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Facial Areas and Emotional Information

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An experiment supports the theory that judgment of emotions differs across different areas of the face.

After two decades of scattered research, there has been a resurgence of interest in the predictability and measurement of facial expressions of emotion. Current studies and reanalysis of older experiments have clearly shown that facial expressions can provide accurate information about emotion (10, Chapter 15). Recently consistent evidence also has been obtained to show that the morphology of facial expressions is pan-cultural for at least five or six emotions (cf. 5; 6, p. 7; 16).

Coincident with and partly in response to these findings on accuracy and universality, there has been a renewed interest in the question of just where in the face one should look to find such information about emotion. There are two ways to ask this question; indeed, there have been two ways in which prior research on this matter has been conducted. The question can be asked in terms of which facial *area* to scrutinize (top or bottom, for example). Or the question can be put in terms of which particular muscular movement or facial *component* should be examined. (For example, within the top area there are a number of components, such as raised brow, lowered brow, drawn together brow, horizontal or vertical forehead wrinkles.) Researchers asking the question in terms of facial areas have

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The research for this article is based upon Boucher's doctoral dissertation.

usually presented one or another area of the face to observers who were asked to judge the emotion. In contrast, researchers asking the question in terms of facial components have measured the facial components and then attempted to determine whether these measurements would account for the judgments made by observers who were shown the entire face.

A recent facial components study by Ekman, Friesen, and Tomkins (11) found support for the theory that there are facial components whose measurement will predict how the whole face is judged by naïve observers. This evidence did not support the contention of Dunlap (4) and Ruckmick (19) that there is one facial area which best distinguishes among the emotions, although Dunlap and Ruckmick did not themselves agree about which facial area was best. Nor did Ekman, Friesen, and Tomkins agree with those who had found no difference among facial areas (3, 12). Instead, in agreement with Hanawalt (13), Hill (14), and Nummenmaa (18), they found that the facial area in which the most distinctive component was located varied with each emotion. For example, to best distinguish between expressions of anger and disgust, the facial components within the lower face should be examined or measured, while to best distinguish between fear and surprise, the facial components within the eyes and eyelids area should be inspected. Since Ekman, Friesen, and Tomkins had used a different research design (measuring faces and comparing measurements to observers' judgments of whole faces) from that used by most of those with whom they disagreed (comparing observers' judgments of different parts of the face), it was not possible to resolve the contradiction between results obtained from the two different research designs.

The present study was designed to clarify this problem of different results from different methods, by determining if the findings of the Ekman, Friesen, and Tomkins components-measurement study would be replicated when observers were required to identify the emotion shown in the brows/forehead area, the eyes/eyelids area, and the cheeks/mouth area. The hypothesis was that the facial area which provided the best accuracy in distinguishing the presence of an emotion would vary from emotion to emotion. More specifically, based on the theory and findings of Ekman, Friesen, and Tomkins, we predicted that accuracy in distinguishing (a) disgust would be best from the cheeks/mouth; (b) fear would be best from the eyes/eyelids; (c) sadness would be best from both brows/forehead and eyes/eyelids; (d) happiness would be best from both cheeks/mouth and eyes/eyelids; (e) anger would be best from both cheeks/mouth and brows/forehead; (f) and surprise would be predictable with equal accuracy from any of the three areas.

Our methodology involved showing pictures to a number of observers.

Photographs of different people were required in order to avoid bias due to a limited sampling of persons. These photographs had to be com-

parable in the detail provided, in the lighting, and in the presumed clarity of information about the presence of a single emotion. The emotions selected for study (anger, fear, surprise, disgust, sadness, happiness) were those investigated in the Ekman, Friesen, and Tomkins experiment. These are the emotions which have been most consistently found in studies designed to determine the vocabulary used to judge emotion from the face (cf. 10, Chapter 13).

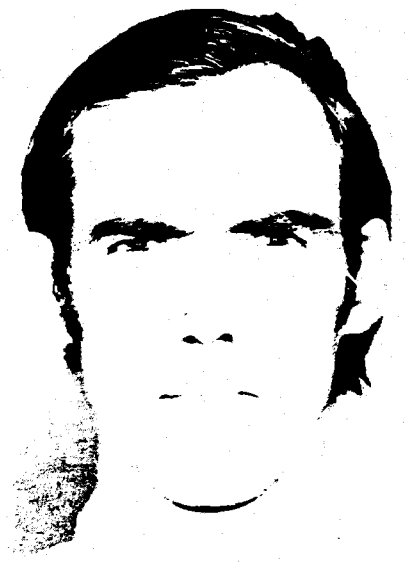

Figure 1: One of the anger poses from which the partial-face stimuli were extracted.

Six male adults posed for photographs. Several photographs of each person's attempt to pose each emotion, and each person's attempt to appear neutral, were shown in a randomized order to a group of 32 college students. The students were required to decide which emotion was present in each photograph, and then to indicate the intensity of that emotion on a seven-point scale. If the students perceived more than one emotion in a photograph they were permitted to indicate their second-choice emotion and rate it on the intensity scale also.

The criterion for selecting a photograph for use in the experiment was that the posed emotion had to be perceived as the only emotion present by more than 70 percent of the students; if two emotions had been judged present, then the emotion attempted by the poser had to be seen as the more intense emotion of the two. If more than one attempt by a person to pose a particular emotion met that criterion, then the selection was made so as to yield a range of intensity scores. With three of the persons photographed, there was at least one photograph which met this criterion for each emotion. With two of them, only five emotion poses met the criterion: one failed to contribute a fear picture, the other failed to contribute a surprise picture. The sixth person provided poses of only four emotions which met the criterion; there were no pictures of fear or sadness. In total, then, there were 32 photographs drawn from six different persons: six poses of happiness, of anger, and of disgust; five of surprise and of sadness; and four of fear.

Figures 1 and 2 are examples of photographs that met the criterion and were selected for the experiment: 81 percent of the students judged the photograph in figure 1 as being anger, and 84 percent of the students judged the photograph in figure 2 as being surprise.

Figure 2: One of the surprise poses from which the partial-face stimuli were extracted.

Each of the 32 photographs was cut to yield three partial facial pictures: a brows/forehead, an eyes/eyelids, and a cheeks/mouth version. The cutting lines were based on a set of *a priori* rules which had been developed on the basis of anatomy texts and inspection of actual faces. The purpose of these rules was to separate the face so that the behavior shown in each of the three facial areas was anatomically independent of an action in another area of the face. However, such a separation was not possible in the happiness poses and in half of the disgust poses. In these instances the muscular movement in the cheeks/mouth area produced a change in the appearance of the eyes/eyelids. For those photographs, a partial face version was made showing both cheeks/mouth and eyes/eyelids, but there was no version showing eyes/eyelids alone. A cheeks/mouth-only version was also made for these photographs since the behavior in the cheeks/mouth was not influenced by action in the eyes/eyelids area for these pictures. A second set of facial stimuli were also prepared by placing each partial face picture over a neutral photograph of each person, producing a composite photograph directly corresponding to the partial faces. These pictures, although much more difficult to make, were devised in order to determine if the results on partial faces were influenced by some unknown artifact associated with seeing only a slice of the face.

College students were paid to participate in the experiment. They were divided into two groups of observers: one group (15 males and 17 females) saw only the partial faces, and one group (23 males and 27 females) saw only the composite faces. Each observer in each group saw all of the partial face or all of the composite face stimuli, arranged in random order.

Every observer was required to rate each stimulus on six separate seven-point scales. Each scale was labeled with the name of one of the six emotions and with the anchors "neutral," "low intensity," and "high intensity." An observer who thought a stimulus showed no emotion could circle the neutral point for the six emotions; if he thought it showed equal intensity for all the emotions he could circle the same intensity level for all six emotions; if he thought it showed only one emotion he could indicate the intensity

of that emotion and circle neutral for all the other emotions. Each stimulus (a 35 mm transparency) was projected onto a screen for two seconds. The observers were then allowed 18 seconds to indicate their judgment before continuing on to the next stimulus.

The hypothesis was tested by deriving an accuracy score for each version of each picture. This score was the number of observers who had judged the emotion which had been intended by the poser (and perceived by the previous group of observers who saw the whole face) at a higher intensity level than any of the other emotions on their rating sheet. For example, when a brow/forehead stimulus from an angry pose was judged by the 32 observers who saw the partial face, the accuracy score for that stimulus was the number of observers who gave a higher intensity rating on the *anger* scale than they gave on the scales of the other five emotions for that stimulus. If an observer gave the same intensity rating to the posed emotion and some other emotion, this was not tallied as an accurate judgment.

The accuracy scores for each stimulus were entered into a series of two-way analyses of variance (ANOVA), a separate ANOVA for each emotion and each group of observers (partial face or composite face observers), contrasting area of the face, and stimulus person. Where a significant main effect for area occurred, post-hoc comparisons between the means were computed, using the method of Newman-Keuls (21).

Significant *F*-ratios for facial area were obtained in both the partial face ANOVAs and the composite face ANOVAs for disgust, fear, sadness, and happiness, indicating that accuracy judgments from the three areas of the face differed. As predicted, the ANOVAs for surprise did not yield a significant main effect for facial area, but contrary to prediction there was no main effect for area in the anger ANOVAs. The Newman-Keuls test of cell means provided support for the hypothesis: the facial area yielding the greatest accuracy was not the same across emotions but, as predicted, varied from emotion to emotion. The main exception was anger, where the predicted difference between facial areas was in the expected direction but did not reach significance. Table 1 summarizes in descriptive form the partial face judgment data, listing the proportion of judges accurate when the different facial areas were seen for the different emotions. The composite face data is not given since it was virtually identical.

Table 2 lists the specific predictions which were hypothesized and the results obtained. As explained earlier, the eyes/eyelids versions of half the disgust pictures were not shown because they reflected the muscular action in the cheeks/mouth. Separate ANOVAs were calculated for the two subgroups of disgust pictures. The same problem occurred with the happiness pictures, except here there were no happiness eyes/eyelids independent of the muscular movements in the lower face, and so there was no version of eyes/eyelids alone for this emotion. The results shown in Table 2 were quite consistent regardless of whether the observers saw the slices of expression in the partial face group or whether they saw the partial expres-

sions melded into otherwise neutral faces in the composite face group. Almost all of the specific predictions were supported, and when support was obtained it generally occurred in both sets of judgment data.

In the ANOVAs the six persons whose faces were judged were treated as random effects, and in the Newman-Keuls tests of cell means summarized in Table 2, any possible interaction with the persons was ignored. Inspection of the results for each of the six persons suggested that the pattern of the results reported in Table 1 and 2 was generally the same for most of the persons.

This experiment provides strong support for the view that there is no one area of the face which best reveals emotion, but that the value of the different facial areas in distinguishing emotions depends upon the emotion being judged.

This finding can be given additional credence beyond that usually ascribed to a single empirical study, because (a) the findings were obtained in two very different research designs: judgments of different facial areas as in this study, and measuring facial components in the previous Ekman, Friesen, and Tomkins study (11); (b) most of the specific theoretically based predictions about the importance of particular facial areas to particular emotions were confirmed in this experiment and in Ekman, Friesen and Tomkins's study; (c) in this experiment the general hypothesis and most of the specific predictions were verified in essentially two replications with different groups of observers and different versions of the stimuli.

Questions could be raised about the limitations of these results because of the fact that the facial behavior being judged was posed rather than spontaneous. This is an old dispute, with some researchers claiming that posed facial expressions are uniquely different from spontaneous ones (15, 17), while others have argued that posed expressions are more extreme and less controlled versions of what are usually seen in spontaneous facial expressions (10). Obviously we hold the latter viewpoint, and believe that the indirect evidence in our support is quite persuasive. In particular, numerous cross-cultural studies have shown that the emotions posed by members of one culture can be identified by members of another culture, including a recent study by Boucher (1) in which Malays and an aboriginal group in Malaysia accurately identified the same full-face stimuli as those used in the present study. However, replication of this study on facial areas with photographs of spontaneous behavior would be the most persuasive way to resolve doubts about the generality of posed facial expressions.

A second traditional challenge to this kind of experiment has to do with the use of still photographs to study facial expression (cf. 2). Although we agree that still photographs are inappropriate for studying the *dynamics* of facial expression (the timing of the onset and decay of a muscular move-

Table 1: Proportion of observers accurately identifying emotion from each facial area

	Disgust	sub-groups	Fear	Sadness	Happiness	Anger	Surprise
Brow/forehead	.13	.06	.26	.38	.24	.31	.79
Eyes/eyelids	.05	—	.67	.67	—	.24	.63
Cheeks/mouth	.92	.84	.45	.45	.98	.36	.52
Eyes/eyelids with cheeks/mouth	—	.67	—		.99	—	

ment), when morphology of expression is the issue, as in this study, a still photograph should be no different in depicting the appearance of the maximum point in a muscular contraction than a motion picture, videotape, or live version.

Another possible limitation to the results of this experiment has to do with sampling the range of intensities in facial expressions. There were few stimuli at the low end of the intensity scale: most were moderate and some were high intensity. Ekman, Friesen, and Tomkins's theory would suggest that at the low end of the intensity scale the differences between facial areas fade away. This has yet to be tested.

While studies of the judgments of different facial areas for spontaneous expressions and low-intensity facial expression would have value, experiments on facial areas are inherently limited. They can only point to where the information is located, in which part of the face. But they can't specify what to look for or measure. Research on the muscular contractions (e.g., 9, 20) which distinguish each emotion is necessary to either measure or teach the cues to the recognition of emotion.

Finally, we wish to note a serendipitous but interesting finding. As explained earlier, all of the photographs selected for this experiment met a criterion of more than 70 percent accurate identification when the entire face was seen by a group of observers. Inspection of Table 1 shows that when only part of the face was viewed a comparable level of accuracy was achieved for at least one area of the face for all of the emotions except anger, where accuracy was always less than 40 percent. This agrees with Ekman and Friesen's (8) hypothesis that anger differs from the other five facial expressions of emotion in being ambiguous to the viewer unless the anger is registered in at least two and usually three areas of the face.

REFERENCES

1. Boucher, J. D. "Facial Behavior and the Perception of Emotion: Studies of Malays and Temuan Orang Asli." Paper presented to the Conference on Psychology and Related Disciplines in Malaysia, Universiti Kebangasaan Malaysia, Kuala Lumpur, 1973.
2. Bruner, J. S., and R. Tagiuri. "The Perception of People." *Handbook of Social Psychology. Vol. 2* (edited by G. Lindzey). Reading, Mass.: Addison-Wesley, 1954, pp. 634–654.

Table 2: Facial areas predicting various emotions

Emotion	Prediction		Newman-Keuls Tests	
			Partial face	Composite
Disgust	cheeks/mouth	brows/forehead	p = 01	p = 01
		eyes/eyelids	p = 01	p = 01
	cheeks/mouth and eyes/ eyelids combined	brows/forehead	p = 01	p = 01
Fear	eyes/eyelids	brows/forehead	p = 01	p = 01
		cheeks/mouth	trend	trend
Sadness	eyes/eyelids	cheeks/mouth	p = 01	p = 01
	brow/forehead	cheeks/mouth	trend	p – 05
Happiness	cheeks/mouth	brows/forehead	p = 01	p = 01
	cheeks/mouth and eyes/ eyelids combined	brows/forehead	p = 01	p = 01
Anger	cheeks/mouth	eyes/eyelids	trend	trend
	brows/forehead	eyes/eyelids	n.s.	n.s.
Surprise	no difference predicted		no difference found	

3. Coleman, J. C. "Facial Expressions of Emotion." *Psychological Monographs* 63 (1, Whole No. 296), 1949.
4. Dunlap, K. "The Role of Eye Muscles and Mouth Muscles in the Expression of the Emotions." *Genetic Psychology Monographs* 2, 1927 pp. 197–233.
5. Eibi-Eibesfeldt, I. *Ethiology: The Biology of Behavior*. New York: Holt, Rinehart & Winston, 1970.
6. Ekman, P. "Universals and Cultural Differences in Facial Expressions of Emotion." In *Nebraska Symposium on Motivation, 1971* (edited by J. Cole). Lincoln, Nebraska: University of Nebraska Press, 1972.
7. Ekman, P. "Cross-Cultural Studies of Facial Expression." In *Darwin and Facial Expression* (edited by P. Ekman). New York: Academic Press, 1973.
8. Ekman, P., and W. V. Friesen. *Unmasking the Face*. New York: Prentice-Hall Spectrum, 1974.
9. Ekman, P., and W. V. Friesen. *The Facial Atlas*. In preparation.
10. Ekman, P., W. V. Friesen, and P. Ellsworth. *Emotion in the Human Face: Guidelines for Research and an Integration of Findings*. New York: Pergamon Press, 1972.
11. Ekman, P., W. V. Friesen, and S. S. Tomkins. "Facial Affect Scoring Technique: A First Validity Study." *Semiotica* 3, 1971, pp. 37–58.
12. Frois-Wittman, J. "The Judgment of Facial Expression." *Journal of Experimental Psychology* 13, 1930, pp. 113–151.
13. Hanawalt, N. G. "The Role of the Upper and the Lower Parts of the Face as a Basis for Judging Facial Expressions: II. In Posed Expressions and 'Candid Camera' Pictures." *Journal of General Psychology* 31, 1944, pp. 23–36.
14. Hill, D. C. *The Communication of Emotions by Facial Expressions in the Light of a New Theory*. M. A. Thesis, Hofstra College, May, 1955.
15. Hunt, W. A. "Recent Developments in the Field of Emotion." *Psychological Bulletin* 38, 1941, pp. 249–276.
16. Izard, C. E. *The Face of Emotion*. New York: Appleton-Century-Crofts, 1971.
17. Landis, C. "Studies of Emotional Reactions: II. General Behavior and Facial Expression." *Journal of Comparative Psychology* 4, 1924, pp. 447–509.
18. Nummenmaa, T. *The Language of the Face. Jyvaskyla Studies in Education, Psychology and Social Research*. Jyvaskyla, Finland: Jyvaskylan Yliopistoyhdistys, 1964.

19. Ruckmick, C. A. "A Preliminary Study of the Emotions." *Psychology Monograph* 30 (Nos. 134–9), 1921, pp. 30–35.
20. Schwartz, G. E., P. L. Fair, P. S. Greenberg, M. J. Friedman, and G. L. Klerman. "Facial Electromyography in the Assessment of Emotion." Paper read at the Society for Psychophysiological Research Meetings, Galveston, Texas, October, 1973.
21. Winer, B. J. *Statistical Principles in Experimental Design*. New York: McGraw-Hill, 1962.

Károly Schmal: Poster for Museum Month, 1974. Photo by János Wahr