EMOTION PERCEPTION AND HEALTH

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Abstract

Our emotional states and action tendencies are expressed and communicated with the whole body, the face included. How others behave has a direct influence on us whether we are aware of it or not. The neurofunctional basis of perceiving facial expressions is reasonably well understood. Research on bodily expression perception is emerging as a new field in neuroscience and promises to extend current emotion perception models. Our present goal is to review behavioral, electrophysiological and neurofunctional studies on whole body and bodily expression perception against the background of what is known about face perception. In this chapter we will discuss how processing facial and bodily expressions relates to health and put forward that the nature of emotion perception cannot be fully understood by focusing separately on social, cultural, contextual, individual or interpersonal factors.

1. INTRODUCTION

In everyday life, we are continuously confronted with other people. One of the most important sources of social information are facial expressions: humans are predominantly visual animals, and we spend a great deal of time looking at and analyzing faces. Moreover, many facial expressions are universally consistent. For this reason, emotion research has predominantly focused on faces. However, bodily expressions are just as well recognized, they can be seen from a distance and are from an evolutionary perspective much older. Body language therefore has a high communicative role albeit we are less aware of it. Models on facial expression processing might also work for understanding bodily expressions. However, whereas faces illustrate the mental states of people, body postures in addition imply motion and show an action intention.

Almost everyone experiences from time to time depressive or anxious moments or even episodes. When truly diagnosed with depression or an anxiety disorder, this can account for major differences in how people recognize and perceive emotional expressions. Research has shown that small diversities in personality type can already account for these differences. Furthermore, neither full attention nor conscious observation is required in order for emotional expressions to be processed and recognized.

We would like to put forward that brain responses to emotional expressions are not driven by external cues alone but determined by the personal state of mind and significance of the current social context. Individual differences such as personality type and psychopathology play an important role. The nature of emotion perception cannot be fully understood by focusing separately on social, cultural, contextual, individual and interpersonal factors. The percept of an emotion is embodied, and its bodily grounded nature provides a foundation for social communication. *"What you see is what you get"* does not apply here. People do not "see" the same, nor do they attend to the same.

All these topics will be discussed in this chapter. They show us that recognizing emotional meaning from others is vital and that facial and bodily expressions are of crucial importance for normal communication. This is clearly impaired in disorders such as autism, schizophrenia, Huntington's disease, Parkinson's disease, depression and anxiety. But before we discuss emotion perception in these disorders, we first provide an overview of the literature on emotional face and body processing in healthy people. Investigations of neurological differences in facial and bodily expression perception will enrich basic clinical research and can lead to the development of new observational and diagnostic tools.

2. PROCESSING FACES AND BODIES

2.1. Inversion effect

The major concept used to argue for the specificity of processing is configuration. There is clear evidence that faces and bodies are not processed as a collection of features (such as objects): when presented upside-down recognition drops significantly and is relatively more impaired than for inverted objects (Reed et al., 2003). The face and body inversion effect can be seen back in the form of an increase of the N170[1], an important electrophysiological (ERP) component known to be involved in processing faces (Righart & de Gelder, 2007). Using magnetoencephalography (MEG), this effect was visible already at 70-100 ms post stimulus onset (Meeren et al., 2008). For faces it was observed in well-known face-selective areas: inferior occipital gyrus (IOG, including occipital face area (OFA)) and fusiform gyrus (including fusiform face area (FFA)), whereas for bodies in the precuneus and posterior cingulate cortex. Hence, whereas face inversion modulates early activity in face-selective areas in the ventral stream, body inversion evokes activity in dorsal areas, suggesting different early cortical pathways for face and body perception.

2.2. Emotional modulation of face- and body selective areas

Several studies have reported emotional modulation of FFA and OFA (Vuilleumier et al., 2001). The effect of emotional information of bodily expressions on activation of body areas has not been studied often. The first functional magnetic resonance imaging (fMRI) study addressing this issue observed increased activation of fusiform gyrus and amygdala for fearful expressions (Hadjikhani & de Gelder, 2003). A follow up experiment additionally showed the involvement of motor areas (de Gelder et al., 2004). Also when directly comparing emotional and neutral bodies with faces (van de Riet et al., 2009), emotional bodies activate motor related structures (inferior frontal gyrus, caudate nucleus and putamen).

[1] The N170 is a negative brain potential peaking at 170 ms after stimulus onset at the lateral occipito-temporal sites (including the fusiform and inferior occipital gyri). The N170 to inverted faces is larger and more delayed than to upright faces, but not inverted objects (Watanabe et al., 2003) A similar effect has been observed for bodies (Stekelenburg & de Gelder, 2004).

Although our findings of emotional modulation of the fusiform body area (FBA) have been replicated (see for an overview de Gelder et al., 2009), emotional modulation of the extrastriate body area (EBA), specifically involved in processing bodies (Downing, 2001), is still unclear. We observe emotional modulation using dynamic (Grèzes et al., 2007; Kret et al., submitted; Pichon et al., 2008) but not static body expressions (van de Riet et al., 2009).

3. IMPAIRED EMOTION PROCESSING IN THE CLINICAL POPULATION

Increased vigilance and enhanced autonomic activity are part of an adaptive response to threat. In various pathological conditions the anxiety response is disproportionate to the stressor, either because of a misinterpretation of threat, or hyper- or hypo-responsiveness at any of a variety of points in the complex network of neural pathways that serve the stress response**.** Imaging techniques offer unique opportunities to explore the neurofunctional basis of personality differences and psychopathology and show that perceiving emotions is greatly regulated by top-down processes being different from person to person.

3.1. Autism

Autism is a neuro-developmental disorder characterized by impaired social interaction and communication, and restricted and repetitive behaviour which signs begin before the age of three (DSM-IV-TR, 2000). People with autism have social impairments and lack social intuition.

Autistic individuals look less at faces than controls and when they do so, perceptual processes and exploratory ocular movements focus much on irrelevant features (Senju & Johnson, 2009). A recent study reported that autistic subjects performed saccades away from the eyes, which were positively correlated with the amount of social information that facial zone contained (Spezio et al., 2007). Also in a naturalistic scene, autistic individuals spend less time viewing people in pictures (Riby & Hancock, 2008) or videos (Riby & Hancock, 2009) of social interactions.

Having difficulties extracting social cues from others is something all individuals with different disorders in the autism spectrum have in common. Individuals with Asperger Syndrome, who have normal or above average IQs, have deficits in the recognition of identity, gender, age and expressions in faces (Celani et al., 1999). Hubert et al. (2007) reported that autistic individuals performed much worse than controls in recognizing bodily emotions from point-light displays[2] even though they performed as well as controls in recognizing simple actions and object manipulations.

One explanation for these deficits is a lack of interest in other people (Jemel et al., 2006). Functional abnormalities have been found in the amygdala and mirror neuron system in response to neutral (Kleinhans et al., 2008) and emotional faces (Dapretto et al., 2006). Moreover, compromised functioning of regions in and around the superior temporal sulcus (STS) (Zilbovicius et al., 2006) and reduced activation in this area in response to

[2] Biological motion refers to the unique visual phenomenon of a moving, animate object. Often, the stimuli used in biological motion experiments are comprised of just a few moving dots that reflect the motion of some key joints of the moving organism, which is known as a point light display (see for example Atkinson et al., 2004).

body (Freitag et al., 2008) and emotional face movements (Pelphrey et al., 2007) as well as functional abnormalities of the fusiform cortex (Pierce et al., 2001) have been reported. Increased activation to fearful versus neutral body images in the fusiform gyrus and amygdala was absent in this group (Hadjikhani et al., 2009). Another study also failed to find increased activity in the amygdala for this contrast, and adding dynamic information to the stimuli did not help. Moreover, atypical functional connectivity was observed including absence of change in connectivity strength when viewing fearful compared to neutral bodies between amygdala and STS, premotor cortex and inferior frontal gyrus. Autism spectrum disorders are thus characterized by shortcomings in socio-cognitive abilities in general, and emotion recognition in particular (Grèzes et al., 2009).

3.2. Schizophrenia

Schizophrenia is characterized by abnormalities in the perception or expression of reality. Distortions in perception most commonly manifest as auditory hallucinations, paranoia and bizarre delusions, or disorganized speech and thinking with social or occupational dysfunction. Onset typically occurs in young adulthood with 0.4 - 0.6% of the population affected (Bhugra, 2005).

Social cognition has become a high priority area in schizophrenia research (Green & Leitman, 2008). Evidence suggests that schizophrenics may have problems integrating visual features into perceptual wholes using configural information (Shin et al., 2008) which may influence sociocognitive abilities such as difficulties in understanding facial expressions (Mueser et al., 1997).

Some studies have investigated emotion perception in language; deficits have been reported in the categorisation of emotional voices and correlations between deficits in hearing and seeing emotions were found (de Gelder et al., 2003, 2005). In the healthy population, a vocal emotional expression influences categorization of a facial expression (de Gelder et al., 1995) and vice versa (de Gelder & Vroomen, 2000). In schizophrenics, the multisensory integration of facial and vocal emotional information is impaired (de Jong et al., 2009). Schizophrenia patients show also deficits in gender discrimination and emotion identification from body shapes and motion (Bigelow et al., 2006). Deficits in affect categorization of socially relevant stimuli go beyond facial features to include basic emotion recognition of human postures, complex social scenes, and body motion. These findings point towards circumscribed domains of impaired social cognition in schizophrenia.

MRI studies have shown the fusiform gyri to be smaller in schizophrenia where volume reduction is proportional to impairment at remembering face identities (Lee et al., 2002; Onitsuka et al., 2006). Functional imaging studies report that compared to controls, the extent of activation in fusiform gyrus, amygdala, parahippocampal gyrus, right superior frontal gyrus, and lentiform nucleus was significantly smaller in patients during facial emotion processing (see for a meta-analysis Li et al., 2009). Schizophrenia is associated with functionally important abnormalities in face processing in the domains of emotion recognition and complex social judgments (see for a meta analysis Marwick and Hall, 2008).

3.3. Neurodegenerative genetic movement disorders

Healthy people automatically mimic others' emotional expressions - as measured by electromyography (EMG) - with surprising speed and accuracy. When observing happy facial or bodily expressions, muscular activity over the zygomaticus major (cheek) region increases. When observing angry (or fearful) expressions, increased muscular activity over the corrugator supercilli (brow) region is observed (Tamietto & de Gelder, 2009). This emotional contagion has been defined as "the tendency to automatically mimic and synchronize expressions, vocalizations, postures, and movements with those of another and, consequently, to converge emotionally" (Hatfield et al., 1993). Adopting the facial expressions of specific emotions (even via unobtrusive manipulations) affects emotional judgments and memories (Schnall & Laird, 2007). Manipulated body postures can affect behavior: slumped postures lead to more ''helpless behaviors'' (Riskind & Gotay, 1982). More evidence comes from a recent study by Harmon-Jones and Peterson (2009) in which participants heard insulting remarks about an essay they had written. Those who were sitting in a chair exhibited more left frontal cortex activity (which has been correlated with experiencing anger than did those who were lying flat on their backs. These findings suggest that body postures may affect our emotions and the brain activity associated with them. If patients with a movement disorder can not *produce* emotional facial expressions (so far, nothing has been reported about bodily expression defecits), it may well be that they also have a deficit in *perceiving* the emotion[3].

[3] People with autism also show less mimicking but this is not due to physical inabilities. Autistic people have less motor control (clumsiness) but this is not even close to the severe deficit apparent in Huntington's disease and has a different cause.

3.3.1. Huntington's disease

Huntington's disease is a rare neurodegenerative genetic disorder that is the most common genetic cause of repetitive abnormal movements called chorea. The prevalence varies from one person per million in populations of Asian and African descent, to seventy per million in Western European populations. The earliest symptoms, appearing around the age of forty, are a lack of coordination and unsteady gait. As the disease advances, uncoordinated movements become more apparent, along with a decline in mental abilities and behavioral and psychiatric problems (Walker, 2007). The disease attacks primarily caudate nucleus and putamen leading to an impairment in motor (Vonsattel et al., 1985) but also emotional tasks (Kampe et al., 2001).

Deficits in the perception of emotions have been widely reported, especially for disgust (Gray et al., 1997). Huntington's disease patients are impaired in recognizing instrumental and angry whole body postures and this deficit was correlated with measures of motor deficit (de Gelder et al., 2008). Research has clearly indicated that action recognition involves similar brain areas that are involved in performance of that same action by the observer (Rizzolatti & Craighero, 2004). The observed impairment in recognition of instrumental actions evokes the concept of motor resonance at the centre of motor cognition abilities, which are implemented in premotor cortex, parietal cortex and STS. Degeneration of the motor areas in Huntington's disease, predominantly striatum and its connections to parietal and premotor cortex and STS, is consistent with the importance of action representation for intact recognition of whole body postures.

3.3.2. Parkinson’s disease

Parkinson's disease is another degenerative disorder of the central nervous system characterized by muscle rigidity, tremor, a slowing of physical movement and in extreme cases a loss of physical movement (akinesia). The primary symptoms are the results of decreased stimulation of the motor cortex by the basal ganglia, normally caused by a deficient dopamine system. Parkinson's disease is chronic and progressive. While many forms of Parkinson are "idiopathic", "secondary" cases may result from toxicity most notably caused by drugs, head trauma, or other medical disorders (Jankovic, 2008). Crude prevalence rate estimates range from 65.6 per 100,000 to 12,500 per 100,000 (see for a meta analysis von Campenhausen et al., 2005).

Parkinson's disease patients have a reduced ability in making spontaneous emotional expressions and have monotonous, flat, and poorly inflected speech. Jacobs et al. (1995) demonstrated that these patients are impaired in imaging, perceiving, and expressing emotional faces. Dujardin et al. (2004) established that early in the course of Parkinson's disease, emotional facial processing is disturbed and untreated patients are significantly impaired in decoding these. It is generally argued that the losses of dopaminergic neurons, resulting in dysfunction of fronto-subcortical systems, not only lead to motor disturbances, but also emotional information processing deficits (Dujardin et al., 2004; Lawrence et al., 2007). Parkinson's disease patients report less arousal compared to controls while perceiving emotional pictures (Wieser et al., 2006). Suzuki and colleagues (2006) showed that these patients were impaired at recognising the facial expression of disgust. Sprengelmeyer et al. (2003) investigated the effect of dopamine medication and observed impaired recognition of emotional facial expressions. This deficit was more severe in non-medicated than in medicated patients. More specifically, the recognition of anger and fear was disrupted in medicated Parkinson's disease participants, and the recognition of fear, sadness, disgust, and anger was impaired in unmedicated patients. Dujardin and colleagues (2004) observed that unmedicated Parkinson's disease participants were less accurate than healthy participants in perceiving facial expressions of anger, sadness, and disgust. More recently, Lawrence et al. (2007) reported that the recognition of anger was impaired in Parkinson's disease patients who had been temporarily removed from dopamine replacement therapy.

Reduced dopaminergic binding sites in the orbitofrontal cortex and amygdala (Ouchi et al., 1999), and abnormal clumps of degenerating neurons in the amygdala of Parkinson's disease patients (Mattila et al., 1999) have been reported. In line with this, Tessitore et al. (2002) observed that in these patients, an emotional task was not associated with amygdala activation but dopaminergic repletion was shown to restore this response. However, several studies failed to demonstrate any difference between patients and controls in facial emotion tasks (Adolphs et al., 1998).

The above described patients cannot fully control their movements, and show impairments in recognizing emotional expressions. That leads us to wonder what would happen to emotion perception in people who are physically restricted to make movements. However, there is not much literature on this topic.

3.4. Impaired motor productivity; impaired perception?

Hennenlotter and colleagues studied women who had received botox injections for cosmetic reasons, thus rendering them unable to flex the corrugator muscle. While lying in the MRI scanner, the women imitated pictures of emotional facial expressions. Half of them were tested prior to receiving the injections to their frown muscles, while the other half was tested two weeks afterwards. Imitating angry or sad expressions provoked increased amygdala activity in all participants. However, for angry expressions, activity in the left amygdala was lower in those who had already received botox compared to those who had not, suggesting that pulling an angry expression modulates the amygdala, via the neural command to flex the face muscles and/or via feedback from the positioning of the facial muscles and movement of the skin. There was no difference between both groups in (pre)motor areas during imitation, so the modulation in amygdala is merely caused by peripheral feedback from face muscles during imitation (Hennenlotter et al., 2009).

These results suggest a close relationship between motor abilities and activation of the emotion circuit but further studies are required.

3.5. Anxiety, depression and personality differences

It has been estimated that 9.5% of adults in the US have a depressive disorder and 18.1% an anxiety disorder. Anxiety disorders frequently co-occur with depression, substance abuse or other anxiety disorders. Nearly three quarters of these patients will have their first episode by age 21.5 (Kessler et al., 2005).

Elevated levels of trait anxiety are associated with an increased ability to accurately recognize fearful facial expressions (Surcinelli et al., 2006). Patients with depression are impaired in recognizing facial expressions in general (Mikhailova et al., 1996).

Anxiety disordered patients show increased amygdala activity when confronted with threatening faces (for a meta-analysis see Etkin & Wager, 2007). However, the role of the amygdala in depression is less clear. Whereas some studies report *increased* amygdala response for threatening expressions related to depressive symptoms (Peluso et al., 2009), others report a *decrease* (Thomas et al., 2001) or no difference at all (Davidson & Dalton, 2003). Several studies report decreased cortico-limbic connectivity in depression in response to emotional stimuli although antidepressant treatment can reestablish this connectivity (Anand et al., 2007). Decreased activation in the anterior cingulate cortex has also been reported in depression (Drevets et al., 2008). Object deep brain stimulation of the subcallosal cingulate gyrus is currently being investigated for the treatment of major depressive disorder (Hamani et al., 2009).

For proper communication it is insufficient to recognize the emotion expressed by another person. The orbitofrontal cortex regulates *appropriate social responses* (Kringelbach & Rolls, 2004). Socially anxious people are afraid of possible scrutiny and negative evaluation by others. Not surprisingly, many studies find an overactive frontolimbic system in this group during threat perception (Etkin & Wager, 2007).

Moreover, the orbitofrontal cortex has been consistently involved in the pathophysiology of depressive disorders (see for a meta-analysis Steele et al., 2007).

People with Type D ("distressed") personality (21% of the general population) experience feelings of depression, anxiety, and irritability and often feel inhibited in social interactions (Denollet, 2005). They suffer from emotional distress ('negative affectivity'), which they consciously suppress ('social inhibition') and is associated with a range of health issues (Denollet et al., 2009). De Gelder and colleagues (2008) observed a correlation between the negative affectivity subscale and amygdala de-activation for fearful static facial and bodily expressions. Kret et al. (submitted) observed more differences by using dynamic stimuli. A negative correlation in the temporal pole and cingulate cortex was observed with both dimensions. Furthermore, a negative correlation was found between negative affectivity and activation in brain areas commonly involved in emotions: amygdala, fusiform gyrus, insula, STS and inferior frontal gyrus (Brodmann's area (BA) 45). Social inhibition correlated negatively with the right orbitofrontal cortex. Interesting is the relation between social inhibition and increased activation following threat in the anterior intraparietal sulcus, left temporo-parietal junction (TPJ), STS, right inferior frontal gyrus (BA 45), secondary somatosensory cortex, and left orbitofrontal cortex since this network is involved in the action goal of the observed person (see for a recent meta-analysis Van Overwalle & Baetens, 2009). Observing action, we need to take *the others' perspective* which we do by activating our mirror and mentalizing system. The mirror system is engaged in perceiving and executing motions of body parts and important for understanding action and emotion (Rizzolatti &

Craighero, 2004). The TPJ plays an important role in our mentalizing system (Van Overwalle & Baetens, 2009). People who tend to inhibit socially are likely to overactivate the mirror and mentalizing system. A social situation gives them so much cognitive stress that they prefer to avoid these. Even small personality differences in the normal population account for a different perception of threat.

Taking the others' perspective is not enough for communication; we need to *empathize and reason how to act* which is the main role of the orbitofrontal cortex. This area is connected with areas that underlie emotional function and empathy (Hynes et al., 2006) and interprets somatic sensations (Bechara et al., 2000) mediated by internally generated somatosensory representations that simulate how the other person would feel when displaying an emotion (Adolphs, 2002). Without reactivating emotion related somatic markers in this orbitofrontal-limbic circuit, it is hard, if not impossible, to react appropriately in emotional situations. Rauch and colleagues (1995) used Positron emission tomography (PET) to measure the changes in cerebral blood flow in phobic patients provoked by exposure. They observed significant increases during the symptomatic compared to the control state in the orbitofrontal and somatosensory cortex. The complex connections between the orbitofrontal cortex and areas involved in emotion suggest implications for its role in anxiety disorders (Rempel-Clower, 2007).

4. AFFECTIVE GIST OF THE SCENE INFLUENCES EMOTION PERCEPTION

4.1. Emotional context

Research on scene effects has a long tradition in object recognition. Repetitive co-occurrence of a given object in a scene makes our brain generate expectations

(Biederman et al., 1974; Palmer & Rosenquist, 1975). A scene can facilitate object detection and recognition (Biederman et al., 1982; Boyce & Pollatsek, 1992; Boyce et al., 1989; Palmer & Rosenquist, 1975). Scenes can be processed and scene gist recognized rapidly (Bar et al., 2006; Junghofer, 2001).

Like recognizing objects is dependent on contextual cues, emotion perception does not proceed on information from one cue alone. Knowledge of the social situation (Carroll & Russell, 1996), scenes (Aviezer et al., 2008), body postures (Meeren et al., 2005), other emotional faces (Russel & Fehr, 1987), voices (de Gelder & Vroomen, 2000) or linguistic labels (Barrett et al., 2007) influence emotion perception and which emotion is seen in the structural configuration of the participants facial muscles. Righart and de Gelder (2006; 2008) report that the presence of a fearful expression in a fearful context enhances the N170 amplitude. The effect was absent for the contexts-only condition, indicating that the increased amplitude resulted from the *combination* of a fearful face in a fearful context (Righart & de Gelder, 2006, 2008). That scenes are indeed important is also shown in fMRI studies where participants interpreted facial expressions differently and different brain areas were activated depending on the context (Kim et al., 2004; Mobbs et al., 2006).

As mentioned before, individuals differ in how many and which cues they use in emotion perception. A recent study examined context effects in Huntington patients while categorizing emotional faces (Aviezer et al., 2009). Disgust faces were embedded on images of people conveying sadness and anger as expressed by body language and additional paraphernalia. Additionally, sad and angry faces were embedded on context images conveying disgust. Despite the deficient explicit recognition of isolated disgust and anger faces, the perception of the emotions expressed by the faces was affected by context in Huntington patients in a similar manner as in controls. These findings suggest that, despite their impaired explicit recognition of facial expressions, Huntington patients display relatively preserved processing of the same facial configurations when embedded in a context. The scenes used in this study were abstract. When complex naturalistic scenes including other people are used, other processes play a role. This will be discussed in the next paragraph.

4.2. Social emotional context and observing interactions

Is our emotional reaction influenced when we watch a single individual fleeing from danger while bystanders are just passively staying where they are? Do we ignore the social scene to focus only on the emotion of the target figure or are we unwittingly influenced by the social scene viewing individual action through the filter it provides us? Studies on crowd behavior (McDougall, 1920; Schachter & Singer, 1962) indicate that social scenes provide a context in which individual actions are better understood prompting an adaptive reaction in the observer. Using point-light displays (Thornton & Vuong, 2004) have shown that the perceived action of a walker depends upon actions of nearby "to-be-ignored" walkers. Another point-light study by Clarke and colleagues (2005) demonstrated that the recognition of a person's *emotional* state depends upon another person's presence. A recent study by Kret and de Gelder (submitted) reports that the social group in which we encounter a person influences how we perceive his body language. Images of emotional body postures were briefly presented as part of social scenes showing neutral or emotional group actions. These were better recognized when the actions in the scenes expressed an emotion congruent with the bodily expression of the target figure. These studies show the importance of a social (emotional) scene. Similar brain areas are involved when subjects experience disgust (Wicker et al., 2003) or pain (Jackson, Meltzoff, & Decety, 2005), as when they observe someone else experiencing these emotions. Such a process may contribute to observers' ability to perceive rapidly ambiguity between a person's body language and its social context. This incongruity may create a conflict in emotional contagion processes triggered by the target figure and help to explain the slower and less accurate reaction in the observer.

In most studies, observers see a face or body that is faced towards him or her self. This way, an emotional expression has most impact on the observer since it asks for an immediate reaction. But what happens when a threat is not directed towards you? This question has been studied by Sinke and colleagues (2009). Video clips were used in which a male grabbed the handbag of a female which was done in either an aggressive, or in a teasing way, as if the two knew each other. The actors faced each other and did not attend to the observer. When you walk on the street you may have your thoughts on an upcoming deadline instead of on the persons on the other side of the street. Will you than still be able to recognize a threat? To investigate this second question, three small dots, presented for 40ms, were added to each movie. Participants in the first task categorized the situation (threatening or teasing). In the second task, they categorized the color of the dots. Results showed that the right amygdala was activated more during the threatening interactions independent of task. This is in line with previous studies that the amygdala acts as a warning signal to react. Furthermore, during unattended threat, the amygdala seemed to pass this threat information through to body sensitive visual regions in fusiform gyrus, middle occipitotemporal gyrus and STS. Furthermore, this heightened activation for unattended threat was paired with better behavioral performance on the dot task during threatening interactions which shows more clearly that the amygdala response has a direct influence on people's actions. In conclusion, bodily expressions are easily recognized even though your attention is not explicitly on the situation and the threat is not directed towards you, which has high survival value, at least in the normal population.

4.3. Perceiving social contexts and observing interactions in patients

But how are social interactions recognized in patient groups like autism and Williams syndrome (WS)? Autism is characterized by social withdrawal and lack of interest in socially relevant information, while WS is a rare genetic disorder where patients show propulsion towards social stimuli and interactions. As far as we know, only behavioral studies have been performed using stimuli showing social interactions with these patients. One study tracked eye gaze of both children with autism and WS looking at pictures of social relevant scenes (Riby & Hancock, 2008). As found before, children in the former group spent less time looking at faces than normally developed children. On the other hand, children with WS spent more time than controls looking at faces. These different visual preferences for social important information could mean that both groups interpret the social cues differently. Also when using videoclips instead of pictures, these same atypicalities in gaze remain (Riby & Hancock, 2009).

Pictures of emotional social scenes were used in a study comparing individuals with autism or schizophrenia with healthy controls (Sasson et al., 2007). Subjects categorized emotion depicted in the scene. Just as persons with autism, schizophrenics do not look as much as controls to faces. For the former group it does not even make a difference whether those faces are blurred or not, while people with schizophrenia like healthy controls do orient faster to face regions when the faces contain information. They only show a delay in this orienting (Sasson et al., 2007). No differences on the emotion judgment task were found between groups or between emotions.

The perception of interactions or complex social, emotional scenes is a yet unexplored field in psychological neuroscience. As far as we know, research that has been done in this field are behavioural studies that focused on autism, WS and schizophrenia. It would be interesting to investigate this topic in more disorders and to investigate to what extent people with for example social phobia will be helped by additional social information in perceiving others' emotions.

4.4. Gender

The presence of a clear context and other people help us recognize others' emotions and this may work the same or differently in healthy people and in patients. However, this is not the whole story; gender-emotion stereotypes have potential consequences for the way people evaluate male and female expressions.

A growing body of research consistently demonstrates that stereotypes about emotions are gender specific (Fischer et al., 2004). In particular, happiness, sadness, and fear are believed to be feminine, whereas anger would be masculine (Birnbaum et al., 1980).

Earlier studies confirm the involvement of amygdala and fusiform gyrus for face and body perception (van de Riet et al., 2009; Meeren et al, 2008). A recent study by Kret et al. (submitted) revealed how this activity is modulated by gender. Participants haemodynamic brain activity was recorded while observing videos showing fear, anger or neutral signals expressed by female and male actors with the face or body. Two event-related fMRI experiments using an oddball task were performed. A higher Blood-oxygen-level dependent BOLD response in left EBA was observed for threatening male versus female actors. Male observers showed more activation for threatening vs. neutral bodies in left FFA/FBA, bilateral EBA, bilateral STS, left TPJ. We conclude that human emotion perception depends to an important extent on whether the stimulus is a face or a body and is male or female but also on the gender of the observer. Regional gender effects in the neurofunctional mechanisms of emotion are thus highly dependent on the exact type of stimulus signal (conveying social, interpersonal information, whether threatening and dynamic).

Not much research has been done on gender differences in emotion perception in patients. In a study to investigate differences in facial mimicry, males and females were tested who scored extreme on the autism-spectrum quotient questionnaire (Hermans et al., 2009). Autistic traits are continuously distributed across the population (Constantino & Todd, 2003) and the authors suspected people who score high on these traits will show less mimicry. Electromyographic activity from the corrugator supercilii and zygomaticus major muscles was measured while participants watched pictures of angry and happy faces. Only the female high scorers showed reduced automatic mimicry to angry facial expressions, but the effect was caused by the high mimicry of female low scorers. Therefore the authors reason that the male group had already reached a ceiling effect.

Vaskinn et al. (2007) examined gender effects when comparing emotion perception in participants with schizophrenia and bipolar disorder with healthy controls. In general, women from the schizophrenia and healthy group performed the emotion perception tasks better than men. No gender differences were found in the bipolar disorder group. There was no deficit in emotion processing in patients with bipolar disorder, while schizophrenics showed undamaged visual but impaired auditory perception.

It has recently been observed that men compared to women with Parkinson’s disease and healthy control men display specific impairments in the recognition of fearful expressions (Clark et al., 2008).

A relation between gender differences and anxiety traits has been found on prefrontal hemodynamic response to fearful facial stimuli (Marumo et al., 2009). Specifically, greater right ventrolateral and premotor activation was found in females than males. Anxiety traits correlated with frontopolar activation in both groups.

Thus, also gender differences seem to exist in emotion perception in clinical groups, but this field is yet underexplored and needs more attention in the future. Further research should also take into account the gender of the actor, especially in clinical populations.

5. CONCLUSION

In this chapter we gave a selective overview of emotional processing of facial and bodily expressions in relation to psychological and neurological disorders.

In healthy people there are important similarities and differences in the neurofunctional basis of faces and bodies. Both are strong cues that grab our attention. But they can also be processed without attention and visual awareness, which shows their evolutionary significance. The scene in which we perceive emotions can facilitate our recognition and the presence of other people expressing the same emotion naturally helps us perceive another's emotion correctly.

The perception of emotions is not a pure bottom up process. Several top down processes, such as knowledge of the social situation and personality type, play a role. Emotion perception is disrupted in many different disorders. But already in healthy people differences in emotion perception exist as a result of differences in person characteristics.

Different disorders such as autism, schizophrenia, Parkinson’s or Huntington’s disease have taught us a lot about the close link between emotion and motor circuits in the brain. Since bodily expressions imply an action tendency in the expresser, as well as a reaction to this in the observer, they involve more brain areas than facial expressions. Still, not much research has been done on the recognition of bodily expressions in these disorders, which is definitely an issue for future research.

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