Deliberate Facial Movement

Paul Ekman
University of California, San Francisco

Gowen Roper
Adelphi University

Joseph C. Hager
University of California, San Francisco

EKMAN, PAUL; ROPER, GOWEN; and HAGER, JOSEPH C. *Deliberate Facial Movement.* CHILD DEVELOPMENT, 1980, **51**, 886–891. Children aged 5, 9, and 13 years tried to imitate elemental and complex facial actions. Performance improved with age, and also when the children had the benefits of practice, encouragement, and seeing themselves in a mirror. The ability to imitate elemental actions correlated with the ability to imitate complex expressions. Certain actions, primarily those involved in fear, sadness, and anger, were difficult even for the oldest group. The relationship between making faces by deliberate action and making faces by self-generating an emotion experience is discussed.

This study examined the development of the ability to produce facial movements intentionally. There have been few studies of this ability compared to the large number of studies on the development of the ability to recognize facial expressions of emotion (for reviews of both types of studies, see Charlesworth & Kreutzer 1973; Ekman & Oster 1979). Facial expressions may appear spontaneously, presumably as signs of an emotion, but expressions may also be put on intentionally to feign, mock, or otherwise provide a socially required performance. Such performances may be achieved by two quite different techniques. In *deliberate action* a person imitates an observed expression or makes a face to fit the memory of an appearance. In contrast, when *generating emotion* one focuses upon the experience, not the expression. Much like a Stanislavski actor, one relives or imagines a situation that is intended to create the experience from which the expression will flow. Whether a person relies upon emotion generation or deliberate action may depend upon the emotion performed, the situational context, or personality. Age may also be relevant, since the abilities required for deliberate action or emotion generation may not develop simultaneously. These two techniques for producing intentional facial expressions probably rely upon different neural pathways. Deliberate performance of facial actions has been shown to involve the pyramidal systems (Meihlke 1973; Myers 1976; Tschiassny 1953), and emotion generation, if it succeeded in creating genuine emotional expressions, would involve the extrapyramidal system.

Unfortunately, the few previous studies of the intentional production of facial expression asked for performance in such a way that it is not possible to determine which technique a subject used. For example, subjects asked to make a face like the one shown in a photograph (Draughton 1973; Odom & Lemond 1972) could deliberately imitate the action shown, or they could decode the emotion message and then attempt to generate the emotion. Each technique might be used by different subjects or by the same subject for different emotions. The other procedures for eliciting facial expressions (asking subjects to pose an emotion [Hamilton 1973]; asking them to show the expression someone would feel in a particular situation [Odom & Lemond 1972]) are also ambiguous, allowing subjects to perform actions deliberately or generate emotional experience.

This research was supported by a grant from NIMH, MH 11976. The preparation of this report was supported by a grant from the Harry F. Guggenheim Foundation. Reprint requests may be sent to Paul Ekman, Human Interaction Laboratory, University of California, San Francisco, 401 Parnassus Avenue, San Francisco, California 94143.

[*Child Development*, 1980, **51**, 886–891. © 1980 by the Society for Research in Child Development, Inc.
0009-3920/80/5103-0031$01.00]

Kwint (1934) is the one investigator who used an unambiguous procedure. He did not ask for emotional expression but instead requested specific facial muscle movements—for example, lift brows, protrude lips, etc. More than 20 different actions were requested, with each movement described in words and shown by Kwint to the subject. Kwint reported that performance improved from age 4 to age 13, slightly declined at 14 and 15, and was impaired in retarded subjects.

There were a number of deficiencies in Kwint's pioneering study which our research has attempted to remedy. Kwint's experiment was limited to the muscular actions involved in the emotions of anger, happiness, and disgust. We extended the list of muscular actions to include three other emotions (fear, surprise, and happiness) in order to encompass actions relevant to all of the emotions that have been consistently found in studies of facial expression over the past 40 years (see Ekman, Friesen, & Ellsworth 1972, chap. 13). Kwint studied only the performance of elemental facial actions and not the more complex facial expressions. We included a condition in which the subjects imitated complex expressions. Other problems in Kwint's study that were remedied include: no check that the live model whom the children tried to imitate performed correctly or consistently; no data on intercoder reliability in the scoring of the children's performances; no statistical tests of significance.

On the basis of Kwint's findings, we hypothesized, first, that performance would improve within the age range studied (5–13 years). Kwint's findings and Ekman and Friesen's (1976) experience[1] in developing an anatomically based facial measurement system suggested a threefold classification of muscle actions in terms of expected ease of performance. Hypothesis 2 predicted that this classification would account for how well various muscle movements were performed. Hypothesis 3 was concerned with the conditions in which the subjects attempted to perform the facial actions. In trial 1, subjects had to rely solely upon their own proprioceptive and cutaneous facial feedback to monitor their performance. Trial 2 was designed to estimate the performance that was possible when the child had the multiple benefits of practice, feedback from a mirror, and suggestions and encouragement from the experimenter. Hypothesis 3 predicted that performance would be better in trial 2 than trial 1.

Method

Requested Facial Action Test.—Since young children were to be studied, and since three trials were to be administered in one session, it was not thought feasible to include all of the 33 elemental facial movements in Ekman and Friesen's (1978) Facial Action Coding System (FACS). We selected 12 action units that Ekman and Friesen (1978) hypothesized are involved in the emotions of fear, surprise, anger, disgust, sadness, and happiness. These 12 actions do not explore all of the movements for all of the expressions of each emotion, but explore some of the most common actions for each emotion. Three combinations of actions affecting only the eyebrows and forehead were added so that for this one facial area it would be possible to test all of the actions relevant to the emotions. The action units in the test are listed in table 1 in the Results section.

A videotape was made of Ekman performing each of these 15 actions three times in a row. The first and second times an extreme muscular contraction was made and immediately released. On the third performance, the extreme contraction was held for 8 sec before being released. There was a 5-sec blank period between the performances of each action unit. The order of actions shown on the videotape was randomly determined, and was constant for all subjects. The tape was played once for trial 1 and again for trial 2. In trial 3 the videotape showed one complex expression for each of six emotions: anger, sadness, fear, happiness, disgust, and surprise. The particular action units combined to portray each of these emotions were identified on the basis of research (Ekman & Friesen 1978; Ekman & Oster 1979) about the actions involved in these emotions.

Subjects.—Thirty-six children in four schools of a predominantly middle-class suburban town in northern California participated. The youngest group (mean age, 5-8) was from a private nursery school and a public school kindergarten. The middle age group (mean age, 9-1) was from the same public elementary school. The oldest group (mean age, 13-4)

[1] In developing their facial measurement system and in teaching voluntary control of facial musculature to adults, Ekman and Friesen have found that certain muscles are generally much harder than others for most people to move intentionally.

was from two public middle schools. Since there have been some consistent findings of superiority of females as compared to males in the production of posed and spontaneous emotional expressions (Hall 1978, in press), an equal number of girls and boys were obtained for each age group.

Procedure.—The children were offered pictures of themselves for participating in a study in which they would "see a man on TV and copy his facial expression." They were individually tested in their school. The experimenter (G.R.) described each movement as the child watched the movement on the television monitor. The descriptions were based on the information in FACS—for example, wrinkle your nose, lift your entire brow up, etc. The child was told that many of the movements were difficult and not to become discouraged if an action could not be performed. The child was told to keep practicing the movement until he or she thought it was correct. The experimenter offered no direct encouragement or praise for any specific performance in trial 1.

In trial 2 the child was allowed to look in a mirror placed next to the television monitor to compare his or her performance with the television model. The experimenter coached the child, offered suggestions about how to do a movement, and told the child if a movement other than the requested one was being made. A score-keeping device was used to maintain the youngest children's interest in the task. In trial 3 the subject imitated the complex expressions with the mirror in place and encouragement as in trial 2.

Scoring the performance.—Each child's behavior was recorded on videotape. In more than 90% of the performances the requested action, if produced, was performed quickly and abruptly. Sometimes a subject would make a number of actions, appearing to seek the correct one and holding the requested action for just a moment. A correct score was earned if the requested action was seen at any point in a subject's attempt, as long as it was separated from any movement before or after it, and did not include actions other than the one(s) requested. The amount of time allowed for a child to produce a performance was identical (10 sec) within and between trials.

The performances were scored using the criteria for correct performance in FACS. Scoring facial movement with FACS has been shown to be reliable (Ekman & Friesen 1978), but those data were gathered on facial behavior during conversations by adults, not on requested facial actions produced by children. Two coders (G. R. and J. H.) who had been trained in FACS scored all of the performances made by six of the 36 children, two from each of the age levels. One of these coders (J. H.) did not know the hypotheses and afterward reported that he usually did not notice age differences. The two coders agreed on 83% of the performances. One coder (G. R.) scored the performances of facial behavior of the other children.

Results

The data from trials 1 and 2 were analyzed in a 3 (age) × 2 (sex) × 2 (trial) × 3 (difficulty) analysis of variance with repeated measures on the last two factors and with the number of correct performances summed over action units as the dependent variable. A significant main effect for age, $F(2,30) = 6.42$, $p < .01$, supported hypothesis 1. Duncan's multiple range tests on the age group means showed that, although correct performances increased with each age, the only significant increase, $p < .05$, was from the youngest to the middle age group.

A significant main effect for difficulty, $F(2,60) = 235.10$, $p < .001$, supported hypothesis 2. Multiple range tests showed that significantly fewer, $p < .05$, action units were performed with each increasing level of difficulty. Table 1 shows the number of children in each age group who performed the action units correctly in trials 1 and 2.

A significant main effect for trial, $F(1,30) = 55.41$, $p < .001$, supported hypothesis 3. The only significant interaction was between trial and difficulty, $F(2,60) = 4.8$, $p < .05$. Simple main effects of this ordinal interaction showed that performance in trial 2 was always superior to trial 1 and that the difficulty classification was significant for both trials. The improvement from trial 1 to trial 2 was greatest for the moderately difficult action units. A series of 2 (trial) × 2 (correct/incorrect) χ^2s were calculated for each action unit to isolate those that showed a significant difference, $p < .05$, across trials. These were action units 7, 9, 16, and 24 and action unit combinations 1+2+4 and 1+4. The ANOVA revealed no other significant effects, including sex.

The number of correct performances of full-face expressions in trial 3 was analyzed

in a 3 (age) × 2 (sex) analysis of variance. As was found for the elemental actions, there was a significant main effect for age, $F(2,30) = 9.4$, $p < .001$, and Duncan's multiple range tests on the age group means showed that the only significant increase, $p < .05$, was from the youngest to the middle group. No other effect was significant.

Finally, correlations were calculated between children's performances of elemental actions when they were performed separately in trial 2 and when they were combined in a complex expression in trial 3. Phi coefficients were separately calculated for each complex expression, to show how well performance of single actions predicted performance when these actions were required in a complex expression. These coefficients were all positive and had a median of .54 ($Z = 3.24$, $p < .005$).

Discussion

The ability to produce facial movements intentionally—both elemental facial actions and complex expressions—improved with age. Improvement was greater between ages 5 and 9 than between 9 and 13. Certain facial actions were very easy to perform, while other actions were, as predicted, difficult. All children performed the one facial action required to signal happiness (action unit 12 [see table 1]). Most of the youngest performed the brow raise (action unit 1+2) involved in surprise, but could not raise their upper eyelid or assemble these actions with jaw dropping as required in the complex surprise expression. The majority of the middle and oldest children were successful in performing actions for surprise and disgust but could not perform all of the actions relevant to fear, sadness, or anger.

Further study is needed to determine the age when children are first able to imitate facial actions and whether this ability develops further in late adolescence. Meltzoff and Moore's (1977) study suggests that deliberate imitation may be possible very early in infancy, but they studied only a few movements, of which only one was involved in emotional expressions. The Requested Facial Action Test should be given to children younger than those we studied. Ekman and Friesen (Note 1) suggest that adults do not perform much better than did the 13-year-olds in this study, although they have found that extended practice benefits performance. On the other hand, Kwint (1934) reported that the ability to make requested facial movements decreased after the age of 15. Data are needed to resolve this issue.

The superior performance of the elemental actions in trial 2 could have been due to practice, encouragement, or the mirror. While we suspect that the mirror mattered most, further research is needed to show that this was so. Study should also be made of the ability to imitate the complex expressions without the benefit of a mirror or prior opportunity to practice elemental facial actions.

Our findings pertain to the ability to make facial actions deliberately. It was possible to focus on this ability by presenting for imitation in trials 1 and 2 only elemental facial actions. Most of these acts are not readily interpretable as depicting a specific emotion (exceptions are action units 12, for happiness, and 9, for disgust). Thus, the children could not easily decode what emotion was relevant and then attempt to generate that emotion. Performance of the elemental actions is informative about the ability to combine those actions intentionally when imitating complex expressions of emotion. Developmental changes in the ability to imitate complex expressions paralleled those found for elemental actions, and the ability to perform specific elemental actions correlated with the ability to combine those actions. However, we cannot be as certain about which technique the children used to produce these complex expressions.

It is important to study the development of the ability to produce expressions by emotion generation, and to compare that ability with success in making deliberate actions on the Requested Facial Action Test. Regardless of how an expression is produced, study is also needed about when different types of intentional expressions may first occur. A child may put on an expression of emotion to feign (meant to be interpreted as felt), to mock (meant to be interpreted as playful), or to mask (meant to hide the felt expression). (See Ekman & Friesen 1975, chap. 11, for a discussion of these and other forms of deceitful expression.) Preliminary observations suggest that children may succeed in mock expressions well before they can successfully feign or mask. For example, in this experiment, we found that the youngest children could perform only one of the actions for anger—the lowered brow. This should be sufficient to produce a mock but not a believable feigned anger. Even this extrapolation should be considered only

TABLE 1

Action Units

Latin Name	Action Unit Name in FACS	Emotions the Action Unit Is Involved in	Predicted Difficulty Level	No. of Children Able to Perform the Action Unit, by Age and Trial					
				Young		Middle		Old	
				Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Frontalis	1 + 2: inner and outer brow raiser	Surprise	Easy	11	12	11	12	12	11
Corrugator; depressor glabellae; depressor supercilli	4: brow lowerer	Anger	Easy	8	10	7	10	9	12
Levator labii superioris, alaque nasi	9: nose wrinkler	Disgust	Easy	5	7	7	9	10	11
Zygomatic major	12: lip corner puller	Happiness	Easy	11	12	11	12	12	11
Masseter; temporal and internal pterygoid	26: jaw drop	Surprise	Easy	10	11	12	12	12	12
Levator palpabrae superioris	5: upper lid raiser	Surprise and fear	Moderate	6	6	5	5	10	10
Orbicularis occuli, pars palpebralis	7: lid tightener	Fear and anger	Moderate	5	9	5	10	9	11
Orbicularis oris	24: lip pressor	Anger	Moderate	1	7	2	9	3	9
Triangularis	15: lip corner depressor	Sadness	Moderate	0	1	2	3	3	3
Depressor labii inferioris	16: lower lip depressor	Disgust and sadness	Moderate	2	4	4	9	7	11
Frontalis, pars medialis	1: inner brow raiser	Sadness	Hard	1	0	2	1	2	1
Frontalis, pars lateralis	2: outer brow raiser	...	Hard	0	0	0	0	1	1
	1 + 4	Sadness	Hard	0	1	2	5	4	7
	1 + 2 + 4	Fear	Hard	0	2	2	8	4	8
Risorius	20: lip stretcher	Fear	Hard	1	3	5	4	2	2

hypothetical. Data on the actual occurrence of different kinds of expression in social interaction are needed.

Reference Note

1. Ekman, P., & Friesen, W. V. Facial exercises. In P. Ekman & W. V. Friesen (Eds.), Analyzing facial action. Book in preparation.

References

Charlesworth, W. R., & Kreutzer, M. A. Facial expression of infants and children. In P. Ekman (Ed.), *Darwin and facial expression.* New York: Academic Press, 1973.

Draughton, M. Duplication of facial expression: conditions affecting task and possible clinical usefulness. *Journal of Personality,* 1973, **41,** 140–150.

Ekman, P., & Friesen, W. V. *Unmasking the face.* Englewood Cliffs, N.J.: Prentice-Hall, 1975.

Ekman, P., & Friesen, W. V. Measuring facial movement. *Environmental Psychology and Nonverbal Behavior,* 1976, **1,** 56–75.

Ekman, P., & Friesen, W. V. *The Facial Action Coding System.* Palo Alto, Calif.: Consulting Psychologists Press, 1978.

Ekman, P.; Friesen, W. V.; & Ellsworth, P. *Emotion in the human face.* Elmsford, N.Y.: Pergamon, 1972.

Ekman, P., & Oster, H. Facial expressions of emotion. *Annual Review of Psychology,* 1979, **30,** 527–554.

Hall, J. Gender effects in decoding nonverbal cues. *Psychological Bulletin,* 1978, **85,** 845–857.

Hall, J. Gender effects in encoding nonverbal cues. *Psychological Bulletin,* in press.

Hamilton, M. L. Imitative behavior and expressive ability in facial expression of emotion. *Developmental Psychology,* 1973, **8,** 138.

Kwint, L. Ontogeny of motility of the face. *Child Development,* 1934, **5,** 1–12.

Meihlke, A. *Surgery of the facial nerve.* Philadelphia: Saunders, 1973.

Meltzoff, A. N., & Moore, M. K. Imitation of facial and manual gestures by human neonates. *Science,* 1977, **198,** 75–78.

Myers, R. E. Comparative neurology of vocalization and speech: proof of a dichotomy. *Annals of the New York Academy of Sciences,* 1976, **280,** 745–757.

Odom, R. D., & Lemond, C. M. Developmental differences in the perception and production of facial expression. *Child Development,* 1972, **43,** 359–369.

Tschiasshy, K. Eight syndromes of facial paralysis and their significance for locating the lesion. *Annals of Otology, Rhinology, and Laryngology,* 1953, **62,** 677–691.