

Another Side of the Emotional Expression Recognition - Body Expression Recognition

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Abstract Emotional body expression is a kind of important nonverbal behavior by which human being expresses their feelings and the study of emotional body expression recognition is developed from the researches on facial expression recognition. From the perspective of stimulus type and emotion type, the paper analyzes the selections of the research materials of current body expression recognition and discusses the influence factors of body expression recognition and neural mechanisms. Furthermore, the paper points out that the existing problems in researches on emotional body expression recognition including limited stimulus types and emotion types, lack of the combination of ecological research in the study of influence factors and unsystematic neural mechanisms, need to be improved in the future study.

Keywords: Forensic science, Emotional Body Expression Recognition, Dynamic Stimulus, Threat Emotions, Neural Mechanisms.

1 Introduction

Emotional body expressions and facial expressions are the important nonverbal behaviors of human to express their emotions. From the aspect of Darwinian Evolution, body movement has an important role in the emotional communication^[1]. In the natural environment, the specific body expressions are most likely to associate with the consistent facial expressions. The information from body expression plays a vital role in reducing the ambiguity of facial expressions^[2]. Therefore, body expressions expression is of great importance for people to understand human's emotion cognition.

Since Darwin published *The Expression of Emotions in Man and Animals* in 1872, human had begun the systematic researches on facial expressions; currently, human has conducted a lot of researches on facial expressions, and has studied emotional body expression through the use of a series of means such as ERP^[3], EMG^[4] and fMRI^[5]; yet, compared with the

researches on facial expressions, the researches on emotional body still occupy a smaller proportion in the study of emotional expression and involve relatively narrower fields.

The paper systemizes the existing pertinent literature of emotional body expression, summarizes and analyzes the researches on body emotional expression recognition from the aspects of research materials, influence factors, and neural mechanism; besides, it points out the problems existing in the researches and puts forward concrete suggestions for future researches.

2 Research Materials of Emotional Body Expression Recognition

2.1 From Static Stimulus to Dynamic Stimulus

In the past decade, static stimuli have been applied in the majority of the emotional researches^[6-7]. However, in real life, most of the people we face are dynamic. Static body postures can also imply movement, but dynamic

stimulus obviously contains more information, which can help people to understand others' intentions better and respond appropriately. The researches on dynamic body expressions show that the dynamic stimulus has better recognition rate than static stimulus^[8]; the patients with the impaired ventral channel can understand dynamic emotions, but they cannot understand static facial expressions^[9]. Some neuro-imaging studies point out that the importance of movement on the processing of emotional expressions^[10]. Furthermore, dynamic stimulus can activate richer and wider neural networks. Ectostriatum body area (EBA) is sensitive to emotional information transfer. Through the use of three seconds of video clips, the researches on threat dynamic body expression reports the dynamic body expression can activate more PM, parietal cortex, TPJ, STS, and bilateral FG than static stimulus under all emotional environment^[11].

2.2 Threat Emotional Stimulus and Happy Emotional Stimulus

Six basic emotions, namely fear, disgust, anger, surprise, happiness and sadness, are universal on the expression and recognition; fear and anger belong to threat expression. For emotional body expression, the researches focus on the threat emotion and happy emotion because attack seems to be more obvious on the body expression while shame or disgust can be more clearly seen from face^[12].

Fear body expression produces more activities than neutral expression in brain and the related emotional processing areas; the areas include FG, TPJ, AMG, temporal cortex, orbitofrontal cortex, retrosplenial granular, anterior insula, gyrus cortex and nucleus accumbens septi; among them, the activated FG and AMG show the right hemisphere is more active than left hemisphere, but only FG and AMG on the left hemisphere have significant differences in activation; body neutral expression is not activated on the right amygdala^[2]. Besides, angry behavior perception has cause relative increase in the activation of left amygdala and temporal cortex^[13].

In addition to the activities of the related areas of emotions, it is also found that behavior and the motion area are significantly correlated with fear^[14] and anger^[13]. Especially EBA^[11] and STS indicate the specific increased activities on threat body expression; EBA is very close to the human body movement area (hMT+/V5); thus, that EBA also has reaction to the movement can't be ruled out; and the threat video contains more movement than neutral video.

By contrast, the similar comparison between happiness body expression and neutral expression shows that there are increased activity only in the visual area^[14] and TPJ^[15].

3 Influence Factors of Emotional Body Expression

3.1 Social (Emotional)

Environment

Social scene provides environment and makes the individual behavior be better understood and cause the appropriate reaction in the observer. Clarke and his colleagues^[16] find that a person's emotional state is influenced by another person in the environment and the inconformity of the observed environment and emotional stimuli causes the decline in the accuracy rate and the increase of reaction time. As for the the above results, by using emotional body posture images in a social scene with neutral or emotional activity, Kret and de Gelder^[7] briefly presents the further illustration that fear body in fear environment can be more quickly recognized than in pleasant environment and neutral environment, suggesting that body expression can be better perceived when the scene activity expression is consistent with the body expression of target object.

The researches find that when the subjects observe others experience disgust^[17] and pain^[18], the involved brain regions in disgust and pain are similar with their own experiences. The process shows the observer can rapidly perceive body language and the social (emotional) environment. And the inconsistency between body expression and the social environment can make a conflict caused by target objects' emotional contagion processing, which can help explain why the observers react more lowly and inaccurately in the case of inconsistency.

Social environment affects body expression, and body expression can be used to judge social interaction. Sinke et al.^[15] research the neural mechanism of body expression when people need a quick evaluation whether the commotion of the observed is threat or a joke.

3.2 Gender of the Observer and the Observed

Some isolated studies show that there may be gender differences on

emotional processing; for example, female has higher scores than male in empathy tests, social sensitivity tests and emotion cognition tests^[19]. However, female shows more facial imitation in response to emotional movie clips, but do not experience more emotions than male, suggesting that there are expression differences between female and male, but there is no difference in experience^[20]. Testosterone levels can effectively predict the existence of anger trait, aggressive behavior and its dominance^[21].

It is found that there is significant mutual effect between the gender of the observer and the observed. The threat body expression of the observed of male can lead to higher EBA and STS activation than the observed of female. In many visual processing areas, the male observers are more active to threat body than neutral body, especially on the reactions to male's body expression. The results show that the male observers are more likely to react to threat signals than female observers^[22]. But brain imaging studies show that when they have fear in face, female activates more amygdala than male^[23]. The studies on the relationship between fear, pleasure, the memory neutral expression and the gender difference of observers show that AMG is more active on the left side when female observers successfully remember female's fear face; while AMG on the right side is more involved when male observers remember male's fear face^[24]. In response to human advantage (for example, despising), male has stronger activation in the IFG and STS than female^[22].

Kret et al.^[25] study the gender differences in emotional expression recognition by using dynamic body expressions stimulus, and suggest that the threat body stimulus is more likely to increase the activation of male observers' FG, STS, EBA, PM and pre-SMA (pre-supplementary motor area)

than neutral stimulus. In the article, Kret et al. expound the importance of gender difference influence on the emotional communication.

3.3 Other Influence Factors

Personality differences are factors that influence the emotional recognition; the researches on cortical blindness patients show that body emotion perception is possible even when there is no striate cortex^[26]; the study proves that the brain can deal with emotional body language under the unconsciousness and without relying on the primary visual cortex for the first time. Besides, in the contrast studies of healthy individuals and patients with cortical blindness, Tamietto et al.^[27] find that the unconscious perception of fear and pleasant body expression activates pulvinar thalami, and can cause excitement or imitation. The researches on personality differences of emotion recognition also involve people with social phobia and anxiety^[28], individual with depression^[29], ASD^[30], and schizophrenia^[31]; but it should be pointed that facial stimuli are used in all the studies, and there has been no literature report on the response to the emotional body stimulus of the above special crowd.

Sound is also one influence factor of body language recognition. The research results of Van den Stock et al.^[32] show that when auditory stimulus (either voice of animal or human) is provided at the same time, the emotional expression recognition tends to body language. When the subjects are asked to judge the emotional tone of voice and ignore the presented body at the same time, they are still vulnerable to the influence of body expression.

Facial expression is one of the factors that influence body expression recognition. It is found that the observers are greatly influenced by emotional body language when judging facial expressions^[33]. Fear and anger face pictures and body pictures are used to create the matching or mismatching

face of emotional expression--body composite image; when the face and body convey inconsistent emotional information, the judgment of facial expression is thwarted and the judgment of body expression emotion is focused^[34].

4 Neural Mechanisms and Models of Emotional Body Expression

4.1 AMG and FG

In fact, in the current studies, the activation of FG is clearly linked to the expression of emotions, and is not related with neutral body posture. Similar reaction is also observed on the activation of AMG, and the fact points out that what drives observation activity is a kind of mechanism that is closely related to the body emotion recognition, and the mechanism is similar to the presumed mechanism of facial expression; the path from AMG to FG plays a decisive role. In the activation of fear, AMG and FG show the left hemisphere is more active than the right one, but significant difference is found only in the left hemisphere (that is, the activation of AMG in left hemisphere is significantly lower than that of FG); the body neutral expression shows no activation in the right AMG^[2]. So far, in the recent brain imaging studies, AMG and FG have been mostly associated with the facial expressions of fear^[15], and have played much broader role in emotional cognition beyond people's cognition. The conclusion provides a new vision for people to understand emotional processing of the normal and clinical crowd.

4.2 N170

As is known to all, N170 is a sign of facial structure coding in the early stages, but in the research literature of facial expression, some people have questioned whether N170 is special for face^[35]. The present results point out that the N170 has a wider range of

functional significance, including on the similarity in the perception of face and body expression. The study shows that the N170 wave of the participants' emotional expression pictures is significantly different from the pictures when they observe things; among them, N170 wave on the pictures of facial expressions and body expression is similar, and N170 wave caused by the reverse is also quite similar; it is pointed out that the N170 wave could be a symbol of structure coding of face and body preception in the early stages^[3]. However, some people might say the brain fills in the appropriate lost facial expressions through the mental imagery and semaletic knowledge, mental imagery is related with the time period of about 400ms, much later than the time period related with structure coding phase (around 170ms)^[36]. Therefore, it can be still speculated that the two areas of facial expressions and body expressions have the same origin; yet it does not mean that there is no difference between face and body processing

4.3 Others

TPJ is systematically related to all kinds of social cognitive tasks, such as the transpositional consideration^[37], empathy^[38], and theory of mind^[39]. In the present studies, although TPJ reacts to all social stimuli, it has more reactions to body than face, especially body emotional expression^[11]. In addition, ACC (anterior cingulate cortex) is closely associated with emotional functions and it plays an important role when people evaluate others' behavior^[40]. Other important areas include superior temporal sulcus (STS), parietal lobe and subcortical structures, etc.; and the EBA-V5/MT area, specializing in body processing, is not sensitive to emotions. In addition, it is worth noting that the researches on isolated facial expressions and body expression perception are wider than that on the ecological integration of facial and body. The

current minority studies of the ecology ecological integration of face and body consistently point out that there is obvious interaction effect between face and body^[41].

5 Problems and Prospects

The emotional expression recognition studies are developed from the isolated facial expressions study to contrast research of emotional body expressions and facial expressions, and then to the research of the ecological integration of body expressions and facial expressions; the researches break through the traditional fields of study. In nearly decade, the studies of emotional expression have become involved in cognitive neuroscience; extensive exploration has been conducted on the processing mechanisms of emotional expression recognition and neural basis; however, the achievement is limited and the following problems in emotional body expression studies need to be solved.

5.1 Use More Diverse Stimulus Types

Static image stimulus is used in the most of the existing researches; in recent years, dynamic video stimulus has been used in more and more researches^[12], but the stimulus types are still single. As for the most of the stimuli, the actors are asked to perform some kind of emotions in front of the set background, but the emotions showed by acting may be different from the emotions that people express in the daily life. Usually, in order to express a certain emotion clearly, the needed body movements range may be inconsistent with the one applied in body expression of daily life. Now, some researches introduce the real situation, yet how to control the independent variables in the real situation is worth thinking about.

5.2 Basic Emotions of Emotional Body Expression

The existing literature involves

the contrast researches between threat emotion, happy emotion and neutral emotion^[14], find that the activation change of the rich neural areas that the observers have in the face of threat emotions^[15], and shows the particularity when people perceive threat emotions. While in the studies of happy emotion, fewer ones are of much significance because the attack seems to be more notable on the body expression^[12], yet surprise, disgust and sadness can be more easily shown through facial expression; currently, the existing emotional body expression researches do not involve surprise, disgust and sadness.

It must be pointed out that the classification of six basic emotions is based on the classification of the research results of facial expressions. Today, with the increasingly rich studies on emotional body expressions, emotion kinds that body can express independently, the emotion kinds that can be correctly recognized by being combined with facial information and whether the body expression emotion classification is different from the classification of facial expression are the problems that should be first discussed. People have known that threat emotion and happy emotion can be independently expressed and properly recognized by body^[7], yet it is still unknown whether disgust, surprise and sadness can be independently expressed and properly recognized by body; if yes, they are still questions that what kind of postures shows disgust, surprised and sadness and which brain regions are activated when the observers recognize the body expressions of disgust, surprised and sadness; besides, it is still unclear about the influence of the matching and of mismatch of body and facial information with the body emotion and facial emotion of the three emotions on emotion recognition when body emotion and facial emotion present at the same time.

5.3 Deepen the Discussions on Causal Relationship and Enrich the Researches on Body Expression Recognition of Special Crowd

At present, the influence factors of emotion recognition that have been put forward include social environment, gender differences, personality differences, voice and facial expressions. There are relatively many studies of the social environment and the results are more consistent^[7]; the research achievements of the social environment need to be affirmed by more dynamic and ecology researches. By contrast, there are relatively fewer researches on the gender differences of observers and the observed, and the researches are not systematic. In addition, there is no causal argument on the gender interactions of observer and the observed^[22] and the differences in neural mechanisms caused by gender difference lack of evidence^[24].

The greatest problem of personality differences in the studies of emotion recognition is that all the researches use facial expressions stimulus^[27], and there is no literature report on the response of expression emotional body stimulus of the special groups such as the individuals with cortical blindness, social phobia, and anxiety. To strengthen the researches on the special groups' emotional cognitive body expression can help people to understand emotional cognitive neural mechanisms^[6] and find ways of restoring special crowd's social functions and development.

The studies of Van den Stock et al.^[32] show that when there are emotion sound stimuli and emotional body language at the same time, the recognition of emotional expression tends to body language. However, the results are also related with the choices of sound stimuli and body stimuli in the experiments; thus, single research results are not enough and more studies with different stimuli are needed to confirm the body is more popular

than sound stimulus in emotional recognition.

In the past two years, the existing researches have involved the relationship between face and body, and pointed out that there is obvious interaction between them^[41]. But it is not clear whether the mutual influence between them is also influenced by gender, emotional types, and social environment and whether the structure equation of the relationship between them can be built up.

Besides, it is worth noting that the stimuli used in the studies of emotional body expressions are Westerners' emotional body expressions^[7], and whether the eastern and western cultural differences result in differences in emotional body expressions and emotional cognition is also worthy to be discussed.

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