The framework for disturbed affective consciousness in autism

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Abstract: The current article explores the implication of the interaction of emotion and consciousness for autism. The framework that is proposed for the disorder explains that the compromised functional integrity of the amygdala is the root cause of disturbed affective consciousness. Amygdala, with its connections to various cortical and subcortical regions, helps detect a fearful facial expression at the attentional periphery and make it the focus of attention and awareness for enhanced processing. The conscious life of autistics with respect to affective objects can thus be very different from that of normal people, which leads them to perceive the world differently. They process fearful stimuli the way normal controls perceive common objects by activating areas responsible for feature based analysis rather than the amygdala and other connected areas. Conscious perception of such stimuli is important for appropriate development of emotion concepts, something that autistics lack, thus leading to impairment in the awareness of one's own emotions especially within the negative spectrum with a prominent position for fearful stimuli. Thus the interaction of emotion with consciousness is ripe for investigation and can help to throw light on the mental life of autistics.

Keywords: emotion, amygdala, visual awareness, fear processing

Introduction

It has recently been argued that consciousness and emotion interact with each other tremendously (Tsuchiya and Adolphs 2007). As the emotional processes interact with consciousness, such an interaction can have implications for cognitive and psychiatric disorders where the emotional processes have been found to be not normal.

According to Tsuchiya and Adolphs (2007), consciousness encompasses two components: the level of a state of consciousness such as wakefulness, coma, and dreamless sleep, and its content, that is, whatever a person is conscious of at a particular point in time (eg, the color of a house). The contents of conscious experience can be analyzed into their phenomenal aspect. The focus of the current paper will be on the contents of consciousness, assuming the state of wakefulness, and in this case the contents will refer to emotional facial expression since humans rely heavily on facial expressions when communicating emotional states to others.

The aim of the current article is to show what implications such an interaction can have for the disorder of autism. Initially the interplay between consciousness and emotions will be described before applying the description of the interplay to illuminate the disturbed affective consciousness in the disorder. For simplicity, the review will focus on fear processing. Moreover, findings from studies, including samples of autistic as well as Asperger syndrome subjects, will be discussed in this paper.

It is important to keep in mind that only a framework for disturbed affective consciousness will be proposed. A framework is not a detailed hypothesis but is a suggested viewpoint for a particular scientific problem suggesting various hypotheses. A good framework sounds reasonably plausible given a particular set of scientific

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data. It is unlikely to be correct in all its details and contains unstated though unrecognized assumptions but this is unavoidable due to the inherent nature of frameworks (Crick and Koch 2007).

A model of interaction between emotion and consciousness

The perception of some stimuli in the environment is important for adaptive behavior; eg, an emotional face. Adaptive behavior requires that processing of some important stimuli such as an emotional face takes place independently of awareness and attention so that attention could be guided towards these stimuli which ultimately receive enhanced processing due to their saliency even while falling outside the focus of attention. Hence, emotional faces conveying threat signals enjoy such privileged status (Vuilleumier 2002).

The amygdala plays a very important role in fear processing. It receives highly processed information not only from the visual cortical pathways but also crude information through a direct subcortical pathway via the thalamus involving the retinocollicular and the pulvinar projections. The direct pathway provides fast signals about any potential threat in the environment such as a fearful face, which bypasses the slow and fine analysis of the visual cortex. Amygdala also has direct connections with the fusiform cortex and sends projections back to orbitofrontal, visual, and the medial prefrontal cortex, anterior cingulate gyrus, basal forebrain nuclei, and striatum. These projections enable the amygdala to influence perceptual and motor processes in response to a threat cue (Vuilleumier 2002). This arrangement of connections can help bring the threatening face into the focus of awareness and attention after it was detected at the attentional periphery. In support of this claim, brain imaging studies have demonstrated that visual cortical regions show enhanced activation in response to emotional stimuli (Kosslyn et al 1996). The magnitude of this enhanced activation in the visual cortex is correlated with the activation of the amygdala in response to these same stimuli (Morris et al 1998a). Vuilleumier and colleagues (2004) provided further support for the claim that the amygdala mediates enhanced responses in visual cortical regions for emotional stimuli. They presented fearful and neutral faces to normal control subjects, patients with damage to the hippocampus only, and patients with damage to the hippocampus and amygdala. Enhanced activation was observed in visual cortical regions for fear versus neutral faces in normal control and patients with damage confined to the hippocampus. Patients with damage to the amygdala did not show any significant activation for fearful versus neutral faces in the visual cortex, which supports the role the amygdala plays in mediating transient changes in visual cortical processing in response to emotional stimuli.

Another set of results obtained by Pascual-Leone and Walsh (2001) supports the role of amygdala in bringing the fearful face detected at the periphery of attention to the focus of attentional and conscious processing. They show that conscious experience depends as much on the lower anatomical regions as on the higher ones but the lower processing anatomical regions participate at a later point in time. Thus areas like the early visual cortices and the amygdala and other structures engaged very early in processing contribute to conscious experience but can be compared with activity driven by feedback from higher regions during a later iteration of processing when the activity is driven by the stimulus.

Disorder of autism

Autism is a psychiatric syndrome characterized by impairments in social interaction, communication, and restricted and repetitive behaviors and interests (Salmond et al 2003). Amygdala has been found to play a role in the neurobiology of autism (Baron-Cohen et al 2000). Ashwin and colleagues (2006) gathered evidence to show that compared with normal adults who activated areas of the social brain like the amygdala while viewing fearful faces implying automatic emotional appraisal of biologically relevant stimuli, the autistic individuals showed activations in the areas responsible for the processing of conscious and feature-based analysis of social and emotional stimuli. A similar conclusion was reached by Wang and colleagues (2004) based on the neuroimaging data that they obtained from children and adolescents. Further the control individuals in Ashwin and colleagues' (2006) study also showed activations in the amygdala and other areas of the social brain similar to those which were responsible for face processing, in response to various intensities of fearful stimuli implying that the amygdala modulates activity in other brain areas to facilitate the processing of biologically relevant stimuli as compared with the autistics. The findings show that the amygdala deficits may have effects on other parts of the brain too.

Therefore the conscious life of autistics with respect to affective objects can be very different from that of normal people, which means that the environment might look different to different people due to their conscious awareness of various affective objects. It is very important to note again that objects having affective value can increase activations in both the amygdala and the central visual cortex (Pessoa et al 2003) because of the extensive connections of the amygdala

with the ventral visual cortex. Consistent with the role of amygdala in visual conscious awareness of such objects, Pessoa and colleagues (2006) have shown that objective awareness of fearful faces at short presentation times is related to the co-activation of the amygdala and the fusiform gyrus (a portion of the ventral visual stream). Vuilleumier and colleagues (2002) have consistently shown that people with amygdala lesions show decreased activations in the fusiform gyrus in response to affective objects.

Conscious perception of emotions is very important for various mental processes. For instance, it has been shown by Honk and Schutter (2007) that the conscious perception of emotional faces serve as socially corrective signals that act to curtail misbehavior on the part of the perceiver. Conscious perception of emotional expressions is also important for the development of appropriate emotion concepts and autistics lack such a concept due to their inability to perceive such emotional signals in others, which thus leads to impairment in the awareness of one's own emotions especially within the negative spectrum with a prominent position for fear (Rieffe et al 2007).

Conclusions

This paper provides a new framework which explains that the conscious life related to fear perception can be very different for people with autism, and causes a different perception of the world from the normal controls. Thus this area is ripe for investigation and will help better understanding of the mental life of autistics. The root cause of their problem lies at the compromised functional integrity of the amygdale, which plays a major role in visual awareness by bringing objects holding affective (eg, fear) value, detected at the attentional periphery to the focus of attention and awareness, due to its connections with various parts of the ventral visual stream and the prefrontal areas and the subcortical areas.

Some autistic symptoms might be related to the way emotions, especially fearful expressions, are perceived by the autistics. It has been shown that they perceive and process fearful expressions the way other general objects are processed by normal individuals by activating areas responsible for conscious and feature-based analysis of social and emotional stimuli, which implies that the significance of such stimuli for them is equivalent to other common objects, and thus leads to the deficits seen in the disorder.

Since conscious perception of such faces is important, it is quite likely that autistics consequently suffer from an inappropriate development of emotion concepts, which leads to impairment in the awareness of one's own emotions, especially within the negative spectrum with a prominent position for fear.

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