

Forty American (20 males, 20 females) and 31 Malaysian (20 males, 11 females) college students responded to 60 tachistoscopic presentations of photographs of facial expressions by judging the gender and the emotional expression of each face. The duration of exposure times ranged from 3 msec. to 800 msec. Stable recognition thresholds for most emotional expressions were established by 12 or 25 msec., with fear requiring 300 msec. to be recognized by each group of subjects. Happiness and sadness were the most accurately identified emotions, and anger and fear were the most difficult for subjects to recognize. Females were better than males at identifying surprise and fear, especially at the longer exposure times, and the ability to identify anger was strongly affected by both the sex and cultural background of the subject. Although there were several instances in which Malaysian and American subjects differed, overall accuracy of recognition and perceptual thresholds were not strongly related to differences in ethnic background.

A CROSS-CULTURAL STUDY OF RECOGNITION THRESHOLDS FOR FACIAL EXPRESSIONS OF EMOTION

FRANCIS T. McANDREW
Knox College

Surprisingly little of the research on the perception of facial expression has been devoted to determining just how long a facial expression must be visible to be interpreted. The paucity of such research is especially surprising as the perception of microexpressions is a central issue in research on deception and the communication of emotion through facial expression. As several areas of the face must be scanned before accurate identification of emotional expressions can be made, and as subjects look at some facial regions more than others and tend to use a regular sequence when doing so (Walker-Smith, Gale,

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& Findlay, 1977), obviously some minimum exposure time must be necessary. At this point in time, it is not at all clear what the duration of this exposure must be.

For example, Haggard and Isaacs (1966) report that filmed facial expressions run at normal speeds are not even noticed at a duration of 200 msec., whereas expressions lasting 400 msec. can be detected but not identified. In contrast, Ekman and Friesen (1969) report that filmed expressions as brief as 20 msec. *can* be perceived, although in actual practice they may not be for a number of reasons. Most of the evidence relevant to this question is indirect and stems from the work of those investigators studying hemispheric specialization in the recognition of faces and emotional stimuli using precisely timed tachistoscopic presentations of stimulus faces. There are a number of drawbacks involved in relying on this line of research for information about exposure times necessary for the recognition of facial expressions. First, as their purpose is to study processing of information rather than perceptual thresholds, these studies typically examine only one or at most a very narrow range of exposure times. Second, almost all of these studies have dealt with the recognition of faces rather than facial *expressions*. Finally, the experimental procedure used in this research is a relatively simple matching task in which subjects merely report whether two expressions are the "same" or "different." Whether the expressions could be identified and named at such brief exposure times is as yet unknown.

Keeping these limitations in mind, Ley and Bryden (1979) report that subjects could identify expressions on two cartoon faces as being the same or different when presented with them for 85 msec. Safer (1981), using the same procedure with real photographs, found successful matching of expressions at 30 msec. and 50 msec. Kennedy (1978), on the other hand, found great variability across subjects in the ability to recognize expressions presented for 100 to 200 msec. These times are at least as brief as those required for the successful recognition of faces in most of the research reported to date.

CROSS-CULTURAL RESEARCH ON FACIAL EXPRESSIONS

There is still some disagreement about the extent to which emotions are expressed the same cross-culturally, but most researchers agree that accurate identifications of emotional expressions are readily made between people of different cultures, although there may be some variability due to different display rules (Ekman & Friesen, 1971; Izard, 1971). There is also compelling evidence to argue that the expression of emotion through the face is an innate ability that should transcend cultural differences (Darwin, 1872; Eibl-Eibesfeldt, 1979). Although the cross-cultural identification of emotional state from facial expressions is always better than chance, there is evidence that the cultural background of the stimulus person and the observer has some effect on the accuracy of these judgments.

For example, when assigning labels to emotional expressions, groups of subjects are usually more uniform when judging expressions of persons from their own culture (Kilbride & Yarczower, 1983) and in some studies actually perform better when judging expressions of compatriots (Gitter, Black, & Mostofsky, 1972; Kilbride & Yarczower, 1980). There may be many reasons for this, as people process faces like their own more deeply (Chance & Goldstein, 1981) and recognize and remember them better than other faces (Shepherd, 1981; Malpass & Kravitz, 1969). Additionally, persons from different racial backgrounds use different facial features when describing faces, resulting in the use of more relevant cues for faces like their own (Deregowsky, Ellis, & Shepherd, 1975). It appears that increased familiarity with the stimulus culture may increase the accuracy of judgment for some emotions (Ducci, Arcuri, W/Georgis, & Sineshaw, 1982), although this effect has not been widely reported.

Most of the work relevant to the non-American group studied here (Malaysians) comes from Boucher and his colleagues. In one of these studies, Boucher and Carlson (1980) point out that although Malays and Americans have almost no

cultural heritage in common and there is little personal contact between Malaysians and Americans, both groups could still identify emotional expressions in the other at well above chance.

There are no cross-cultural data available on minimum exposure times necessary for recognition of facial expressions of emotion.

GOALS, RATIONALE, AND HYPOTHESES

This study was designed as a straightforward perceptual study that would help to establish the minimum exposure duration needed to accurately identify facial expressions of emotion. In an effort to extend previous cross-cultural findings, it was also a comparative experiment in which the recognition thresholds and accuracy of subjects from two very different cultural backgrounds (Malaysians and Americans) were examined. The study was most concerned with discovering how much time subjects would need under controlled, ideal, laboratory conditions.

I acknowledge that in real interactions such conditions almost never exist, but the intent was to determine what perceptual parameters make recognition *possible*. To achieve this, the stimulus faces would have to be clear and unambiguous and have the demonstrated ability to produce reliable and accurate judgments. Because context (Ekman, Friesen, & Ellsworth, 1982) and sequence of exposure (Thayer, 1980) have been shown to affect judgments, the stimulus faces were presented in a context-free situation that carefully controlled for order effects. Consistent with previous studies that have used tachistoscopic presentations of still photographs, all presentations in this experiment were unmasked (that is, not followed by another visual stimulus that could cause erasure or interference).

This was very much an exploratory study. However, a few general hypotheses were tested.

- (1) As all stimulus faces were Euro-American, and as it has been demonstrated that familiarity with the stimulus culture affects judgment variability and accuracy, it was predicted that the Americans would show greater overall accuracy and require less exposure time than Malaysians.
- (2) It was predicted that happiness would be recognized more often and at briefer exposure times than other emotions, and that anger and fear would be less easily identified and require longer times.
- (3) Extrapolating from the findings that females are usually better at judging expressions of emotion than males, it was predicted that they not only would be more accurate overall, but would probably show lower recognition thresholds as well.

METHOD

STIMULI

The emotional expressions were chosen from the set of photographs prepared and published by Ekman and Friesen (1975). The entire set was pretested on undergraduate psychology classes in an attempt to weed out the most difficult pictures and those showing obvious affect blends. Thirty pictures were selected, representing the five most accurately identified expressions of each of the following emotions: happiness, sadness, anger, disgust, fear, and surprise. Each photograph measured 19 by 27 cm. and was mounted on a 40 by 63 cm. white index card.

APPARATUS

The stimuli were presented by way of a model T-3B-1 three-field Harvard tachistoscope manufactured by the Ralph Gerbrands Company, Inc.

SUBJECTS

Subjects were 20 male and 20 female Caucasian American college students and 20 male (12 Malays, 8 Chinese) and 11 female (10 Malays, 1 Chinese) Malaysian college students. All subjects were students at the same liberal arts college in the United States, and all were volunteers who were paid for their participation.

PROCEDURE

Ten exposure times were used: 3, 6, 12, 25, 50, 100, 200, 300, 400, and 800 milliseconds. There were five pictures of each of the six emotions, and each picture was presented twice. This resulted in 60 presentations, with 10 presentations of each emotion. To ensure that all subjects saw exactly the same expressions at each exposure time, each photograph was randomly paired with one of the exposure times so that each emotion appeared once at each exposure time; no photograph was ever presented twice for the same length of time. The order of presentation was randomized within two blocks of 30 trials, so that a photograph would not appear twice within a block. The order of presentation was counterbalanced across subjects to control for sequence and practice effects.

Subjects reported individually to a small, dimly lit room where they were greeted by a male experimenter and seated in front of the tachistoscope. The experiment was described to them as an attempt to find out how quickly people can pick up information from the faces of other people and whether the individual's cultural background influences his or her ability to do this. Each subject was given a standardized response sheet with brief written instructions on the first page. Malaysian subjects were given a choice of instructions/answer sheet typed in English or Malay. After the subjects had read the instructions, the experimenter orally reviewed the procedure and answered any questions the subject might have.

On each trial, the subject looked into the tachistoscope and awaited the prompt from the experimenter. A trial began with

a "ready" prompt followed by a one-second exposure to a blank white field immediately preceding exposure to the stimulus face. The subject responded on each trial by circling the word on the answer sheet that best described the face he or she had seen. In order to orient the subject to the tachistoscope and give him or her some idea of what to expect, two practice trials (250 and 450 msec. in duration) presenting a photograph not used in the experiment were run before the real trials began. There were 60 trials altogether, with a brief rest period between trials 30 and 31 at which time the subject was paid. At the conclusion of trial 60, the subject was debriefed and given the opportunity to ask questions.

DEPENDENT MEASURES

Responses were made on an answer sheet that consisted of 60 lines, one for each trial. Each line began with a coded number identifying the photograph and exposure time used in that trial, followed by a list of the following words: happy, sad, fear, anger, surprise, disgust. The order of these words was different from trial to trial. At the end of each line was an M and an F. Immediately following exposure to each picture, subjects circled the emotional label that they thought best described the face they had just seen, and they were told to circle M if they thought the person in the photograph was male and F if the person was female.

The Malay words used to describe the emotions were *gembira*, *sedeh*, *takut*, *marah*, *terkejut*, and *jijik*. These correspond to the English emotion terms listed in the same order above.

RESULTS

A recognition threshold for the facial expressions was defined as that exposure time at which 50% of the individuals in a group correctly identified the emotion without the group's

performance dipping below 50% more than once at longer exposure times. The threshold for gender recognition was defined as the point at which at least 50% of the subjects were perfectly accurate on all six of the faces seen at that exposure time.

An inspection of the data indicates that all emotions except fear were recognized reliably between 12 and 25 msec., with the performance on happiness and sadness being the best. All groups accurately identified these emotions at 12 msec. Females recognized surprise at 12 msec., whereas males could not do this consistently until they had seen it for 25 msec. Recognition of disgust required 25 msec. for all groups, and fear was the most difficult of all. Recognition of the fear expression did not reliably occur in any of the groups until 300 msec. Performance on the anger expression was more variable. These results are illustrated in Table 1.

Surprisingly, when recognition accuracy scores are averaged across exposure times, all four groups of subjects recognized the emotions in the same descending order of accuracy. Happiness was the most accurately identified emotion, followed by sadness, surprise, disgust, anger, and fear. Chi-square analyses on these overall levels of recognition accuracy revealed no significant differences among the four groups of subjects on any of the six emotions.

The recognition threshold for gender was 12 msec. for all but the Malaysian males, who required 25 msec.

Although the groups did not differ in recognition accuracy when performance was averaged across exposure times, analyzing performance only at very brief or very long exposure durations did reveal some differences. When performance at the 12 msec. exposure time (the shortest one at which better than chance accuracy occurred) was examined, it was discovered that all of the groups were significantly different from one another in identifying anger, $\chi^2(3) = 44.29$, $p < .001$, as even the two groups who were closest together (American males and Malaysian females) were significantly different from each other, $\chi^2_{\text{comp}}(1) = 4.02$, $p < .05$. In descending order, the

TABLE 1
Exposure Time (in msec.) at Which Stable Recognition
of Facial Expressions Occurred in Four Groups

Emotion	American Males	American Females	Malaysian Males	Malaysian Females
Happiness	12	12	12	12
Sadness	12	12	12	12
Surprise	25	12	25	12
Disgust	25	25	25	25
Anger	12	25	300	12
Fear	300	300	300	300

accuracy of identification was Malaysian females, American males, Malaysian males, and American females. Malaysian females and American males also recognized happiness significantly more often at 12 msec. than the Malaysian males and American females, $\chi^2_{\text{comp}}(1) = 8.05$, $p < .05$. Females were significantly better than males at recognizing surprise, $\chi^2_{\text{comp}}(1) = 7.92$, $p < .01$, with the Malaysian females doing better than the American females, $\chi^2_{\text{comp}}(1) = 4.02$, $p < .05$. There were no differences among the groups in recognizing sadness, disgust, or fear at 12 msec.

Analyzing the data from the 800 msec. exposure time, at which all subjects clearly had sufficient time to process the facial expressions, revealed the following:

- (1) Females were more accurate than males when identifying surprise, $\chi^2_{\text{comp}}(1) = 13.34$, $p < .001$.
- (2) In recognizing fear, females were again better than males, $\chi^2_{\text{comp}}(1) = 14.88$, $p < .001$ and American females did better than Malaysian females, $\chi^2_{\text{comp}}(1) = 13.10$, $p < .001$.
- (3) Malaysians were more accurate than Americans in recognizing sadness, $\chi^2_{\text{comp}}(1) = 13.34$, $p < .001$.
- (4) Malaysian females were more accurate than American males at recognizing disgust, $\chi^2_{\text{comp}}(1) = 10.52$, $p < .01$.

- (5) Both groups of males more accurately identified anger than did Malaysian females, $\chi^2_{\text{comp}}(1) = 5.22$, $p < .05$. American females were intermediate and not significantly different from any of the other groups.
- (6) There was no difference among the groups on the ability to identify happiness.

The percentage of subjects in each group accurately identifying expressions at 12 msec. and 800 msec. is displayed in Table 2.

DISCUSSION

Even though the stimulus faces were Euro-American, Americans generally did not have lower recognition thresholds than Malaysians, nor did they show higher rates of accuracy. Although it is true that the Malaysian males required more time to recognize anger than any of the other groups, it should also be noted that Malaysians outperformed Americans in some other situations. The emotions on which females were consistently more accurate than males were fear and surprise, and there was no evidence that females need less time than males to make accurate judgments of facial expressions. In addition, it was found that judgment of a morphological characteristic such as gender did not require less time than judgment of facial expressions. Finally, this study replicated the findings of previous research that happiness is the easiest expression to identify, with fear being the most difficult. Consistent with other studies, fear was most often misidentified as surprise. Anger and disgust were also more difficult for many subjects than happiness, sadness, or surprise.

Probably the two major findings of this study were the surprisingly brief exposure times at which accurate recognition of emotional expressions could be made and the fact that the cultural background of the individual had relatively little effect on how accurately the expressions were identified.

TABLE 2
Percentage of Subjects Correctly Identifying Facial
Expressions at 12 Msec. and 800 Msec.

Group	Happiness	Sadness	Surprise	Disgust	Anger	Fear
12 Milliseconds						
American Males	75	65	40	20	50	25
American Females	60	50	50	25	20	20
Malaysian Males	50	50	30	20	35	25
Malaysian Females	73	55	64	18	64	27
800 Milliseconds						
American Males	100	85	85	90	95	50
American Females	100	90	100	95	85	85
Malaysian Males	100	100	90	95	90	60
Malaysian Females	100	100	100	100	82	73

In line with previous research, females were often better at interpreting facial expressions than males. Female superiority occurred primarily on the emotions of fear and surprise, which are traditionally the two most readily confused expressions. As one of the reasons for the confusion of fear and surprise is the great similarity in the facial configurations involved in these expressions, it may be that females do better simply because they spend more time looking at other people's faces and are therefore more aware of and sensitive to subtle differences between expressions than are males. Anger was the only emotion on which males were ever more accurate than females. In fact, the anger expressions proved to be the photographs on which the groups were the most different, as each group's performance was significantly different from each of the others.

The Malaysian subjects in particular showed a complex response to the anger expressions. Malaysian females were the poorest at identifying them, and the Malaysian males could not consistently identify them until an exposure time of 300 msec., after which they did quite well. The variability among the four groups may be due to the expression of anger probably being more rigidly controlled by display rules than most of the other emotions. Although no hard data exist, researchers tend to agree that the display rule against displaying and acknowledging anger in others is much stronger in Malay culture than in the United States. The display rules will differ widely not only between cultures, but also between sexes within a culture; usually, it is more inappropriate for females to express anger publicly than it is for males.

In conclusion, although accuracy improves with longer exposure times, the fact that the subjects in this study could identify most of the emotions within 12 or 25 msec. means that people have the ability to perceive extremely short microexpressions. However, an individual engaging in real interactions would undoubtedly require more time than would be needed in this laboratory situation, due to the effects of context and the expression being embedded in a quickly changing sequence of facial displays. In fact, the duration of the unmasked microexpressions viewed in this study are probably equivalent to somewhat longer exposure times in real interactions because of visual persistence and iconic storage not always available in natural situations. Nevertheless, the implication is that most of the time when microexpressions are missed it is *not* because of perceptual inability to grasp such brief expressions, but because the individual is distracted by other things occurring in the interaction or because he or she simply is not looking at the other's face when the microexpression occurs.

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Francis T. McAndrew received his Ph.D. from the University of Maine, and is currently Assistant Professor of Psychology at Knox College. In addition to research on nonverbal behavior and cross-cultural psychology, he is interested in environmental psychology and the relationship between arousal and emotion.