Neuroscience year: Supplement 3 to the Encyclopedia of Neuroscience, 1993, 51-52.

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Facial Expression and Emotion

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Charles Darwin, in his book on the expression of emotions, wrote that facial expressions are innate, evolved behavior. In this century many social scientists have argued that facial expressions of emotion are language-like, socially learned, and culturally variable. In the last 25 years the first methodologically rigorous studies on the universality of facial expressions of emotion have supported Darwin's view. The major building blocks that support this position and new directions of research on the behavior and biology of emotional expression will be described.

Universality

Cross-cultural research on facial expressions of emotion has included Western, non-Western, literate, and preliterate cultures. Although the evidence on spontaneous emotional expressions is limited, several studies have shown that observers in different cultures apply the same emotion labels to photographs of faces depicting anger, disgust, happiness, fear, and sadness. The expression for surprise has been distinguished from all of the preceding emotions, but not from fear in one preliterate culture. The universal recognition of contempt is still a debated topic.

Comparisons between the expressions of great apes and humans have revealed similarities in facial morphology. Such interspecies commonalities are consistent with the universality findings, and with an evolutionary view of facial expressions of emotion.

Facial movement is under voluntary and involuntary control, allowing the opportunity for deliberate efforts to manage behavior to mask unintended emotional expressions. Experimental research has shown that cultural differences in the learned rules of expression management in social situations can produce the appearance of culture-specific facial expressions. Such cultural differences in display rules may account for the observations of both biologically based universal expressions and culturally specific emotional behavior.

Development

Facial expressions of emotion appear earlier in life than researchers had previously thought. By the age of two a child's repertoire of facial behavior includes the expressions for most of the basic emotions. Most of the debate in the developmental literature focuses on the age at which emotional expressions emerge, and whether all emotional expressions are present at birth or if there is a precise developmental sequence for the appearance of each affective expression. Infants demonstrate the ability to imitate expressions within a few hours of birth. Newborns show expressions that resemble adult disgust, smiles appear in the first few weeks of life, and anger appears by at least 4 months, although the components of some other negative emotion expressions are present by 1 month.

Three- to four-month-olds show differential responses to facial expressions in recognition tasks, supporting the findings on spontaneous expression. Empirical evidence suggests that between 4 and 8 months the ability to use expressions instrumentally emerges. During this period infants first learn to direct anger expressions at the source of frustration; by 7 months they will also direct them toward their mother to elicit help.

Measurement techniques

There are two different approaches for measuring facial expressions in muscular or anatomical terms. In one technique, human coders learn to recognize visually distinct facial actions that can singly or in combination account for all of facial movement. In such coding procedures, emotion interpretations are made on the basis of whether the actions or combinations of actions demonstrated are indicative of emotion on an empirical or theoretical basis. The advantage of this approach is that it is precise, and inferences about emotion are made after the facial behavior is coded. The disadvantage of this technique is that it is labor-intensive and insensitive to very slight changes in muscle tonus.

The other method is facial electromyography (EMG), in which surface electrodes placed over different regions of the face measure electrical discharge from contracting muscular tissue beneath the skin. The EMG signal lends itself to immediate recording, is not labor-intensive, and is sensitive to slight muscular movements that may not be visible even to the trained eye. One drawback is that EMG is highly obtrusive; the application of surface electrodes makes subjects aware of the facial measurement. Another disadvantage is that the recording selectivity of facial EMG is not muscularly specific, but rather regionally specific, and it is not yet certain whether EMG allows the differentiation of as many different emotions as can be done with measurement that relies upon observer scoring of visible muscular actions.

Voluntary and involuntary expression

Whether or not the face is an accurate source of emotional information depends on the situational context in which the expressions are elicited. When the individual is aware of being observed the face can provide misleading information to the untrained observer, as both deliberate as well as unintended expressions may be present. There is tentative evidence that some observers can distinguish between these types of information, but most cannot. Current research is developing methods to train people to differentiate deliberate from unintended emotional information on the face.

Most of the research comparing voluntary and involuntary emotional expressions focuses on the distinction between enjoyment smiles and the many types of nonenjoyment smiles (e.g., polite smiles, smiles put on to mask negative feelings, and compliance smiles). Enjoyment smiles can be distinguished from other smiles on the basis of timing and the presence or absence of the contraction of muscles around the eye (orbicularis oculi). As predicted by Duchenne de Boulogne, the neurologist who wrote in the last century, orbicularis oculi activity is present in enjoyment smiles but not in nonenjoyment smiles. Orbicularis oculi is a muscle that is difficult for most people to contract voluntarily; thus, it is a marker of enjoyment for most people when it occurs along with contraction of the zygomatic major (which raises the lip corners). Although smiling is the only mode of emotional expression for which the distinction between voluntary and involuntary contraction has been demonstrated, it is reasonable to expect that it will be possible to distinguish between voluntary and involuntary expressions of other emotions in a similar fashion.

Voluntary facial action as a generator of emotion responses

Facial expressions have been regarded as one of the peripheral response systems in emotion. In the past 8 years, however, researchers have found that voluntary contraction of facial muscles can elicit the physiological response of certain emotions, as well as the subjective experience of emotion for some people. This finding has been replicated five times. Differential patterns of autonomic activity distinguish between the expressions for several emotions. Not only do these patterns discriminate between positive and negative emotion expressions, but among negative emotions as well—anger, fear, sadness, and disgust each have a unique autonomic blueprint. Facially generated autonomic specificity has been replicated in non-Western cultures and in subjects from 20 to 70 years of age. There are new and not yet replicated findings of voluntary performance of universal emotion expressions also generating distinctive patterns of EEG activity. The mechanisms underlying the phenomenon of facially elicited physiological and experiential responses are the subject of debate, ranging from afferent feedback to direct links between the motor cortex and hypothalamic areas.

Expressions and physiology

The bulk of evidence on autonomic specificity of emotion comes from studies in which physiological reactions have been elicited by voluntary facial expression (as described previously). It is notable, however, that the autonomic patterns produced by voluntary facial expressions are enhanced when (a) the expressions most closely resemble the configuration of the universal expression for the associated emotion, and (b) when the subject reports that the emotion was experienced. Recent research has shown that these patterns of activity also occur when emotion is elicited by reminiscence. Whether these patterns hold up for emotion spontaneously generated in a social context remains to be seen. Three autonomic measures distinguish different types of emotions: heart rate, skin conductance, and finger temperature. On the basis of heart rate and skin conductance, distinctions have been made among the negative emotions of anger, disgust, and fear, and the positive emotion of happiness. Heart rate and finger temperature patterns also distinguish between four negative emotions. These findings challenge long-held but poorly substantiated claims in the literature that all emotions are characterized by an undifferentiated state of autonomic arousal.

There is also evidence of central nervous system differences among emotions, but to date it is more limited than the evidence for autonomic nervous system activity. The only replicated findings show inter- and intrahemispheric differentiation in EEG activity between emotions that may be distinguished on the basis of whether they are characterized by (a) positive versus negative valence or (b) approach versus withdrawal behavioral tendencies.

Brain damage and facial recognition

Research on the relationship between certain types of brain damage and the generation of facial expression has been equivocal. There have been problems with the evocation of emotion in some of these patient groups, as well as heterogeneity of lesion location. There is a substantial body of literature, however, on recognition of facial expressions of emotion. Patients with right temporal or parietal damage are poor at recognizing facial stimuli in general. The neuropsychological literature suggests that right temporoparietal regions are involved in recognition of emotional facial expressions, and that the ability to recognize emotional expressions may be separable from the ability to recognize faces in general.

Further reading

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