expression and the concomitant limitation of spared visual ability of patients with blindsight. Blindsight refers to the residual visual ability of patients who, following damage to primary visual cortex, can detect, discriminate and localize visual stimuli presented in their blind visual field despite denying any accompanying conscious visual experience.

Perhaps GY could indeed make such ecological perceptions with the limited visual pathways remaining to him. If, as the evidence of de Gelder et al. suggests, GY can covertly discriminate facial expression in his blind field, then we might ask how he does it. Morris et al. showed in normal subjects that unseen faces excite a subcortical route to the amygdala. There is, however, a problem in invoking this pathway as the explanation of GY’s abilities. Although the amygdala is implicated in the recognition of facial expression, it has long been thought to be more involved in the perception of some emotions than others. In their neuroimaging study, Blair et al. failed to find any systematic variation in amygdala activations with the degree of anger in expressions, although they did find a systematic effect of fear and sadness. Neuroimaging studies have shown that patients with amygdala damage have some difficulty recognizing a range of emotions, although they showed particular difficulty in recognizing fear and anger and were near normal in their ability to recognize happiness and disgust. There are several regions that appear to be involved in the processing of facial expression, including orbitofrontal and anterior cingulate cortex. The pattern of performance, where both visual and auditory stimuli are discriminated well but anger and fear are often misidentified, may reflect the distributed nature of the representation of facial expression in the amygdala. In the conditioned fear paradigm, it is not clear whether the response of the amygdala is a result of the emotional quality of the facial expression or of the aversive nature of the event associated with that visual stimulus. The amygdala has been implicated in mediating fear responses following conditioning to a previously neutral stimulus. It is conceivable that a change in the circuitry involved, for example, the generation of an autonomic response to the aversive stimulus. In neuroimaging studies that have required subjects to view masked
facial expressions, whenever amygdala activation has been demonstrated in the absence of conditioned fear, subjects have not been required to make a forced-choice response about the nature of the unseen expression. That is, they were not engaged in the sort of guesswork undertaken by blindsight patients. It is plausible that GY, a much-practised observer, is able to monitor his automatic responses and use them to mediate above-average performance in the discrimination of facial expression. However, the differential response of the amygdala to different facial expressions is consistent with its role in the processing of least some facial expressions. The response with which the responses to unmasked fear-conditioned stimulus desensitize leaves open the possibility that repeated presentation could mitigate against GY’s performance. Moreover, it remains an interesting possibility that an improvement in performance might have been obtained had GY been asked to make a reflexive response, such as a key press, which is less likely to verbalization to invoke reflexive conscious processes. The genuine cues of an unformed conscious system might potentially interfere with the stimulus-driven responses of the putative cortical circuit. We will have to wait for further experiments to answer this question.

References

Affective blindsight: are we blindly led by emotions?


Beatrice de Gelder, Jean Vroomen, Gilles Pourtois and Larry Weiskrantz

The recent findings that facial expression can be recognized in the absence of awareness by blindsight patients suggests that, as the saying goes, we might indeed be blindly led by emotions. Although we are entirely in agreement with the comments made by Heywood and Kentridge (Heywood, C.A. and Kentridge, R.W. (2000) Affective blindsight? Trends Cogn. Sci. 4, 125–126)3 we would like to take this opportunity to discuss some of the questions that they raised and to describe our most recent data that may clarify some of the important issues.

Heywood and Kentridge remark, the finding of covert discrimination by a blindsight subject of facial expression presented to his blind field (‘‘affective blindsight’’) raises the question of how blindsight is found only for textures. Indeed, our most recent results in-