Facial Action Coding System

Investigator's Guide

by
Paul Ekman, Ph.D.
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cover back

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Contents

Acknowledgements *Acknowledgements v*

Preface *Preface vii*

Chapter 1: *Background, Development, and Overview 1*

Background of the Facial Action Coding System **2**
Development of the Facial Action Coding System **4**
An Example of Scoring Faces **10**
Concluding Comments **12**

Chapter 2: *Reliability of the Facial Action Coding System 15*

A. Reliability Issues **15**
B. The Behavior Sample **16**
C. The Coders **16**
D. Procedure **17**
E. Raw Data Matrix **17**
F. An Index of Agreement **17**
G. Overall Agreement **19**
H. Did Scoring Head/Eye Position Inflate Reliability? **19**
I. Does Arbitrating Differences Enhance Agreement? **19**
J. Agreement About Intensity **21**
K. Representativeness of the Behavior Sample **22**
L. Errors in Scoring Particular Action Units **22**
M. Reliability in Location of Facial Action **23**
N. Another Look at Description Reliability **24**
0. Summary and Discussion **25**

Chapter 3: *Behavior Records Required for Using FACS 27*

Chapter 4: *Training Procedure 29*

Chapter 5: *Materials in the Facial Action Coding System 31*

Chapter 6: *FACS Score Checker Computer Program 35*

Chapter 7: *Correct Answers for Practice Scoring Items 41*

Chapter 8: *How Others Scored Practice Items 69*

Chapter 9: *FACS in Relation to Other Facial Measurement Systems 101*

9.1. Introduction **101**
9.2. The basis for deriving units **105**
9.3. Comprehensiveness or selectivity **107**
9.4. Depicting facial measurement units **112**
9.5. Separating inference from description **113**
9.6. Types of records and persons to which measurement has been applied **114**
9.7. Reliability **115**
9.8. Validity **118**
9.9. Costs **121**
9.10. Other techniques for facial measurement **122**
9.11. Conclusions **124**
Appendix. How the facial action brow raise is described in each of the 14 measurement techniques **125**
References **128**

Chapter 10: *FACS Measurement Units Compared to Others 133*

Visual Categorical Measurement **134**
Scalar measurement **137**
Method of Comparing Visual Categorical Units **138**
Using the Appendixes **141**
Summary **145**
References **145**

Chapter 11: *Scoring the Separate Strands of AU 4: AUs 41, 42, and 44 163*

Action Unit 41 – Glabella Lowerer **165**
Action Unit 42 – Inner Eyebrow Lowerer **167**

Action Unit 44 – Eyebrow Gatherer **169**
Video Examples for AUs 41, 42, and 44 **172**

Chapter 12: *Suggestions About Using FACS 173*

1. Translating AU Scores Into Emotion Terms **173**
2. Options in Scoring Location of an AU in Time **175**
3. Delineating Events **178**
4. Scoring Head and Eye Movements **180**
5. Scoring Movements in Relation to Speech **181**
6. Short Cuts in Measuring Facial Movement **181**
7. A Final Note **181**

Chapter 13: *Assessing Proficiency: The FACS Final Test 183*

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Preface

This ***Guide for the Investigator*** was written separately from the FACS Manual for three reasons:

(1) We have assumed that anyone using FACS will want to have at least one other person learn the system so that inter-coder reliability can be determined. Since the other person might be someone not trained in scientific methods, we have kept out of the ***Manual***, but placed in this ***Guide***, any technical information requiring sophistication on the part of the reader.

(2) It would be ideal if the person coding facial actions did not think about the possible meaning of the behavior he scores, but focused only on describing appearance. Information about the meaning of facial behavior has been kept out of the ***Manual*** and is mentioned only in this ***Guide***.

(3) FACS is an unavoidably expensive package, entailing not only a text but many photographs, motion picture films, computer programs, etc. It seemed reasonable to provide the prospective user an opportunity to find out something about FACS at a minimal cost to determine whether it is appropriate to his interests. The first five chapters of this ***Guide*** provide the prospective user with that information.

FACS is in the experimental stage of development. It is not complete, final nor proven. It is the product of seven years of methodological research on how to measure facial behavior. We adopted the particular approach followed in FACS six years ago, and virtually all of our efforts have been expended in the development of this ***Manual*** during this time. We know the following about FACS:

People without any scientific training can learn FACS.

FACS can be learned in about 100 hours, taking five weeks if 3-4 hours is spent per day.

People can learn to use FACS without any direct contact with us .

Reliability is satisfactory, with high agreement among the learners and high agreement with how we score facial action. (See Chapter 2 on reliability.)

FACS allows the description of all facial behavior we have observed, and every facial action we have attempted.

FACS successfully postdicts observers' judgments of emotions shown in films or photographs, and a poser's intent about what he is showinq.

Currently, we are using FACS to study conversational facial signals (movements which illustrate speech much as hand movements can) , changes in facial action over the course of hospitalization for depression, and differences between honest and deceptive facial behavior. FACS is proving workable for each of these applications. A number of people whom we have trained in the use of FACS have found it useful in measuring facial behavior in a variety of applications: study of neonatal facial behavior; facial movement shown by deaf persons when they engage in sign language; measuring facial movement changes in response to pharmacological treatment of retarded children; changes in facial behavior associated with changes in heart rate, GSR, and other psychophysiological measures.

We do not have complete information about certain methodological issues:

Is the reliability obtained after learning FACS maintained over a long period of time, or is there a need to refresh or retrain to sustain reliability? We know that without any use of FACS over a period of a few months reliability is maintained when scoring is resumed. We do not know how well reliability is maintained with continued use of FACS over a period of six months to a year.

How many hours per day can someone use FACS before reliability falls off? We suspect it is about three hours a day.

Are all the rules provided in FACS to enhance reliability necessary? Are additional rules needed?

Are the settings or calibrations of the requirements for scoring minimum changes in appearance optimal, too high or too low? We suspect many can be adjusted to pick up more subtle signs of action.

Are all the distinctions in appearance which FACS allows needed for any study of facial activity? We believe the answer will be positive for certain studies.

Answers to these questions requires more experience using FACS to measure various samples of facial behavior. If those who use FACS share with us their experience and problems, their answers to the questions listed above, we will compile their experiences with ours, and determine what changes are needed. We invite you to write us about your experience. We will then revise FACS and share that information with you.

Chapter 1: *Background, Development, and Overview*

Measuring Facial Movement[1]

by

Paul Ekman and Wallace V. Friesen

This article reports a new method of describing facial movement based on an anatomical analysis of facial action. Most research on facial behavior has not measured the face itself, but instead measured the information that observers were able to infer from the face. Examples of the questions asked are: can observers make accurate inferences about emotion? Can observers detect clinical change or diagnosis? Do observers from different cultures interpret facial expression differently? Are observers influenced by contextual knowledge in their judgments of the face? Do observers attend more to the face than to the voice, etc.?

Few studies have measured the face itself. Examples of the type of questions which could be asked are: which movements signal emotion? Do facial actions change with clinical improvement or differentiate among types of psychopathology? Do the same facial movements occur in the same social contexts in different cultures? Are certain facial actions inhibited in certain social settings? Which facial movements punctuate conversation, etc.? The differences between these two approaches to the study of facial behavior (i.e., observer's inference vs. facial measurement) were discussed and the literature reviewed by Ekman, Friesen and Ellsworth (1972).

Research focused on the face has been impeded by the problems of devising an adequate technique for measuring the face. Over the years various procedures for facial measurement have been invented. Early work has rarely been cited by current investigators, e.g., Frois–Wittmann (1930), Fulcher (1942), Landis (1924) or Thompson (1941). More current approaches to facial measurement have varied in methodology, ranging from analogic notations of specific changes within a part of the face (Birdwhistell, 1970), to photographic depictions of movements within each of three facial areas (Ekman, Friesen & Tomkins, 1971), to verbal descriptions of facial gestalts (Young & Decarie, 1977).

No consensus has emerged about how to measure facial behavior. No tool has been developed which has become the standard, used by all investigators. Each investigator has almost been in the position of inventing his own tool from scratch. The only exception has been that the category lists of facial behavior described by some human ethologists (Blurton Jones, 1971; Grant, 1969; McGrew, 1972) have influenced other human ethologists studying children.

Although different in almost all other respects, most facial measurement techniques have shared a focus upon what is visible, what a rater can differentiate when he sees a facial movement. An exception, Schwartz, et al. (1976) used electromyographic (EMG) measurement to study changes in muscle tone which are not visible. EMG could also be used to measure visible changes in muscle tone which do not involve a noticeable movement, but such work has not been done.

1. We reprint here, with only minor changes, an early article about FACS, which appeared in the first issue of the Journal of Environmental Psychology and Nonverbal Behavior, 1976, 1(1), 56-75. The Journal of Environmental Psychology and Nonverbal Behavior, Randolf Lee, editor, is published by Human Sciences Press, 72 Fifth Avenue, New York, New York. Reprinted with permission.

EMG also could be employed to study visible movement, but we think it is unlikely that surface electrodes could distinguish the variety of visible movements which most other methods delineate.

Vascular changes in the face are another aspect of facial behavior which can occur without visible movement and which, like muscle tonus, could be measured directly with sensors. No such work has been published on coloration or skin temperature although Schwartz[2] in unpublished studies has found thermal measures useful in measuring affective responses. Some of the measurement procedures which utilize observers to rate visible movement, have included a reference to a "reddened" face.

Elsewhere (Hager, 1986, Ekman, 1981)[3] we have compared other methods for measuring facial movement with our own method, contrasting the assumptions which underlie each method, explaining how units of measurement were derived, and providing point by point comparisons of the measurement units. Here, we will only selectively contrast other methods with our own to explain our technique.

Background of the Facial Action Coding System

Our primary goal in developing the Facial Action Coding System (FACS) was to develop a comprehensive system which could distinguish all possible visually distinguishable facial movements. Most other investigators developed their method just to describe the particular sample of behavior they were studying. Our earlier approach, the Facial Affect Scoring Technique (FAST) (Ekman, Friesen & Tomkins, 1971), also had a more narrow objective. It was designed primarily to measure facial movement relevant to emotion. While we remain interested in describing the emotion signals, to do so we needed a measurement scheme that could distinguish among all visible facial behavior. We were also interested in a tool which would allow study of facial movement in research unrelated to emotion: e.g., facial punctuators in conversation, facial deficits indicative of brain lesions, etc. With comprehensiveness as our goal it was necessary to build the system free of any theoretical bias about the possible meaning of facial behaviors.

The interest in comprehensiveness also led us to reject an inductive approach to developing FACS. Most other investigators devised their descriptive system on the basis of careful inspection of some sample of the behavior they intended to measure. While their system might contain gaps, as long as its purpose was simply to measure a prescribed sample of events it was perfectly practicable. With comprehensiveness as a goal an inductive method would require inspecting a very large and diversified sample of behavior.

We chose to derive FACS from an analysis of the anatomical basis of facial movement. Since every facial movement is the result of muscular action, a comprehensive system could be obtained by discovering how each muscle of the face acts to change visible appearance. With that knowledge it would be possible to analyze any facial movement into anatomically based minimal action units.

No other investigator has so exclusively focused on the anatomy of facial movement as the basis for his descriptive measurement system. Blurton Jones (1971) considered anatomy in developing his descriptive categories, but it was not the main basis of his measurement system. He did not attempt to provide a description of the full range of minimal actions.

Our interest in comprehensiveness was motivated not only by the diverse applications we had in mind, but by an awareness of the growing need for a common nomenclature for this field of research. Comparisons of the measurement units employed by other investigators would be facilitated if the particular units used in each study could be keyed to a single comprehensible list of facial actions. Also, a complete list of facial actions would reveal to the potential investigator the array of possibilities, so he could better select among them. And, of course, there might be some investigators who, like us, would want to measure not just some facial behavior, but all possible movement they could observe.

2. Schwartz, G., personal communication, 1976.
3. See Chapters 11 and 12 for these references, respectively.

A constraint in the development of FACS was that it deals with what is clearly visible in the face, ignoring invisible changes (e.g., certain changes in muscle tonus), and discarding visible changes too subtle for reliable distinction. In part, this constraint of measuring the visible was willingly adopted, based on our interest in what could have social consequences. In part, the constraint of dealing only with the visible was based on our interest in a method which could be applied to any record of behavior – photographic, film or video – taken by anyone. If our descriptive system included the nonvisible, we would be limited only to situations where we could ourselves attach the apparatus (e.g., the leads for EMG). The visibility constraint was also dictated by our belief that if subjects know their face is being scrutinized their behavior may differ radically. The odd results obtained by Landis (l924) may have been due to this in part (cf., Ekman, Friesen & Ellsworth 1972, pp. 79-84, for a discussion of the Landis studies). A method based on visible behavior would use video or motion picture film records, which could be gathered without the subject's knowledge.

Another limitation was that FACS would deal with movement, not with other visible facial phenomena. These other facial signs would be important to a full understanding of the psychology of facial behavior, but their study requires a different methodology. (Elsewhere [Ekman, 1977] we have distinguished a variety of static and slow facial signs contrasting the types of information they may contain with rapid facial movement.) FACS excludes visible changes in muscle tonus which do not entail movement. These changes can be measured through EMG or by having observers make global inferences about brightness, alertness, soberness, etc. Changes in skin coloration are not usually visible on black and white records. Facial sweating, tears, rashes, pimples, and permanent facial characteristics were all excluded from FACS. As the name states, the Facial Action Coding System was developed to measure only movement of the face.

Ideally, the Facial Action Coding System would differentiate every change in muscular action. Instead, it is limited to what humans can reliably distinguish, since it is used by human operators viewing facial behavior, not a machine-based classification. FACS includes most but not all of the subtle differences in appearance which result from different muscle action. The fineness of the scoring categories in FACS depends upon what can be reliably distinguished when a facial movement is inspected repeatedly, and in stopped and slowed motion.

A system for measuring visible facial movements can follow one of two approaches. The minimal units of behavior can be specified, which can in combination account for any total behavior. Or, a list of possible facial gestalts can be listed. The sheer variety of possible actions which the facial musculature allows argues for the minimal units solution rather than gestalts if comprehensiveness is the goal. There are too many different possible total facial actions to list all of the gestalts. If the method specifies facial gestalts (e.g., Young & Decaries', 1977 list of 42 facial gestalts) it cannot score facial actions which show only part of the gestalt, or actions which combine some of the elements of three or four of the gestalts.

While most investigators have listed minimal units, they were not explicit as to how they derived their list. How did they determine how many separate facial actions are possible? How did they determine whether an action was minimal or, instead, a composite of two actions which might separately appear? Usually the decision was based on a hunch, speculation about signal value, or simply what was observed in a limited sample of facial behavior. It seemed to us that an answer would come from knowledge of the mechanics of facial action. We would have to determine the number of muscles which can fire independently, and whether each independent muscular action results in a distinguishable facial appearance. Such an anatomically-based list of facial appearances should allow description and differentiation of the total repertoire of visibly different facial actions.

Some might argue that there is no need to make such fine distinctions among facial actions. Indeed, there might not be a need; many differently appearing facial actions may serve the same function, or convey the same message. There may be facial synonyms, but that should be established empirically, not on *a priori* grounds. Only a measurement scheme which separately scores visibly different facial actions will permit the research that can determine which facial actions should be considered equivalent in a particular situation.

Another consideration which guided our development of the Facial Action Coding System was the need to separate inference from description. We are interested in determining which facial behavior is playful, or puzzled, or sad, but such inferences about underlying state, antecedent, or consequent actions should rest upon evidence. The measurement must be made in non-inferential terms that describe the facial behavior, so that the inferences can be tested by evidence. Almost all of the previous descriptive systems have combined inference-free descriptions with descriptions confounded with infer-

ence; e.g., “aggressive frown” (Grant, 1969); “lower lip pout” (Blurton Jones, 1971); “smile tight–loose 0" (Birdwhistell, 1970). Each of these actions could be described without inferential terms. Since humans do the measurement, the possibility of inferences cannot be eliminated, but they need not be encouraged or required. If a face is scored, for example, in terms of the lip corners moving up in an oblique direction which raises the infraorbital triangle, the person scoring the face still may make the inference that what he is describing is a smile. Our experience has been that when people use a measurement system which is solely descriptive, as time passes they increasingly focus on the behavioral discriminations and are rarely aware of the “meaning” of the behavior.

Another problem which has plagued previous attempts to measure facial movement has been how to describe most precisely each measurement unit. Blurton Jones (1971) noted that facial activity could be described in three ways: the location of shadows and lines; the muscles responsible; or the main positions of landmarks, such as mouth corners or brow location. He opted for the last basis, although he said he used the other two as well. He decided not to base his descriptions on muscular activity because it would be “more convenient if description could be given which did not require that anyone who uses them should learn the facial musculature first, although knowledge of the musculature obviously improves the acuity of one's observations” (p. 369).

We have taken almost the opposite position. The user of FACS must learn the mechanics – the muscular basis – of facial movement, not just the consequence of movement or a description of a static landmark. FACS emphasizes patterns of movement, the changing nature of facial appearance. Distinctive actions are described – the movements of the skin, the temporary changes in shape and location of the features, and the gathering, pouching, bulging and wrinkling of the skin.

FACS' emphasis on movement and the muscular basis of appearance change helps overcome the problems due to physiognomic differences. Individuals differ in the size, shape and location of their features, and in the wrinkles, bulges or pouches which become permanent in mid-life. The particular shape of a landmark may vary from one person to another; e.g., when the lip corner goes up the angle, shape or wrinkle pattern may not be the same for all people. If only the end result of movement is described, scoring may be confused by physiognomic variations. Knowledge of the muscular basis of action and emphasis on recognizing movements helps to deal with variations due to physiognomic differences.

Development of the Facial Action Coding System

Our first step in developing FACS was to study various anatomical texts to discover the minimal units. We expected to find a listing of the muscles which can fire separately, and how each muscle changes facial appearance. We were disappointed to find that most anatomists were seldom concerned with facial appearance. The anatomy texts for the most part described the location of the muscles. Capacity for separate action or visible changes in appearance was not the basis for the anatomists' designation of facial muscles. Instead, they distinguished muscles because of different locations, or if there was a similar location they separately named what appeared as separate bundles of muscle fibers[4].

Duchenne (1862) was one of the first anatomists concerned with the question of how muscles change the appearance of the face. He electrically stimulated the facial muscles of a man without pain sensation, and photographed the appearance changes. By this means he was able to learn the function of some of the muscles. His method was problematic for exploring the action of all of the facial muscles. Many of the muscles of the face lie one over the other, and surface stimulation will fire a number of muscles. Inserting a needle or fine wire through the skin to reach a particular muscle may fire others as well.

Hjorstjo (1970) provided the most help. An anatomist interested in describing the visible appearance changes for each muscle, Hjorstjo learned to fire his own facial muscles voluntarily. He photographed his own face and described in drawings and words the appearance changes for each muscle. His aim was not to provide a measurement system, and so he did

4. We are grateful to Sherwood Washburn (University of California) for explaining why the standard anatomy texts were of so little help and for encouraging our attempt to explicate the muscular basis of facial action.

not consider many of the combinations of facial muscles, nor did he provide a set. of rules necessary for distinguishing between appearance changes which are in any way similar.

Following Hjorstjo's lead, we spent the better part of a year with a mirror, anatomy texts, and cameras. We learned to fire separately the muscles in our own faces. When we were confident we were firing intended muscles we photographed our faces. Usually there was little doubt as to whether we were firing the intended muscle. The problem instead was how to learn to do it at all. By feeling the surface of our faces we could usually determine whether the intended muscle was contracting. By checking Hjorstjo's account we could see whether the appearance on our faces was what he described and showed in his drawings. There were a few areas of ambiguity, and here we returned to a variation on Duchenne's method. A neuroanatomist placed a needle in one of our faces, inserting the needle into the muscle we were uncertain about. With the needle in place, the muscle was voluntarily fired, and electrical activity from that needle placement verified that indeed it was the intended muscle. As this method was uncomfortable, we used it rarely, and only when we were in doubt.

One limitation of this method of deriving facial units must be noted. If there are muscles which cannot be fired voluntarily, we cannot study them. This seems to be the case only with the *Tarsalis* muscle, and, as best we can determine, its action and effect on appearance are not different from those of one of the voluntarily controlled muscles, *levator palpebrae*.

Our next step was to examine the photographs taken of each of our faces, scrambling the pictures so we would not know what muscle had been fired. Our purpose was to determine if all the separate muscular actions could be distinguished accurately from appearance alone. Often, it was easy to determine, although it usually required comparing the appearance change with the resting or baseline facial countenance.

There were instances in which we found it difficult to distinguish among a set of muscles in accounting for a photograph of a facial appearance. Sometimes we could tell one muscular action from another, but the differentiation seemed so difficult that we prejudged it as not likely to be reliable. Sometimes the appearance changes resulting from two muscles seemed to differ mostly in intensity of the action, not in type of appearance. In either instance we designated and described one Action Unit which could be produced by 2 or 3 different muscles.

Note that we call the measurements action not muscle units. As just explained, this is because a few times we have combined more than one muscle in our unitization of appearance changes. The other reason for using the term Action Unit is because we also have separated more than one action from what most anatomists described as one muscle. For example, following Hjorstjo’s lead, the frontalis muscle which raises the brow was separated into two Action Units, depending upon whether the inner or outer portion of this muscle lifts the inner or outer portions of the eyebrow.

Table 1-1 lists the names, numbers and anatomical basis of each Action Unit. Most of the Action Units involve a single muscle. The numbers are arbitrary and do not have any significance except that 1 through 7 refer to brows, forehead or eyelids.[5]

The table indicates where we have collapsed more than one muscle into a single Action Unit, or where we have distinguished more than one Action Unit from a single muscle. The FACS names given in the table are a shorthand, not meant to describe the appearance changes, but a convenience to call them to mind.

5. This table applies to the first edition. AUs 41, 42, and 43 are now combined; AU 44 is 7E; 25, 26 and 27 have modified definitions.

Table 1-1: Single Action Units (AU)

AU Number	FACS Name	Muscular Basis
1	Inner Brow Raiser	Frontalis, Pars Medialis
2	Outer Brow Raiser	Frontalis, Pars Lateralis
4	Brow Lowerer	Depressor Glabellae; Depressor Supercilli; Corrugator
5	Upper Lid Raiser	Levator Palpebrae Superioris
6	Cheek Raiser	Orbicularis Oculi, Pars Orbitalis
7	Lid Tightener	Orbicularis Oculi, Pars Palebralis
8	Lips Toward Each Other	Orbicularis Oris
9	Nose Wrinkler	Levator Labii Superioris, Alaeque Nasi
10	Upper Lip Raiser	Levator Labii Superioris, Caput Infraorbitalis
11	Nasolabial Furrow Deepener	Zygomatic Minor
12	Lip Corner Puller	Zygomatic Major
13	Cheek Puffer	Caninus
14	Dimpler	Buccinnator
15	Lip Corner Depressor	Triangularis
16	Lower Lip Depressor	Depressor Labii
17	Chin Raiser	Mentalis
18	Lip Puckerer	Incisivii Labii Superioris; Incisivii Labii Inferioris
20	Lip Stretcher	Risorius
22	Lip Funneler	Orbicularis Oris
23	Lip Tightner	Orbicularis Oris
24	Lip Pressor	Orbicularis Oris
25	Lips Part	Depressor Labii, or Relaxation of Mentalis or Orbicularis Oris
26	Jaw Drop	Masetter; Temporal and Internal Pterygoid Relaxed
27	Mouth Stretch	Pterygoids; Digastric
28	Lip Suck	Orbicularis Oris
38	Nostril Dilator	Nasalis, Pars Alaris
39	Nostril Compressor	Nasalis, Pars Transversa and Depressor Septi Nasi
41	Lid Droop	Relaxation of Levator Palpebrae Superioris
42	Slit	Orbicularis Oculi
43	Eyes Closed	Relaxation of Levator Palpebrae Superioris
44	Squint	Orbicularis Oculi, Pars Palpebralis
45	Blink	Relaxation of Levator Palpebrae and Contraction of Orbicularis Oculi, Pars Palpebralis
46	Wink	Orbicularis Oculi

Table 1-2 lists an example of how each Action Unit (AU) is described in the FACS *Manual*. The description includes four types of information:

(1) The muscular basis of each AU is given in words and diagrams.

(2) Detailed description of the appearance changes are keyed to illustrative still photograph and film examples.

(3) Instructions are given as to how to make the movement on one's own face. This aids in learning the appearance changes particularly if FACS is learned by a group of people who can observe the variations in appearance on each other's faces. Learning how to do each AU also provides the user with a technique for later analyzing movements to be scored into their component parts. The user imitates the movement to be scored, noting which muscles he had to move in his own face to produce the movement to be scored. By this means the scoring of any novel, complex facial action can be determined.

(4) A rule is given specifying the minimal changes which must be observed in order to score a slight version of each AU.

Table 1-2: An Example of the Information Given in FACS for Each Action Unit

ACTION UNIT 15 – Lip Corner Depressor

The muscle underlying AU 15 emerges from the side of the chin and runs upwards attaching to a point near the corner of the lip. In AU 15 the corners of the lips are pulled down. Study the anatomical drawings which show the location of the muscle underlying this AU.

(1) Pulls the corners of the lips down.

(2) Changes the shape of the lips so they are angled down at the corner, and usually somewhat stretched horizontally.

(3) Produces some pouching, bagging, or wrinkling of skin below the lips corners, which may not be apparent unless the action is strong.

(4) May flatten or cause bulges to appear on the chin boss, may produce depression medially under the lower lip.

(5) If the nasolabial furrow[a] is permanently etched, it will deepen and may appear pulled down or lengthened.

The photographs in FACS show both slight and strong versions of this Action Unit. Note that appearance change (3) is most apparent in the stronger versions. The photograph of 6+15 shows how the appearance changes due to 6 can add to those of 15. Study the film of AU 15.

How to do 15

Pull your lip corners downwards. Be careful not to raise your lower lip at the same time – do not use AU 17. If you are unable to do this, place your fingers above the lip corners and push downwards, noting the changes in appearance. Now, try to hold this appearance when you take your fingers away.

Minimum Requirements to score 15[b]

Elongating the mouth is irrelevant, as it may be due to AU 20, AU 15, or AU 15+20.

(1) If the lip line is straight or slightly up in neutral face, then the lip corners must be pulled down at least slightly to score 15.

or (2) If lip line is slightly or barely down in neutral face, then the lip corners must be pulled down slightly more than neutral and not the result of AU 17 or AU 20.

a. A wrinkle extending from beyond the nostril wings down to beyond the lip corners.

b. The concept of Minimum Requirement was abandoned in 1992; specific intensity criteria are now used instead.

The determination of the single AUs (Table 1-1) and their description (as shown in Table 1-2) was the first step in developing FACS. The procedure of moving muscles, photographing the movement, and inspecting the pictures was reiterated with all the possible combinations of 2 AUs. There was no need to describe AU combinations which could not interact. For example, pulling the lip corners down is done by a muscle which cannot affect the muscles which control the position of the eyebrows. Two-way combinations were performed separately for the AUs controlling the brows, forehead, and upper and lower eyelids, and for those AUs controlling the lower eyelids, cheeks, and lower regions of the face.

There were a few hundred combinations to perform and examine, for only in a very few instances did we discover that two AUs could not occur simultaneously.

Study of the photographs of the AU combinations showed that most of the appearance changes were additive. The characteristic appearance of each of the two AUs was clearly recognizable and virtually unchanged. There were a few AU combinations which were not additive. The appearance change may have incorporated some of the evidence of the single AUs, but also new appearance changes from their joint action were evident. All of these distinctive combinations were added to FACS, each described in the same detail as were the single AUs.

Inspection of the photographs of the AU combinations revealed that the appearance changes may be neither additive nor distinctive, but there may be a relationship of dominance, substitution or alternatives for another AU. In dominance, the strong AU overshadows the weak one. It may completely conceal the appearance due to the subordinant AU, or it may make the evidence of the subordinant AU very difficult to detect. In order to enhance agreement in scoring, rules were established which prohibit the scoring of subordinant AUs when there is clear evidence of a dominant AU.[6]

In substitution the appearance of two different AU combinations is so similar, that in order to avoid disagreements, we designated only one of the combinations as the score to be used for either of the combinations.[7]

In alternatives, two AUs cannot both be scored because both cannot be performed simultaneously, or it is hard to distinguish one from the other, or the logic of other FACS rules does not allow scoring both. The coder determines which of the two alternatives best describes a particular action.[8]

After analyzing the pictures of all the combinations of 2 AUs, the process of performing, photographing, and then inspecting was reiterated, but this time with combinations of 3 AUs. Instead of hundreds there were thousands to so examine. Those which produced a distinctive rather than an additive combination of AUs were allotted their own entry in FACS with full descriptions as per Table 1-2. When we were ready to explore the combinations of 4 AUs, the number to consider was so great that we decided to make only selective study. On the basis of what we had learned from the 2-AU combinations and 3-AU combinations we extrapolated which further combinations were likely to result in distinctive facial movements. In total, between four and five thousand facial combinations were performed and examined. This included all the possible combinations of AUs in the upper regions of the face, and all 2-way and 3-way combinations in the lower face, plus some of the 4-, 5-, 6-, 7-, and 8-AU combinations in the lower region of the face.

The *Manual for the Facial Action Coding System* was written in a self-instructional format, to serve as an initial tutor and subsequently as a reference in scoring facial behavior. The *Manual* contains the following information:

1. Textual material describing each single AU listed in Table 1-1. Each AU is described in terms of its muscular basis, appearance changes, instructions for making the movement, and requirements which must be met for scoring slight versions (cf. example in Table 1-2).

2. The same information for each of more than 44 combinations of AUs.

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6. Dominance rules were dropped from FACS in 1992 and are not included in the current version; the description of AU interactions and the issues these interactions pose remain valid.
7. Substitution rules were also dropped.
8. Many Alternative rules were eliminated, leaving only logically incompatible alternatives.

3. A simple, less precise account of 11 additional single AUs listed in Table 1-3. Many of these AUs do not involve the facial muscles. We have not described them as finely as was done in Table 1-2.

4. Descriptors which can be used to measure head and eye position.

5. Tables comparing and contrasting AUs (or AU combinations) which differ only subtly. More than 400 such subtle differences are tabled.

6. Scoring rules based on the Dominance, Alternatives and Substitution relationships among AUs.[9]

7. A scoring sheet and a step-by-step procedure to follow in measuring a facial movement. The procedure contains a number of internal checks designed to increase inter-rater reliability.

Table 1-3: More Grossly Defined AUs in the Facial Action Coding System

AU Number	FACS Name
19	Tongue Out
21	Neck Tightener
29	Jaw Thrust
30	Jaw Sideways
31	Jaw Clencher
32	Lip Bite
33	Cheek Blow
34	Cheek Puff
35	Cheek Suck
36	Tongue Bulge
37	Lip Wipe

There are also still photographic and motion picture film examples of all the single AUs in Tables 1-1 and 1-3, of the 44 AU combinations, and the head and eye position descriptors. Additional still photographs and motion picture film examples of facial behavior are provided to practice scoring facial movement. Correct scores are given, with commentary about the source of possible errors in scoring.[10]

In addition to the *Manual*, a separate publication, Analyzing Facial Action is in preparation[11]. This describes in detail the development of FACS, reliability, validity, results from experiments using FACS, and possible areas of application. Theoretically based predictions about the particular AUs and AU combinations which signal emotions and emotion blends are also included.

9. Most of these rules do not appear in the current version of FACS. See the previous footnotes.

10. The photographs and film are now digital images and MPEG video.

11. This work was not published as described, but other works contain these materials, including the currently in print volume ***What the Face Reveals*** by P. Ekman and E. Rosenberg (Eds.), Oxford University Press, 1997.

An Example of Scoring Faces

It is not feasible in a short article and without film or video to illustrate the actual use of FACS to score a facial movement. The logic which underlies FACS can be illustrated, however, with still photographs. See the seven facial behaviors shown in Figure 1-1.

They all involve some common elements in appearance, in particular the down curve to the line of the mouth. They also differ. Analysis of these faces in terms of the single AUs involved will allow precise differentiation among them.

These seven faces include three single AUs and the four combinations among these AUs. Figure 1-A is the appearance change due to AU 15 described earlier in Table 1-2. Figure 1-B shows AU 17, described in Table 1-4; Figure 1-C shows AU 10, described in Table 1-4.

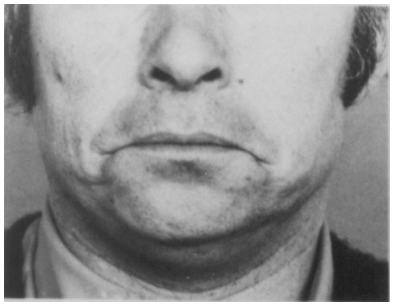
If you read these verbal descriptions matching them to the photographs, you should then be able to “dissect” the other four faces in Figure 1 into their component AUs. Figure l-D combines AU 10 and 15; Figure l-E combines AU 10 and 17; Figure 1-F combines AU 15 and 17; and Figure l-G combines AU 10, 15, and 17.

Any complex facial behavior can be so analyzed into its component elements, if the single AUs have been learned, and if rules regarding combinations have been studied. The scoring procedure leads the user to break down any action into a set of single AU scores. When he is in doubt, he is encouraged to consult the verbal descriptions, photographic and film examples, and tables of contrasting subtle differences. The person is also encouraged to imitate the action he sees, observing his own face and noting what AUs he must use in order to reproduce the action he observes.

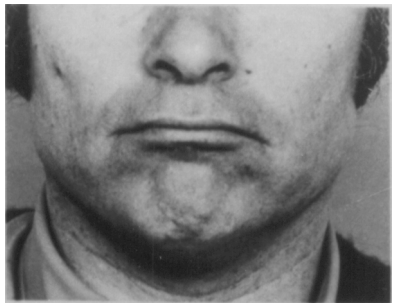
It is important not to be mislead by this example into thinking FACS is designed for scoring still photographs. FACS emphasizes movement and its chief purpose is to score facial actions seen on motion records, although it can be used with stills if there is also a picture of a “neutral” face.

It has been shown how FACS scoring differentiates the seven facial behaviors shown in Figure 1-1. They are not visibly the same. Are these seven the same functionally, psychologically, communicatively? Is one a sadness expression, another a pout, another a disbelief gesture, etc.? It is only if the facial measurement distinguishes among these behaviors that we can determine empirically how many of the distinctions are useful. Once we can measure their separate occurrence, we can examine the contexts in which the behaviors occur, or we can study preceding or consequent actions of other persons, isolate concomitant behavior in the person showing the behavior, study observers' inferences from viewing each behavior, etc.

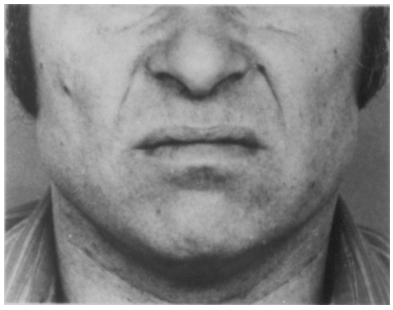
Figure 1-1: AUs 10, 15, 17, and their combinations



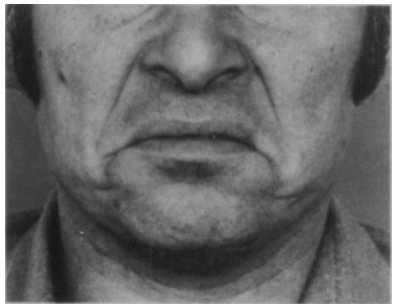
1 A



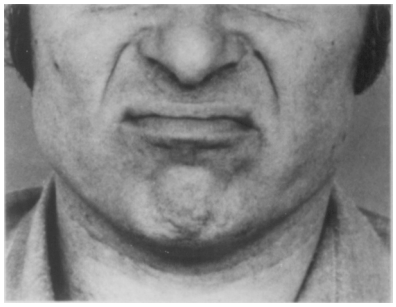
1 B



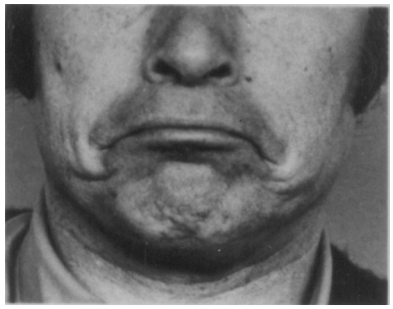
1 C



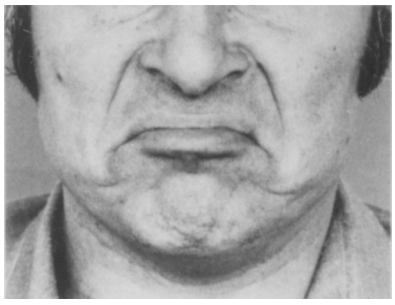
1 D



1 E



1 F



1 G

Table 1-4: Appearance Changes Due to AU 10 and to AU 17

ACTION UNIT 10

The muscle underlying AU 10 emerges from the center of the infraorbital triangle[a] and attaches in the area of the nasolabial furrow[b]. In AU 10 the skin above the upper lip is pulled upwards and towards the cheek, pulling the upper lip up.

(1) Raises the upper lip. Center of upper lip is drawn straight up, the outer portions of upper lip are drawn up but not as high as the center.

(2) Causes an angular bend in the shape of the upper lip.

(3) Raises the infraorbital triangle; and may cause the infraorbital furrow to wrinkle or deepen if it is already evident in neutral.

(4) Deepens the nasolabial furrows and raises the upper part of this furrow producing a shape as  .

(5) Widens and raises the nostril wings.

(6) When the action is strong the lips will part.

ACTION UNIT 17

The muscle underlying AU 17 emerges from an area below the lower lip and attaches far down the chin. In AU 17 the skin of the chin is pushed upwards, pushing up the lower lip.

(1) Pushes chin boss upward.

(2) Pushes lower lip upward.

(3) May cause wrinkles to appear on chin boss as skin is stretched, and may produce a depression medially under the lower lip.

(4) Causes shape of mouth to appear  .

(5) If the action is strong the lower lip may protrude.

a. Roughly the cheek area.

b. A wrinkle extending from beyond the nostril wings down to beyond the lip corners.

Concluding Comments

Six people have learned FACS. It required about 100 hours for them to learn and practice scoring. Reliability in scoring was satisfactory. The formula used was to divide the number of AU scores on which two persons agreed, by the sum of the number of AUs scored by each person. If there was perfect agreement on a facial movement the score would be 1.00. The average coefficient of agreement among all possible pairings of the 6 persons across the faces they measured was .83[12].

FACS far exceeded our initial anticipation of what would be required to provide a comprehensive descriptive system for measuring facial action. Certainly, FACS is a very elaborate system, more comprehensive than any previous system by quite a margin. There is no facial action described by other systems which cannot be described by FACS, and there are many behaviors described by FACS not previously distinguished by others. FACS allows for measuring facial asymmetries, when different AUs appear on each side of the face. FACS does not include a measure of the intensity of action for every AU, although it does so for four of the AUs listed in Table 1-1. It would be possible for others to follow the procedure used for these AUs to elaborate intensity of action scoring for the other AUs.[13]

We are reasonably confident that FACS is complete for scoring the visible, reliably distinguishable actions of the brows, forehead, and eyelids. FACS probably does not include all of the visible, reliably distinguishable actions in the lower part of the face. The hinged jaw and rubbery lips allow a nearly infinite number of actions. We have included everything we could see, everything anyone else has included, and what are probably the most common elements and combinations of actions in the lower part of the face among children and adults. As we and others use FACS, we expect that some other AUs may need to be added; hopefully, not many. Others may well be interested in more finely discriminating separate AUs from the list of gross AUs in Table 1-3.

Some will ask the question whether FACS is too elaborate, too comprehensive and detailed. We believe it has been useful to attempt an approximation of the total repertoire of facial action, to isolate minimal Action Units which can combine to account for any facial movement. At the least, FACS provides a means to cross-reference with a common nomenclature the different scoring categories used by others. It may also serve to alert the investigator as to his choices, so he may, if he so chooses, be more explicit in his decisions about what to ignore when he does his measurement. No one knows at the outset how many of the variations in facial behavior can be ignored in any research study without losing important information. In preliminary observations, or pilot studies, investigators may wish to use FACS to comprehensively measure, and then, based on these results, more selectively score only certain AUs or AU combinations in their main study.

Apart from these more selective uses of FACS, there will be some who need a comprehensive measurement system. If we wish to learn all the facial actions which signal emotion (and those that do not), or whether facial emphasis markers are the same regardless of the content of speech so emphasized (to mention just two of our current interests), then a method such as FACS is needed.

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12. More information on reliability is provided in the next chapter of this Guide.
13. Intensity scoring is now part of the scoring of almost all AUs.

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Chapter 2: *Reliability of the Facial Action Coding System*

A. Reliability Issues

The fundamental issue was whether independent persons would agree in their scoring of facial behavior. More specifically, whether persons who learned FACS without instruction from the developers would agree, both among themselves and/or with the developers.

Scoring of facial behavior requires two different operations – description and location – and thus two different reliability issues. By description, we mean what happened, what are the Action Units responsible for an observed change in facial behavior. By location, we mean when did it happen, at precisely what moment in time did whatever happened start and stop. Suppose the brows have moved. To describe the movement we would ask which type of movement it was; did the brows raise, lower, raise and draw together, did just the inner part raise or the entire brow, etc.? To locate the movement we must determine at what video frame (1/60 second) the movement, whatever it is, started and at what video frame it ended. The two questions are independent to some extent. Reliability could be high on description but low on location, or vice versa.

Our emphasis has been upon description. We believed that if we could succeed in achieving a reliable descriptive system for distinguishing what happens, it will be likely that there will be reliability in spotting when it happens. The ***Manual*** teaches description; there is no instruction on how to solve location problems, although this is considered in Chapter 11 of the ***Guide***. Most of this chapter is about description reliability. Section M. reports preliminary results on location reliability.

For either description or location, reliability can be evaluated in two terms:

(1) agreement among independent persons;

(2) agreement between a learner and an expert.

We were interested in not only whether there was intercoder agreement, but whether those who learned FACS without instruction from us would score facial behavior the way we do. Data are reported for both types of agreement. The results were about the same.

Description of facial movement with FACS involves four operations and the reliability of each can be studied:

(1) Determining which AUs are responsible for the observed movement. The coder learns how to recognize the appearance changes due to each of 44 AUs, singly and in combination. The logic of the system is that any movement can be scored in terms of which AUs produced it. Theoretically, it is possible for about 20 AUs to combine to produce a single facial movement or as few as one. (All 44 cannot combine since some involve antagonistic actions, and also the occurrence of some actions conceals the possible presence of others.) Most of this chapter is focused upon the reliability of this operation.

(2) Scoring the intensity of action for five of the 44 AUs. While intensity scoring could have been provided for each and every one of the 44 AUs, we have used intensity scoring only where we thought the magnitude of action could influence the recognition of a particular Action Unit or a related action. Intensity is scored in terms of three levels: low, medium and high. Reliability of intensity scoring is reported separately in section J.

(3) Determining whether any AU is shown on only one side of the face rather than bilaterally. Asymmetries, where an AU is bilateral but of different intensity on the two sides of the face, are not scored. While unilaterality was included in the reliability study, it was so rare that no evidence is provided about the reliability of this operation.

(4) Scoring the position of the head and the position of the eyes during a facial movement. This descriptive system is grosser than that provided for the AUs. Fourteen descriptors are provided, of which up to six can be scored for any event. Because head/eye scoring is a simpler system, agreement on it might have inflated agreement measures on the total scoring of a face. Results are therefore reported separately including and excluding head/eye position scores. In fact, it made little difference.

The last issue considered is whether agreement is substantially improved by having the independent coders arbitrate their disagreements. The agreement achieved by six independent coders (intercoder agreement and agreement with experts) is contrasted with agreement achieved by three pairs of arbitrated scores in section I. Arbitration improved agreement, but not by much.

B. The Behavior Sample

We selected behavior samples from 10 of the honest-deceptive interviews we have been studying the past eight years (Ekman & Friesen, 1974; Ekman, Friesen & Scherer, 1976). We selected the first two actions shown by the subject while she conversed about her reactions to a film she was watching, and the first two actions shown while the interview continued after the film was over. In order to increase the variety of behavior which would be subject to scoring, if the first two actions repeated an AU or AU combination already selected more than once, then the next non-redundant action was taken. By these means a total of 40 items was obtained. Six were dropped because the video picture was not acceptable, leaving 34 items.

Coders were given the videotape with the instruction to score whatever occurred within each of the 34 events. Note, that by defining each event ahead of time, giving the coders the start and stop frame within which they should score, we eliminated decisions about location and studied just description reliability.

C. The Coders

Seven persons previously unfamiliar with FACS learned FACS as a group in January-February 1977. We had minimum contact with them during this period, so that their performance can be considered a fair test of whether FACS produces reliable scoring when learned without instruction from the developers. Working about half-time it took five weeks for them to complete the FACS instructional procedure. The results reported are based on six persons since one coder did not continue.

These six coders included five women and one man. Two were research assistants who have bachelors level education. Two were doctoral candidates, one in psychology, another in linguistics. Another was a post-doctoral fellow trained in developmental psychology. The last was a visiting associate professor of clinical psychology whose native language is German.

D. Procedure

The six coders independently scored the 34 events without any communication among them. After their scoring was completed the six were grouped into three pairs and given their scores on any event where they disagreed. They were required to jointly arrive at an arbitrated final scoring.

We, Ekman and Friesen, jointly scored each of the 34 events. We then examined the scoring of the six learners, and considered whether we would want to change our scoring in light of their performance. We did so only a few times, and those decisions did not increase agreement between them and us.

E. Raw Data Matrix

Thirty-four events were scored by six independent persons producing 6 x 34=204 sets of Action Unit scores. Additionally, there are the three arbitrated pair scores for each event.

Table 2-1: Example of Raw Scores on One Behavioral Event

	Experts:	1+4+	7
	Blossom:	1+4+	7
	Kathy:	1+4+	6
	Charlotte:	4+5X+	7+10X
	Linda:	1+4+	7
	Sonia:	4+	7
	Rainer:	4+	7
Arbitrated	Bl-Ka	1+4+	7
Arbitrated	Ch-Li	1+4+	7+10X
Combined	So-Ra	4+	7

The first row is the scoring of Ekman and Friesen. The next six rows show the scoring of this event by each of the six persons. The next three rows show the arbitrated scoring of the three pairings. (Note that Sonia and Rainer agreed on this event so they did not arbitrate.) The entries are the numbers for the AUs, which is the system used to record scores. The experts scored three AUs – 1, 4 and 7 – which describe a raising of the inner corners of the brow (1), pulling the brows together (4) and tightening of the eyelids (7). There was agreement among all coders that AU 4 was present. Some did not score AU 1. One coder scored an outer eyelid action (6) rather than the inner eyelid action of 7. One coder also scored an upper eyelid raise (5X, the X means she scored it as low in intensity); and a low level upper lip raise (l0X).

F. An Index of Agreement

It was not obvious what type of measure of agreement should be employed. Reliability measures often are applied to situations where scoring involves a binary decision (present or absent) or assignment into one of a series of exclusive categories. In FACS there is a range of possible scores, from 1 to about 26 (about 20 AUs and 6 head/eye descriptors) which could be scored for any one event. There are many more opportunities for disagreement than is usually the case in psychological measurement.

We could have assessed reliability for each AU separately, determining how many times the six persons agreed about its presence or absence over the 34 items. This method, often used in reliability studies, would give as much credit to an agreement that an AU was not scored for an event, as agreement that it was to be scored. Such a method would have produced reliability scores much higher than the procedure we selected.

The index of agreement that we employed (Wexler, 1972) was a ratio calculated separately for each of the 34 events, for each pair of coders and for each coder compared to the expert scoring. The arbitrated scoring was also evaluated with the same index. The formula was:

(Number of AUs on which Coder 1 and Coder 2 agreed) X 2
Divided by:
The total number of AUs scored by the two coders

For example, if the scoring by one coder was 1+5+7+22 and the scoring by a second coder was 1+7+16, the ratio would be:

2 (Number of AUs agreed upon) times 2=4, divided by
7 (Total number of AUs scored by the two coders) =.57

Table 2-2 shows the matrix of ratios generated with this formula for the raw data shown in Table 2-1.

Table 2-2:Matrix of Agreement Ratios for the Scoring of One Behavioral Event

		Experts	**Blossom**	**Kathy**	**Charlot**	**Linda**	**Sonia**
	Blossom:	1.000					
Single	**Kathy:**	0.667	0.667				
Person	**Charlot:**	0.571	0.571	0.286			
Scoring	**Linda:**	1.000	1.000	0.667	0.571		
	Sonia:	0.800	0.800	0.400	0.667	0.800	
	Rainer	0.800	0.800	0.400	0.667	0.800	1.000
		Experts	**Bl-Ka**	**Ch-Li**			
Arbitrated	**Bl-Ka:**	1.000					
Pairs	**Ch-Li:**	0.857	0.857				
Scoring	**So-Ra:**	0.800	0.800	0.667			

The top part of Table 2-2 gives the ratios calculated for the scoring of each individual person. The bottom part of the table gives the ratios when the scoring reached through arbitration by a pair of persons was evaluated. We will use the top part of the table to illustrate how the ratio represents agreement. The first column shows the ratio when each coder's scoring was entered into the formula with the scoring of the experts. Perfect agreement (Blossom, Linda) generated 1.00 ratios. Disagreements generated lower ratios. The other columns in Table 2-2 show agreement between each pair of coders. One can see that Sonia and Rainer agreed exactly as did Linda and Blossom. The maximum disagreement was between Kathy and Charlotte.

The mathematics of this formula are such that if only one or two AUs are scored for an event, a disagreement will lower the ratio more than if six or seven are scored. If two coders disagreed about only one AU and agreed about one AU, they would earn a ratio of .50. If they disagreed about one AU and agreed about four AUs, the ratio would be .80. Even though

the disagreements in both instances about only one score, it seems reasonable that the formula rewards agreement on a high proportion of actions which are present.

We checked on how many AUs were scored for each of the 34 events by the experts. The mode was three scores for an event, with about 1/3 of the 34 events having one or two scores, and 1/3 having four to seven scores. Thus, if the absolute number of scores distorted the ratio of agreement, the 314 events produced a balanced distribution in this regard.

Two matrices were generated. One matrix is composed of the ratios derived by comparing each person's scoring of each event with the experts' scoring, generating 204 data points (6 persons times 34 events). The second matrix disregarded the experts' scoring, and calculated the ratio by comparing each person's scoring with each other person. With six persons, for each person five such ratios were generated, (comparing that person with every other person) for each of the 34 events scored. The mean of those five ratios was taken as the measure of a particular person's average agreement with others for a particular event. This yielded a second matrix which again had 204 points, with each point representing the mean ratio of agreement with the other person's for each event scored (34 events times 6 persons).

G. Overall Agreement

The mean ratio across all coders (six) and all events scored (34) was .822 when scoring was compared to experts, and .756 when intercoder agreement was evaluated. Figure 2-1 shows the distribution of the 204 ratios represented by these means. Figure 2-1 shows that the distributions of ratios were skewed towards high agreement. For example, 141 out of 204 ratios of agreement with the experts were .80 or above, and only 28 out of the 204 ratios were below .60. Figure 2-1 shows also that the distribution of ratios representing intercoder agreement was similarly skewed towards agreement, with just as few low value ratios, but not as many ratios above .80 as when agreement with experts was calculated.

H. Did Scoring Head/Eye Position Inflate Reliability?

The answer is no. Recall that the measurement of head/eye position was a grosser descriptive scheme than that of the Action Units. Agreement on what might be an easier set of decisions might have inflated the agreement ratios, concealing disagreements about the scoring of AUs. When head/eye position scores were disregarded and the ratios recalculated, the mean ratio across all coders and all events was .816 (as compared to .822 including head/eye) when scoring was compared against experts, and .745 (as compared to .756 including head/eye) for intercoder agreement. The distributions were examined and they are not noticeably different from those shown in Figure 2-1. Results reported hereafter include the head/eye position scores.

I. Does Arbitrating Differences Enhance Agreement?

The answer is slightly, but it depends upon how much they disagreed and how low their individual agreement was prior to arbitration. Presenting the coders with their disagreements and asking them to arbitrate their differences could have produced lower rather than higher agreement. Each pair after arbitrating might diverge more from the other pairs or from the experts. Instead there was a slight increase in both agreement measures.

The mean ratio across all coders and all events went up from .822 to .863 in terms of agreement with experts, and from .756 to .809 in terms of intercoder agreement. Table 2-3 shows that the benefit was negligible for the pair who had high agreement individually (Charlotte and Linda), moderate for a pair somewhat lower individually (Blossom and Kathy), and considerable for the pair where one member (Rainer) had the lowest coefficient of agreement. His gain through arbitration, however, was at the cost of a loss for the person he arbitrated with (Sonia).

Figure 2-1: Agreement Distribution

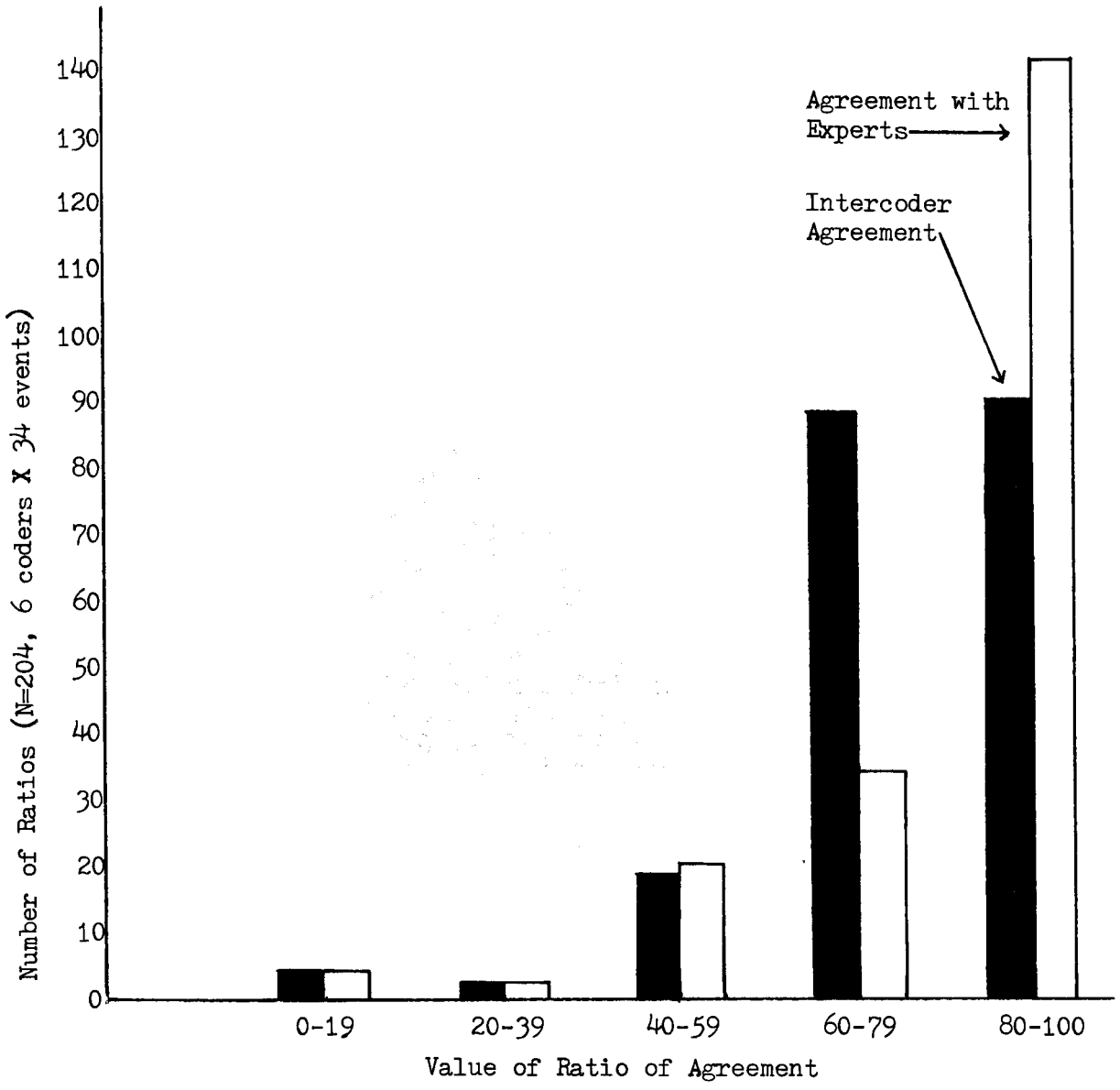

Table 2-3: Benefits of Having Coders Arbitrate Their Disagreements in Pairs

	Mean Ratios of Agreement with Experts	
	Individual Scoring	**Arbitrated Pairs**
Blossom	.782	
Kathy	.827	.869
Charlotte	.859	
Linda	.858	.886
Sonia	.973	
Rainer	.732	.833

When the same comparisons were made utilizing the measures of intercoder agreement (rather than agreement with experts as shown in Table 2-3), the values were two to three hundreths lower but the pattern was the same. For example, the mean ratio of intercoder agreement for Sonia and Rainer's arbitrated scoring was .802 as compared to .833 for agreement with experts.

Two other methods for reconciling disagreements were explored. In one, a simple flip of the coin was used to determine who was “correct” on each disagreement. Using the coin flip as the basis for saying what the final score should be for items where a pair disagreed yielded ratios of agreement with the experts that were just as high as arbitration for the coder pairs who had not disagreed much to begin with (Blossom and Kathy; Charlotte and Linda). For the pair which included the one coder who had shown the lowest agreement with the experts (Rainer) a coin flip did not yield as much increased agreement as did arbitration. Another method for resolving disagreements was to apply a set of logical rules to determine who was “correct” for any events where a pair disagreed. These rules benefitted the pair who most disagreed (Sonia and Rainer) as much as did arbitration.

J. Agreement About Intensity

The data analysis so far has ignored any disagreements about intensity. Such disagreement could have occurred on the scoring of only five of the 44 AUs, since FACS provided for intensity scoring on just those few AUs. There were 19 instances in which the experts had scored one of the intensity-AUs, providing 114 opportunities for agreement (6 coders times 19 instances).

Exact agreement about intensity was reached on 55% of these scores. Recall that intensity involved a three-point scale. There were no two-point disagreements; instead about half the disagreements were one-point disparities, the other half were when one person entirely missed scoring an intensity-AU that had been scored by the experts at the low intensity level.

The scoring of the pairs of persons who had disagreed on intensity were subject to arbitration. Arbitration enhanced agreement with experts. Exact agreement about intensity rose to 74%.

Recall that the data reported in section G., H. and I. had disregarded disparities in intensity scores. The agreement ratios for each of the six coders compared to the experts' scoring were recalculated considering a disagreement about intensity as a total disagreement. The mean ratio across all six persons and all 34 events was .778 when a difference on intensity was considered an error, as compared to .822 when intensity disagreement was ignored. Of course the reason why the ratio of agreement did not decrease further was that there were not that many instances where intensity could be scored. In another

behavioral sample, in which there was a preponderance of behavior involving AUs where intensity could be scored, the ratios of agreement might be lower.

K. Representativeness of the Behavior Sample

The scores were tabulated for each AU across all coders and all events to provide a picture of the extent to which the behavior sample offered opportunity for testing the reliability of all the AUs. For this tabulation we considered not only whether an AU was scored, but also whether an AU was considered, even if not scored, during the coders' step-by-step scoring procedure. (Such information is readily retrieved from the scoring sheets on which the coders recorded every AU considered.)

Twenty-five out of the 44 AUs were scored or considered many times; 19 of the AUs each were scored or considered less than ten times. These 19 AUs are probably rare occurrences in most conversations between adults; for example, sticking out the tongue, tightening the platysma muscle, sucking the lips in to cover the teeth, puffing out the cheeks, etc. While we cannot generalize from this study to the reliability which might be obtained if the behavior scored included such actions, there is no reason to suspect that reliability would be lower. Quite the contrary, the classification of many of these infrequent AUs probably involves an easier set of discriminations than is required for the AUs which were often considered and scored in this study.

L. Errors in Scoring Particular Action Units

The purpose of this examination was to determine (a) if there were more errors in the scoring of some AUs than others, (b) if frequent errors were primarily failing to score an AU versus substituting another AU for the correct one, and (c) if frequent errors were the product of only one or two persons or the entire group of coders. The number of times each AU was not scored by a coder but was scored by the experts was tallied, as was the number of times each AU was scored by a coder when it was not scored by the experts. Errors were fairly evenly distributed across the entire group of AUs, with no pattern as to the type of error or who made the mistakes, with the exception of five AUs. These five AUs (out of 44) accounted for a third of all errors.

Two of these high error AUs involve the muscles orbiting the eyes. In agreement with anatomists, FACS distinguishes *orbicularis oculi* into two Action Units, one AU referring to the involvement of the *pars palebralis* (AU 7) and the other referring to *pars orbitalis* (AU 6) (the inner and outer portions respectively). The errors involving these two AUs for the most part were substitutions of one for the other. We are doubtful that it will be possible to decrease errors on this discrimination, since the distinction is frequently a subtle one.

Two of the high error AUs involve muscles which reach down from the upper portion of the face to raise the upper lip. In agreement with anatomists, FACS distinguishes between *Levator Labii Superioris Caput Infraorbitalis* (AU 10) and *Levator Labii Superioris Alaeque Nasi* (AU 9). Here again, most of the errors involved substituting the scoring of one for the other. Since this also can be a subtle distinction additional instruction or training would probably not decrease errors substantially.

The last high error AU involves a muscle or muscle group which stretches the lips horizontally. Anatomists disagree about whether this action (AU 20) is due to *Risorius*, *Buccinator*, or some strands of *Platysma*. Most of the errors involved a total failure to score the AU (when it was scored by experts) rather than a substitution. With this AU, further instruction or training might be beneficial. Those using FACS should be attentive to providing more practice on AU 20 and monitoring reliability on this action.

Errors were found to be distributed across the six persons rather than made disproportionately by any one person. Note also that even with the high error AUs reported above, in the majority of instances the learners scored the high error AUs correctly (in agreement with experts).

M. Reliability in Location of Facial Action

In section A. we distinguished between two aspects of measuring facial action – description (what happened) and location (when something happened). The ***Manual*** deals with description and provides no instruction about location. In section B. we explained that the learners in their practice and in this test of reliability were not required to locate actions but only to describe them. We, the investigators, located a series of events for them to score the AUs responsible for the event.

Let us now consider the issue of location, the reliability of determining when an action occurs. Preliminary information is available from a dissertation by Sonia Ancoli (1978), one of the six people who had learned FACS. In Ancoli's experiment, subjects sat alone in a room and watched two films. One film showed scenes which other subjects had rated as causing pleasant feelings. The other film had been rated as producing feelings of disgust and fear. The subjects were monitored on EEG, heart rate, EMG on skeletal muscles, and respiration. In addition, a videotape was made of their faces. Ancoli scored all of the facial behavior shown by 35 subjects, a total of three minutes during a pleasant film and two minutes during the unpleasant film for each subject.

Reliability was evaluated at two points in the study. After the first ten subjects had been scored by Ancoli, she randomly selected the facial behavior during one of the two films for each subject. This sample was then scored by a second person (Linda Camras, another one of the people who had recently learned FACS). Later, a second sample was drawn, selecting a 30-second period from the video records of each of the 25 remaining subjects. Again, Camras scored the randomly selected sample.

Location, unlike FACS description, can be regarded as a binary decision – something is happening or not at each frame in time. The decision should be easy with a large facial movement or when the face is completely still. It should be difficult when there is a very small movement. FACS provides a set of minimum requirements for the amount of change which must occur before a movement can be scored. The most difficult decision, and the main opportunity for disagreement is when there is a small movement and the person must evaluate whether it is sufficient to meet FACS requirements for scoring. If it does not, the coders treat it as a no-movement.

When occur versus no-occur decisions are made point-by-point in time, a common way to assess reliability is to determine for each point in time whether two independent persons agree. Agreement is then represented as a percent of total time considered. Each 1/10 of a second was so examined. In sample 1, the two coders agreed (as to whether or not something was occurring) 89% of the time. In sample 2, the two coders agreed 95% of the time. This calculation gave equal credit to agreement that nothing happened, as to agreement that something happened. If the sample contained long periods of time in which the face was inactive, this measure of location agreement would be inflated. In sample 1, the face was totally inactive or not scorable (action but not meeting the Minimum Requirements demanded by FACS) 69 percent of the time; in sample 2, the face was inactive or not scorable 66 Percent of the time.

There is of course quite a difference between agreement that nothing has occurred, and agreement that something has occurred but it is unscorable (does not meet the Minimum Requirements specified by FACS). Agreement about an unscorable action should represent the most difficult location decision. Since Ancoli's study we have added a new Action Descriptor to FACS for unscorable actions. If this had been available in Ancoli's study it would have been possible to calculate the percent of time two coders agreed: (a) that a scorable action occurred; (b) that an unscorable action occurred; (c) and that no action occurred. Now that unscorable actions have been included in the scoring procedure, in future studies using FACS, we recommend that location agreement be so examined. It will then be possible to isolate disagreements where one person said the action was scorable and another called it unscorable, and instances where one person said the action was unscorable and the other recorded no action. In either case, additional instruction can be given to increase location reliability if a consistent pattern is found, consistent for a particular coder or a particular AU.

Another way to examine agreement about location, which avoids the problem of inflating the estimate by agreements on the absence of action, is to examine the occurrence of complete disagreements. The worst error in location is when one person scores an event which the other failed to score (either because they missed the event entirely or judged it as not reaching the minimum requirements dictated by FACS). In sample 1, such complete disagreement occurred with 18.4% of the behavior scored; in sample 2, such complete disagreement occurred with 12.9% of the behavior scored.

Location reliability can be studied in more detail by examining exactly how closely coders designated when an event began and when it ended. Table 2-14 shows that information.

Table 2-4

	Percent of Total Events Located					
	Agree on Beginning		Agree on End		Agree on Both beginning & End	
	within 1/10 sec.	within 1/2 sec.	within 1/10 sec.	within 1/2 sec.	within 1 sec.	within 2 sec.
Sample 1	25.0	59.1	13.6	38.6	47.7	68.2
Sample 2	64.5	74.2	61.3	67.7	74.2	74.2

The percentage of agreement used the total events scored by both (including events seen by only one) as the denominator. Agreement was higher for judgments of when an action began than for judgments of when it ended. Agreement was higher in sample 2 than in sample 1, perhaps because of experience. The last two columns in Table 2-4 show the percent of events where both persons agreed within one second and within two seconds on both the start and stop of an action. A high percent agreement was found in sample 2.

N. Another Look at Description Reliability

Ancoli's dissertation allows another opportunity to study the reliability of the FACS description. Table 2-5 reports the ratios of agreement (calculated as explained in section F.) for the two behavior samples.

Table 2-5: Description Reliability Ratios of Agreement

	Including events scored by only one	Including events scored by both	Including only events scored by both – excluding events they agreed were not scorable
Sample 1	.722	.878	.815
Sample 2	.791	.909	.824

The first column shows the mean ratio when the events scored by only one coder was included in calculating the mean across all events. For those events scored by only one coder, the ratio was zero. Thus, the first column allows disagreement about location to lower the measure of agreement on description. The second column included in the calculation of the agreement ratios only events scored by both persons. These ratios include agreements that in certain instances there was no scorable facial action. That is, of course, an important type of agreement, but it is not the same as agreement about how to describe what is present. In the third column the ratios were calculated excluding items in which both coders agreed that the event was a no score or neutral action. The figures in the third column are directly comparable to the ratios reported earlier for inter-coder agreement among 6 persons, since in that reliability test no neutral events were included in

the behavior sample and the ratios are not deflated by disagreements about location. Agreement remained about as it was for the learners described in section H.

Now that FACS provides an unscorable action descriptor, it is possible to analyze description reliability with one further refinement not shown in Table 2-5. Agreement ratios would be calculated for all events considered scorable or unscorable by one or the other of the coders, excluding from the ratio only agreements that no action had occurred. These ratios would give credit for any agreements that unscorable activity occurred. Since that represents a difficult decision, it seems sensible to include such agreement in at least one of the measures of description reliability.

0. Summary and Discussion

The description of facial action in terms of the Action Units responsible for an observed behavior change appears to be reliable. Importantly, high reliability was found for persons who learned FACS using self-instructional materials without tutoring by Ekman or Friesen. Reliability will, of course, vary with the type of facial behavior which is measured. In both sampling situations – behavior during conversation and while silently viewing films – reliability of FACS description was high.

One area where description reliability needs improvement is in the scoring of the intensity level of an Action Unit. Such intensity differentiations are allowed on only five of the 44 AUs. The intensity differentiation is limited to three levels. While there was never an instance in which there was a two-level disagreement, there was disagreement on almost half of the intensity scoring. With arbitrated scoring, agreement reached 74%. Note also that when disagreements on intensity were regarded as a total disagreement, the measure of agreement still remained high.

The reliability of locating a facial movement, i.e., designating its onset and offset, is encouraging, since the problem was not explicitly addressed in the FACS Manual and since learners were not given practice on locating facial actions. The agreement reached on location would be satisfactory for many studies, e.g., using facial behavior as a criterion measure to differentiate responders versus nonresponders to a treatment, comparing changes in facial behavior with change in heart rate or some other measure which is scored in 1/2 second units. Agreement on location needs to be improved to study such issues as the internal organization of facial actions, or to differentiate micro- from macroexpressions. Suggestions about how to measure location are discussed in Chapter 11 of this Guide.

References

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Chapter 3: *Behavior Records Required for Using FACS*

FACS describes appearance changes both in terms of movement of the face and configuration at the point when the movement reaches its apex (the point of maximum action). FACS was designed for measuring facial action where there is a motion record, film or video. It can also be applied to still photographs if there is a baseline photograph, showing no observable action, for comparison. The scoring of still photographs, however, is more difficult and vulnerable to more error than the scoring of movement records.

FACS should not be used without a record of behavior to allow repeated and, if it is a movement record, slow motion observation. Repeated viewing is necessary in order to reliably observe differences on the two sides of the face. It is also necessary to attend to changes in the brows and eyes, as well as in the lower part of the face. Even within a facial area repeated viewing is often needed if the action is complex, in order to determine how many different Action Units were involved. Slowed motion viewing is often necessary to observe certain changes in order to decide if an action occurred at all, or whether the changes are due to one or another Action Unit. Often small actions must be viewed repeatedly at real time, because in slowed motion the action may not be visible. We have not done a study to prove that reliability is poor when FACS is used at real time, but we have a wealth of experience which overwhelmingly suggests that FACS requires too many distinctions to be used for real time scoring without substantial modification.

FACS is easiest to apply if the camera provides a head-on view of the face being scored. It is possible to use FACS with a three-quarter view, and even with a profile view, but then the scoring is only of the visible side of the face. Shooting from above or below the subject may obscure some Action Units but our exploration of head and eye position does not suggest that many become undetectable. Chapter 9 in the Manual provides a simple system for scoring changes in head and eye position if the baseline position is head-on. It also describes the particular Action Units which become unscorable if there is a major deviation in up or down position of the head.

The more detail the picture of the face provides the less the strain in using FACS. It is hard to specify what the minimum size of the picture should be, since the lighting and quality of the lens, and other technical factors affect the resolution of the picture obtained. If one utilizes inexpensive 1/2 inch videotape equipment and cameras with normal room lighting, a very acceptable picture of the face can be obtained with one camera if the picture is shot from the waist up. If two cameras are multiplexed onto one videotape recorder, half the screen can be used for just the face, and the other half can show the full face and body. If 16mm film is used, and the picture shows the full face and body from toes to the top of the head, it will be a strain to score certain of the Action Units: 5, 7, 11, 23, 24 and 28, and slight level of activity for the others. These guidelines for video developed from experiences with 1970's era half-inch videotape. Today's higher quality analog and digital imaging equipment afford much greater flexibility and expanded possibilities.

If you have a doubt about whether your record of facial behavior is suitable for FACS scoring, or for scoring all of the Action Units in FACS, you can make a test. Make a recording of yourself in exactly the situation in which you intend to gather records. Be certain that the camera, lens, lighting, distance, etc., are exactly as they will be for your research records. Voluntarily perform each of the Action Units, starting with the smallest possible movement you can do, and slowly increasing it until you reach a very strong action. (In learning FACS you will be instructed how to make each Action Unit voluntarily, and over time you will become adept at performing these actions – this is further explained in Chapter 4 of this Guide.) At the moment you start each Action Unit performance you should make a visual signal (moving a hand) which will be easy to see. Inspection of this test videotape will show if all the Action Units are visible under your

circumstances. Or, it may show that you need to eliminate certain Action Units from consideration in the scoring of your records.

In some situations where you intend to apply FACS to measure facial behavior it may be possible to obtain the cooperation of the subjects after the records are collected to obtain examples of the subjects' voluntary performance of certain AUs. These could be helpful in providing anchor points for scoring intensity of an action, including extreme versions of an AU. If your subject has difficulty performing an action you may want to show him the FACS film illustrating the AU, asking him to imitate it, perhaps observing his own performance in a mirror. Obviously you would do this after the records have been collected, and in many non experimental situations such performances would not be obtainable. FACS has been designed assuming that you do not have the benefit of such information on each person whose face is scored.

Note: Since this chapter was originally written, more detailed specifications for recording behaviors have been compiled, for example, see Harald G. Wallbott. Technical Appendix. Audiovisual recording: procedures, equipment, and troubleshooting. In K. R. Scherer & P. Ekman (Eds.) Handbook of Methods in Nonverbal Behavior Research. Cambridge: Cambridge University Press, 1982.

Chapter 4: *Training Procedure*

Chapter 1 of the ***Manual*** explains why it is important that the coder learn how to perform each AU and AU combination on his own face when learning FACS. This will provide:

- an opportunity to learn the mechanics of facial action;
- knowledge of the idiosyncrasies in appearance changes associated with each AU by comparing one's own performance with that of others who are also learning FACS, as well as with the film and photograph demonstrations of each AU;
- a tool to use to confirm the score for a face, by imitating the action observed, and verifying that the AUs needed to visually duplicate the facial action being scored is the list of AUs scored for that action.
- a tool to determine how to score facial actions the scorer cannot analyze by following the scoring steps outlined in Chapters 3 and 10. Imitation can help to determine what AUs are responsible for an appearance change.

Most of the AUs are easy to perform if the coder uses a mirror, studies the anatomical illustrations and follows the instructions. Some AUs are difficult, and it is necessary to encourage the learner to persist in his attempts. As the student proceeds and acquires mastery over the other AUs, the ones which were initially difficult will become accessible to voluntary performance. In our experience virtually all coders have been able to learn virtually all the AUs.

It is important that at least two people learn FACS together.[1] Joint learning will provide:

- the opportunity to see idiosyncrasies in how an AU appears on individual faces;
- the likelihood that if one person cannot perform an AU initially that another person can; seeing the other person do it will help the one having difficulty;
- the likelihood that if one person does not understand an explanation or distinction another person will;
- opportunity to continually monitor reliability in practice scoring, focusing attention on anyone who consistently errs from the rest of a training group.

Don't rush through the chapters of the ***Manual***. Chapter 2 is the hardest chapter, because it first acquaints the coder with the use of terminology and the logic of FACS. Take ample time to study Chapter 2 before proceeding to Chapter 3. Be certain the video illustrations and images have been studied, as well as the Subtle Difference Table. Let the coders practice by having one of them do an AU or AU combination, while the others try to score it. Don't be discouraged by how long it takes to learn Chapter 2. It will get easier.

Chapter 3 in the ***Manual*** describes a step-by-step scoring procedure. It is purposefully constructed to be a slow process with many built in checks. Be certain the coders follow this procedure. Later in Chapter 10, they will learn some short cuts they can use. After they have scored the practice items give the correct answer and information listed (Chapter 7 in this Guide) for the upper face. Do not let the coders keep their scoring, as they will be required to score the upper face on these practice items again later.

1. The number of FACS Manuals purchased must equal the number of people who simultaneously use the Manual in order to comply with the license agreement and copyright law.

One Score Sheet should be used for each practice item by each coder. The Score Sheets follow the logic of the scoring procedure in Chapters 3 and 10 and will remind the coder of what he should do. By using the Score sheets it will also be possible to determine if a particular AU was considered or not, and why it was rejected if it was not included in the final scoring. Once FACS has been learned, you may or may not want to continue to use the Score sheets. It may seem a waste of paper and it does take additional time to use them, but it may well serve to enhance reliability and does provide the basis for analyzing any consistent errors.

Chapter 8 of this ***Guide*** provides information about how a group of six coders fared in their practice scoring. It allows you to compare yourself and those you are training with a group who succeeded in learning FACS and achieved reliability. You can determine whether you are making the same types of errors, and if you are making the same number of errors. If you are making more errors you should spend more time in study and practice scoring.

After the coders have restudied Chapter 2 in the ***Manual*** to clarify any confusions revealed in their scoring of the practice items, proceed to Chapter 4. After they have mastered Chapter 4, they should read Chapter 10 which gives the scoring procedure for the lower face, and repeats the procedure for the upper face. They should then score the items listed at the end of Chapter 4.

Discourage coders from thinking or talking about the meaning of AUs or AU combinations. It may be tempting at first to think of emotions, for example, but it is quite possible for them to become absorbed in describing behavior, which is enough of a task. In time, they should become so absorbed that they think of facial action in terms of the AU numbers forgetting about meaning entirely.

Chapter 5: *Materials in the Facial Action Coding System*

The System is composed of the following parts:

1. Manual
2. Graphic, Image, and Video Illustrations of Action Units
3. Score Sheet
4. Image and Video Practice Items
5. Answers to Practice Items
6. Norms on Learners' Progress
7. Computer Program
8. Final Test of Scoring (available separately)
9. Investigator's Guide

1. Manual for FACS: A 370 page self-instructional text.

Chapter 1: Introduction to Facial Measurement: Explanation of terminology for referring to facial areas, wrinkles, etc. and an overview of learning FACS.

Chapter 2: Upper Face Action Units: AUs which change appearance in brow/forehead and eyelids.

Chapter 3: Scoring Procedure: A step-by-step scoring procedure for applying FACS to scoring facial actions.

Chapter 4: Up/Down Action Units: Explanation of AUs in the lower face which move the face in an up/down direction.

Chapter 5: Horizontal Actions: Explanations of AUs in the lower face which produce horizontal movement.

Chapter 6: Oblique Action Units: Explanation of AUs in the lower face which move the face in an oblique direction.

Chapter 7: Orbital Actions: Explanation of AUs in the muscles which orbit the lower face which are produced by the mouth.

Chapter 8: Miscellaneous Actions: A number of actions in the lower face are explained in less detail than those in previous chapters.

Chapter 9: Head and Eye positions: A procedure for describing head and eye position is explained, and how head and eye position may affect the scoring of the previously learned AUs.

Chapter 10: Scoring procedure: Summary presentation of scoring procedure to use in scoring upper face, lower face, miscellaneous and head/eye position.

Chapter 11: Advanced Scoring Techniques: Scoring during speech, events, asymmetry.

Each AU and AU combination in Chapters 2, 4, 5, 6, 7, and 8 is described in terms of:

1. The anatomical basis of each AU.

2. A detailed verbal description of the appearance change resulting from each AU or AU combination.

3. Instructions about how to perform the AU on your own face.

4. Guidelines for scoring the intensity of each AU or Combination.

The ***Manual*** also includes two sets of tables. Reference tables explain how to score AUs when the one AU conceals or enhances the presence of another. Subtle Difference Tables compare and contrast AUs and AU combinations which are most difficult to distinguish.

2. FACS Illustrations

A. Anatomical illustrations of the muscular basis of each AU. There are ten such drawing and photographs included in the text of the ***Manual***.

B. One hundred thirty five reference example images of AUs and AU combinations described in the ***Manual***.

C. MPEG digital video reference examples of AUs in motion showing each AU and each AU combination in the ***Manual***.

3. Scoring Sheets

A Score Sheet to use in coding is available, which is keyed to the step-by-step procedure. The Score Sheet lists certain rules to facilitate scoring. One Score Sheet is used for scoring each facial event.

4. Practice Items

Practice images and digital video are provided for the learner to score after he has studied chapters 2, 3, 4, 5, 6, 7, and 8. Forty-six still photographs are provided which show facial actions by nine different people. Forty-seven actions are shown on MPEG digital video, showing facial actions by five different people.

5. Answers to Practice Items

The correct answer to each practice item and commentary on possible errors is included in Chapter 7 of the Guide.

6. Norms on Learner's Progress

Norms are provided which allow the learner to compare his progress on each set of practice items with the performance of six people who later achieved high reliability when they completed FACS. These data are given in Chapter 8 of the Guide.

7. Computer Program

A computer program can be used in scoring, for the coder to determine whether his scoring of a face has violated any of the rules built into FACS, to determine the accuracy of practice scoring, and to facilitate comparisons between coders in their scoring of faces.

8. Final Test of Scoring

This digital video contains excerpts from conversations. By scoring this videotape a learner or group of learners can compare their scores with those of the FACS developers and the norms on six other learners. Commentary is provided on sources of errors. See Chapter 13 in this ***Guide*** for details on obtaining and using this test.

Chapter 6: *FACS Score Checker Computer Program*

The purpose of the FACS Score Checker computer program is to compare scores for the practice images and video to the criterion scores in Chapter 7 of this Guide[1]. It provides a more structured alternative to visual inspection of the correspondence between the trainee's scores and the criterion scores, and contains features that help the trainee to learn the scoring notation and to avoid errors. Using the program separates practice score checking for a particular chapter from reading Chapter 7, which contains all the answers to all chapters, and preventing premature knowledge of the answers to items. It also provides a quantitative measure of the success in learning to score with FACS. The program can also be used after training to enter any FACS scores into a machine readable file, suitable for subsequent processing by other applications, such as FACSAID. FACS Score Checker is written in Java ®[2] and so can run on any computer on which the appropriate Java runtime can be installed.

The instructions for using the FACS Score Checker are contained in the help file for the program, which can be accessed from the Help item on the program's menu bar or by using a Web browser to read the **help.html** file on the CD ROM in the Checker directory. These instructions are not repeated here, but are summarized only briefly. This chapter contains installation instructions, operational alternatives, details of the program's score checking ability, how the output is calculated, and other aspects of the program not directly related to it operation by the end user.

Installation of Java Runtime

The first step in running the FACS Score Checker is to install a Java runtime on your computer. You may already have a Java runtime installed, either in the form of the JRE or the SDK[3], in which case, you only need to verify that it is a version that supports the Java 2 platform. If you need to install a Java runtime, the CD ROM contains versions in English for various flavors of the Microsoft's Windows ®[4] 32-bit operating system (Windows 3.1 does not work with the required version of Java) and the Linux ®[5] operating system in a RedHat Package Manager[6] file. You can obtain other versions of the Java runtime or JDK free from Sun's Web site: http://www.sun.com in some other languages, packaging formats, or for the Solaris operating system. You can obtain a Java runtime for other operating systems from their respective vendors,

1. Readers of the original Guide might remember that Wallace V. Friesen wrote three programs in FORTRAN on Hollerith cards for use on an IBM mainframe computer that processed various aspects of entering, validating, and comparing FACS scores. These programs provided many of the ideas for the functions of FACS Score Checker, but some of the original functions are not available in FACS Score Checker, either because they are no longer relevant or because of time and effort constraints.
2. Java is a registered trademark of Sun Microsystems Inc.
3. The JRE is the Java Runtime Environment, the essential program required to run Java applications. The Java 2 SDK (JDK in earlier versions) is the Java Development Kit used to develop Java application programs. Either or both of these may already exist on your computer.
4. Windows is a registered trademark of Microsoft Corporation.
5. Linux is registered trademark of Linus Torvalds.
6. RedHat and RedHat Package Manager are registered trademarks of RedHat.

e.g., for OS/2 ®[7] from IBM's OS/2 Web site[8] or for Macintosh[9] from Apple's Web site[10]. The versions of the JRE included on the CD ROM are particularly convenient if you do not have a fast Internet connection to download them.

To install the Java runtime from the CD ROM, go to the Java directory on the CD ROM, change to the directory for the operating system you are using, and install the runtime according to the specific instructions for your operating system. If the operating system you are using is not included on the CD ROM, go to the Web site of the vendor for your operating system, find their JRE or SDK implementation, download it, and follow their installation instructions. For the Windows version on the CD ROM, execute the file using a command line, the Explorer, Start Menu, etc. For the Linux RPM file, install by using the rpm command from a terminal session or use a tool such as GnoRPM. If you are using Windows or the Macintosh, you should be ready to start the FACS Score Checker program after completing this installation. If you are using Linux, OS/2, or a UNIX[11] operating system, you may have to adjust some environment variables after completing the runtime installation, according to the instructions for your operating system, which can be found in the runtime installation directories. Installing the JRE may require that you agree with the terms of Sun's licensing policy.

Running FACS Score Checker

You can run the FACS Score Checker from the CD ROM or copy it to your computer or any networked computer and then run it from there. To run it from the CD ROM, use a command window to change directory to the Checker directory on the CD and enter the command:

java -jar checker.jar

or set up a script or visual program object to emulate this procedure, following the procedures for your operating system. On certain versions of some operating system (e.g., Windows and Solaris) the checker.jar file can be executed by clicking on its iconic representation (consult your operating system documentation). If you copy the program to another disk, you will have to change to the directory in which you put it to run the program.

The general procedure in using FACS Score Checker is to enter in the appropriate text boxes an item identifier (for practice, the practice item number) and the score for the item, and then check the score for common errors. FACS Score Checker uses the "Plus" format score notation, similar to that in the instructions in the Manual for writing a final FACS score when completing a scoresheet. Unlike the recommended handwritten version, the program waives some rules, so a score entered in the text box should following guidelines:

- Use only valid AUs, prefixes, and suffixes.
- The prefix-AU-suffix sequence should contain no spaces, although the program is robust in ignoring irrelevant spaces when it can infer the likely meaning (e.g, 1 b +l 2 c + 4 d + L 2 0 c equals 1B+L2C+4D+L20C).
- Separate each AU from others by only one plus (e.g., 1B+2C+4D+L45).
- Spaces outside the the prefix-AU-suffix element are irrelevant (e.g, 1b +l2c + 4d equals 1B+L2C+4D).
- It does not matter what order you write the AUs (e.g., 10D+1C+25B+4B) — they are ordered by the program (thus becoming, 1C+4B+10D+25B).
- Case does not matter (e.g., r2c equals R2C).

When the user checks the score for errors, the program looks for the following specific problems:

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7. IBM and OS/2 are registered trademarks of International Business Machines Corp.
8. At the time of writing, http://www-06.ibm.com/developerworks/java/jdk/JREsite.html or by searching on "Java runtime environment for OS/2."
9. Macintosh and Apple are registered trademarks of Apple Computer.
10. At the time of writing, http://developer.apple.com/java/classic.html or searching on "MRJ."
11. UNIX is a registered trademark of The Open Group.

- the validity of the AU, e.g, ‘97’ is not a valid AU;
- the validity of any prefix for the AU, e.g., ‘C’ is not a valid prefix;
- the validity of any suffix (intensity) for the AU, e.g., ‘X’ is not a valid intensity or suffix;
- malformed scores, such as a score that contains two consecutive pluses, or an illegal character;
- a particular AU appearing twice or more in the score (an AU can appear only once in a score);
- incompatible AUs, e.g., Neutral (0) cannot be scored with other AUs, or violations of Alternative Rules such as 5+43;
- inconsistency if an area of the face is scored as not visible (70, 71, 72, 73), and there are other scores for that area

FACS Score Checker does not enforce requirements to score intensity. Intensity should always be scored during practice scoring. If intensity is not scored, the comparison with criterion will reflect the omission. Other scoring tasks after training have variable intensity scoring requirements, and a strict intensity scoring requirement would prevent using the program outside practice score checking.

If there is an error in the score, a message pops up explaining the error, which can then be corrected. Some errors may be syntactical or logical and can be resolved by referring only to the notational rules, but other errors may require review of the recorded behavior to correct the score. If there are no errors in the score, it is placed in the list of validated scores.

When the FACS score is placed in the list of validated scores, it is written in correct AU-order with capitalized prefixes and suffixes and no spaces. The scores in the list follow the rules of FACS notation and have valid AUs, prefixes, and suffixes. The scores are ready to be compared to the criterion scores or saved in a file or exported to plain text. The program has methods to edit, delete, and move scores in the list, and is designed to protect against the introduction of inadvertent errors into the scores in the list.

Students can compare their own scores at a time convenient to them, or the instructor can collect the scores students have stored in files and analyze them at a specified time, such as a class deadline. The instructor can disable the ability of the trainee to compare scores by removing the answer file, answers.ser, from the Checker directory when copying this directory to another file system. This flexibility is intended to accommodate different training requirements, such as situations where someone learns FACS alone versus participating in a group of trainees supervised by an instructor.

Checker Output

The program produces several statistics in two sections comparing the trainee’s scores with the criterion scores. The first part of the output shows the comparison in regard to each practice item scored, and the second in regard to each AU scored. The first section makes evident any difference between the coder’s score and the criterion score. For each item, a table shows the criterion score and the trainee’s score in which all the different AUs in the two scores occupy different columns, allowing the reader to see easily what AUs were scored in both (the “hits”), what AUs in the criterion score were not scored by the trainee (the “misses”), and what AUs the trainee scored which were not in the criterion (the “adds”). A second table presents statistics that quantify the accuracy of the coder. The “agreement index” is the standard statistic for agreement in FACS scoring, calculated by the formula:

$$\frac{\text{the number of exact agreements on AUs by both coder and criterion times 2}}{\text{the sum of the number of AUs scored by the two coders}}$$

This calculation is the same as the agreement ratio explained in Chapter 2 of this Guide, and ranges from zero for no agreement to 1.0 for perfect agreement on the AUs scored. The entries following in the table show the number of hits, misses, and adds from which the agreement index is calculated. These statistics show what items are difficult for the coder. They do not take account of any prefix or suffix that may have been scored with an AU.

If the training is conducted in a group, each difficult item should be discussed by the group of learners to examine the reasons why an AU was added or missed. Scoresheets should be reviewed by the coder to see if carelessness was responsible for the error or, as most often will be the case, to clarify the essential cues required to score an AU.

The second part of the comparison evaluates accuracy in regard to each AU involved in the scores. Each different AU scored in the trainee's scores and the criterion scores is listed with statistics that show how well the trainee is scoring particular AUs. The first entry in the table is an agreement index calculated for the particular AU, followed by the hits, misses, and adds. These statistics should clearly indicate whether there are any specific AUs that the coder is particularly good or poor at scoring (assuming there are enough of each AU scored to support such a generalization, about 3 or more).

The three subsequent entries in the table for each AU show statistics for the intensities scored for that AU. The Intensity Scored column shows how many of the hits the coder scored for intensity. The number of hits and the number in the Intensity Scored column should be the same, unless the coder is failing to score intensity. The Deviation column shows the average deviation of the coder's intensity score from the criterion intensity score, and ranges from 0 to 4. For example, if the criterion intensity were C and the coder scored a D, the deviation would be +1 intensity level, but if the coder scored a B, the deviation would be -1. Thus, the sign of the deviation shows whether the coder is over-scoring intensity (in the case of positive deviations) or under-scoring (in the case of negative deviations). The greater the number of AUs involved in this calculation, the more confidence can be placed in the figure as indicating an actual tendency to over- or under-score intensity for that AU. Of course, it is possible that the average deviation statistic is low or zero, but individual deviations are marked and show little agreement, except when averaging them. To examine this possibility, a variance statistic is calculated as the average squared deviation. This figure, in combination with the deviation, reflects how erratic the coder is when scoring intensity, and ranges from 0 to 16. If the average deviation is less than one, and the variance is less than one, then the coder must be relatively consistent in scoring within one intensity level, a desireable situation. The maximum variance of 16 can only be obtained if the criterion scores are all A and E and the coder consistently scores at the opposite end of the intensity scale, an indication of an unusual situation. (The expression NaN in these columns merely indicates that the statistic cannot be calculated.)

At the end of the comparison is an overall agreement index across all the AUs and items scored. This figure is not an average of the agreement indexes in the tables above. This average can be easily calculated manually, but does not reflect the different numbers of AUs in the individual indexes. Instead, the calculation uses the same formula above except summing over all the AUs scored in the entire list of scores.

In regard to evaluating the magnitude of the agreement index, experience indicates how it corresponds to ability levels. Coders should strive for the highest agreement, and an index above .9 indicates a very good scorer. An index below .7 is not acceptable and indicates the need for further practice or for better understanding of the scoring principles and facial behaviors. In our experience, no single coder has been consistently the best or worst in successive sets of practice items. However, should a coder consistently perform poorly, the investigator should consider not using that person as a coder for research involving FACS scoring.

Other Functions

FACS Score Checker includes functions that allow for flexibility in its use. How to use these functions is explained in the help text. The scores in the list of valid scores can be saved to a disk file. Later, these scores can be retrieved to add additional scores or to compare them to criterion scores. An instructor might choose to prevent coders from checking their own work, and collect the saved score files for analysis. The format of this saved score file is a Java serialized object, so it is of little use outside the Score Checker. In order to save a file in a form that is useful in other programs, the validated scores in the list can be exported to an ASCII text file. The scores are written in a column delimited format padded with spaces according to the following schema:

- the score in plus format beginning in column 1 and ending in column 61, filled on the right with spaces if needed (there must be a space after the score, so column 62 is always a space);
- the first nine characters of the scorer's id in columns 63 to 71;

- if the item id is exactly three characters, the characters "CH.n" (where n is the chapter number) appear in columns 72 to 75, followed by a space in column 76,
- the number or pound sign ‘#’ in column 77, and finally the three character item id in columns 78 to 80;
- but if the item id is 1, 2, or 4 to 9 characters long, it is right justified on column 80, with the columns after the scorer's id filled with spaces, if needed.

The variation in how columns 72 through 80 are filled gives flexibility in labeling the items. If three characters are used as an item id, the program assumes that the item is practice scoring and fills out these columns with a chapter id, much as the format in the original Guide describes. However, if the item id is not three characters, then these peculiarities are omitted and the id is right justified on column 80. This convention permits an investigator who uses the Score Checker outside the practice scoring application to devise labels suiting one’s own purposes.

This format for the exported data file roughly resembles that for punched cards in the first edition of FACS, and can be used with little, if any, adjustment in other FACS-tools, such as FACSAID. Each item is separated from other items by a line feed. In some editors on some operating systems (e.g., Notepad on Windows), these line feeds are rendered as block characters and the lines run together. To fix this problem, open the file with another editor that understands the line feed (e.g., WordPad on Windows), then save the file as plain text. Now the file can be read with any editor. If some different data format is required, a script can programmatically manipulate the data based on its defined columns.

The text of the comparison between the coder’s scores and the criterion scores can be saved. The format of the save file is ASCII text marked up with HTML. Thus, this file can be read with any Web browser, and edited with a plain text or HTML editor. The text is created with the minimum characters so some re-formatting may be desireable when editing this text (an HTML editor can perform this function easily). It is advisable to keep a copy of each coder’s comparison for each chapter to assess consistency in scoring accuracy, but coders should not review either the summary or the scoresheets when practice items in early chapters are re-used in later chapters.

FACS Score Checker has a toolbar for quick access to common functions, and a status bar that shows the state of the program, both of which can be toggled off or on. Help is also available and provides a guide to using the program and a list of Web sites relevant to FACS scoring.

Chapter 7: *Correct Answers for Practice Scoring Items*

The table below lists the correct answers for each practice still image and video item. The images use a number series in the 100s, the video items use a number series in the 200s. The answers are listed according to the item number, rather than in the order that they are scored while learning FACS. Click on the thumbnail to see a larger version of the image or to view the video. Click on the "(Get Neutral)" label to view the neutral image for that person.

Each entry lists the chapter(s) for which a practice item is scored, and the answer for that chapter. Some items are listed for Chapter 3 (scoring Upper Face) and also for later Lower Face chapters. When an instructor provides the correct answers for Chapter 3, give only the commentary that is listed after the Chapter 3 label in the table, not the information listed for a later chapter. Similarly, read the paragraph relevant to the Upper Face only, not the one relevant to the Lower Face when providing feedback on Chapter 3. Do not allow the trainees to keep Chapter 3 scores, so it will be possible to have a test-retest indication of comparability in scoring the Upper Face when they rescore some of the Chapter 3 items for later chapters. Some items are scored for one of the Lower Face chapters, and then again are scored after the Miscellaneous Actions chapter. When an item is first scored, give the correct answer only for the chapter that the coder has just learned, and read only that information.

The information in the commentary justifies the correct scoring, and discusses some of the reasons why certain AUs are not scored. The commentary reflects what a skilled FACS coder does when analyzing the face, looking at each appearance change, the degree of change, and the evidence it provides for scoring an AU, or the evidence that is insufficient to score an AU. Practice scoring will provide the coder with an experience base that defines the range of behavior considered for a particular score. Compare the performance of your group of coders (or of only yourself if you are learning FACS alone) with the data provided in Chapter 8 of this ***Guide***. You will be able to see if you are progressing as have others who learned FACS. Make this comparison after reading the correct answers for each set of practice items scored after Chapters 3, 4, 5, 6, 7, and 8. Using the FACS Score Checker program to quantitatively compare each trainee's scores to the answers provided here is also helpful in assessing learning progress.

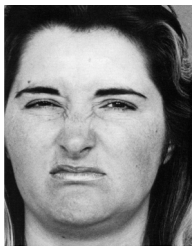
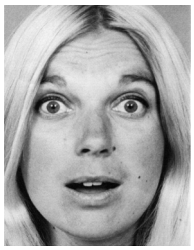
Explain to the trainees that it is important that they learn and incorporate the calibrations we have established in FACS. Sometimes they may all agree among themselves but disagree with us. If you and your trainees learn FACS so that you agree with our criterion correct answers, you will know, and others who read your reports will know, that you are using the same set of calibrations.

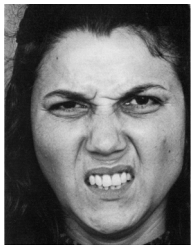
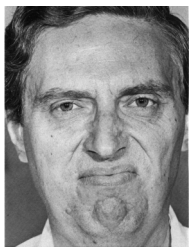
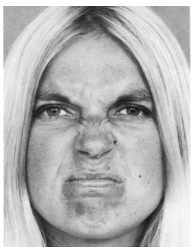
The following is to be read after finishing the first practice scoring, just before giving the correct scores and information on possible mistakes:

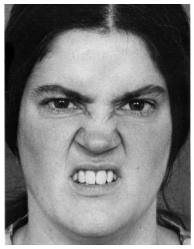
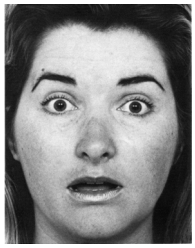
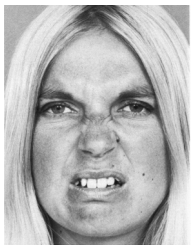
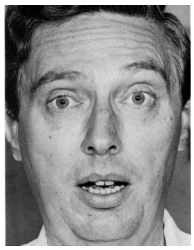
Remember this is called Practice Scoring, It is not a test. While you should be concerned and interested in how you did, the purpose is for you to gain experience and learn. The ***Manual*** defines and explains, but learning requires experience in how facial behavior is actually scored. Your experience in practice scoring and your discussions with others who are learning with you will make meaningful what you have read in the ***Manual***. You will begin to develop a set of calibrations for when AUs have reached different levels of intensity. The correct answers will establish an experiential definition or calibration of many of the definitions in FACS. You will become alerted to the different approaches different people may use in viewing facial action and how these approaches may be more or less effective in isolating the AUs responsible for the appearance change.

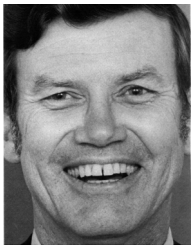
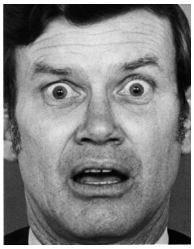
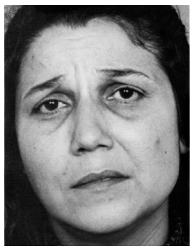
Expect mistakes. If you have completely failed to identify an AU or a particular photo or video, study the item carefully for evidence of the relevant appearance changes. If you have considered scoring AUs which you rejected in your final scoring, try to become more sensitive to the evidence of the AUs. If you have scored an AU that was not included in the correct scoring, look carefully for evidence that another AU was responsible for the changes that caused you to score the way you did and also consider reducing your sensitivity to scoring the erroneous AU. If errors of missing an AU or adding an AU are repeated frequently, try to re-calibrate your sensitivity to the problematic AU(s). Discuss these problems with your group. Many of the people in your group may be having the same problem and it may be better to deal with it together. If only you are having the problem, someone should be able to explain their own scoring of the problematic AU(s) in a way that will help improve your scoring. Work carefully to identify and understand the reason or reasons for your errors. Remember that you need the practice to learn, that it is not a test but a part of the learning process.

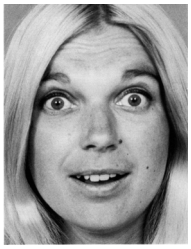
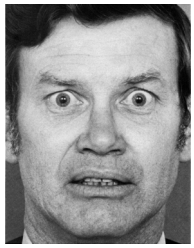
Correct Answers and Explanations of Practice Images and Videos

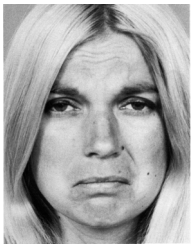
Sample Name	FACS Score by Chapter number	Rationale
101  (Get Neutral)	Chapter 4: 7D+9D+17B	In the lower face, the *slight* wrinkling on the chin boss, the *trace* of lower lip pushed up, the *trace* of chin boss pushed up with the *slight* increase of depression under the lower lip indicates AU 17 at the B intensity (a reasonable argument for A can be made if you think the wrinkling is *trace*). The *severe* to *extreme* wrinkling of the nose with the sharply angled pouching above the nostril wing is characteristic of AU 9. The infraorbital triangle near the nose is raised *severely* pushing the skin up to form the wrinkles and increasing evidence of the nasolabial furrow and raising the lip *slightly*, establishing the D intensity. AU 9 produces some of the same appearance changes as AU 7 because the pushing up of the skin of the cheeks also pushes up the skin of the lower eyelid, but here the skin of the lower eyelid is changed beyond what the 9 can do. The narrowing of the eye is *severe* on the left to *extreme* on the right and both the upper and lower lid are drawn together, which is apparent at both inner and outer corners. The raising and straightening of the lower eyelid are *extreme*, and the bagging, wrinkling and pouching of the lower eyelid is *pronounced* and extends laterally beyond the area affected by 9, evidence for the D intensity. The eyebrows are lowered *slightly*, but this is not sufficient evidence to score 4 with 9 because 9 can produce these appearances (check 4 with 9 in the Reference for AU 4).
102  (Get Neutral)	Chapter 3: 1D+2D+5C Chapter 4: 1D+2D+5C +25C+26D	In the upper face, the horizontal wrinkles across the entire forehead are a sure sign of 1+2, so the AU combination 1+2 description is used to provide the intensity scoring criteria. The brow raising, wrinkling, and eye cover fold exposure is *severe* to *extreme*, indicating a D intensity. Even though the hair, especially on the right, hides the lateral aspects of the forehead, the raise of the entire brow can be inferred from the wrinkles and is evident from the visible exposure of the upper eye cover, and there is no reason to use an “not visible” score. The raising of the upper eyelid shows *slightly* more sclera above the iris than a hairline, indicating a C intensity for an iris partially covered in neutral. In the lower face, the jaw is lowered *severely* to about the extent that would be produced if the jaw closing muscle relaxed, and in a still photo the only reasonable score for this lowering is 26, and as the opening is a little less than a finger, i.e., a little less than the most lowering that relaxing alone might produce, the D intensity is assigned. The separation of the lips is about what you would expect with this jaw drop, so C level is assigned as the intensity. You can see the tongue, but it is not sticking out, so 19 is not scored.

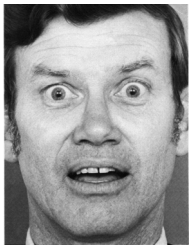
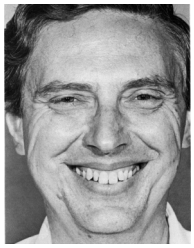
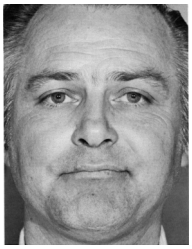
103  (Get Neutral)	Chapter 4: 4D+6C+7D+ 9D+16A+25D	In the lower face, there are *slight* wrinkles on either side of the chin boss and below the chin boss, and *slight* evidence that the skin on either side of the chin boss is pulled down and laterally, and the lip is pulled down *slightly* to *markedly* so that the gum can be seen between the lower teeth, but the entire tooth and gum line is not exposed. These signs indicate 16, at the A intensity in a still image. The upper lip is pulled up almost as much as seems possible, so that the 25 lip parting due to combined upper and lower lip movement is at the D intensity, given that the jaw is not dropped. The *severe* nose wrinkling, the *severe* pulling up of the medial infraorbital triangle pushing skin up on the nose, the pointed pouching above the nostril wing indicate 9 at the D intensity. AU 9 hides evidence of AU 10, and although an argument might be made here for 10 based on the deepening of the lower part of the nasolabial furrow and the angular shape of the upper lip, these changes can be explained by the 6 (scored below) with the 9, and without any motion to see 10 separately from 9, this evidence is insufficient for 10. In the upper face, the eyebrows are pulled down *extremely* to *maximally*, which might be due to AU 9, but there are shallow vertical waves of skin running from the middle of each eyebrow medially, a sure sign of AU 4, together with the bunching of skin in the glabella, and the eyebrows are also pulled together *severely* to *extremely*, indicating a D intensity. The raise of the outer part of the infraorbital triangle is *pronounced*, the outer corners of the eyebrows are pulled down, and there is *marked* wrinkling and gathering at the outer corners of the eye, indicating the 6C. The straightening of the lower eyelid and *pronounced* to *severe* narrowing of the eye opening is more than 6 and 9 can produce, and with the *severe* bagging in the lower lid indicate a D intensity of 7.
104  (Get Neutral)	Chapter 4: 4B+7B+10C+17D	In the lower face, the *severe* wrinkling and raising of the chin boss, pushing up the lip, indicate 17D. The upper lip is pulled up *markedly*, the infraorbital triangle raise is *pronounced*, and the nasolabial furrow is deepened to a characteristic 10 shape (particularly apparent on the left), widening and raising the nostril wings, indicating a 10C. There is no nose wrinkling and the pouching of the nasolabial furrow is out in the cheeks, not above the nostril wing, so evidence of AU 9 is lacking. (After reading Chapter 6, one might argue the straight shape of nasolabial furrow on the right and its deepening in the middle more than the top indicate AU 11 on the right, but the pouching at the top of the triangle and lift of the lip and nasal wing indicate 10 is present as well, making the R11 a difficult, but not incorrect, call.) In the upper face, the eyebrows are *slightly* lowered, both in the middle and inner corners, and pulled together a *trace*, with *slightly* more vertical wrinkling and skin gathering in the glabella, indicating a 4B. The eye opening is *slightly* narrower, more than can be attributed to the 4, and there is a *trace* to *slightly* more wrinkling bagging, and bulging of the lower lid, indicating a 7B.
105  (Get Neutral)	Chapter 4: 7C+9D+17D	In the lower face, the *severe* wrinkling in the chin and *extreme* pushing up of the chin boss and lip indicate a 17D. The upper lip, medial part of the infraorbital triangle, and nostril wings are pulled up *severely*, and the sharply angled pouching above the nostril wings and the *extreme* nose wrinkling indicate a 9D. In the upper face, the eyebrows are *markedly*, or more, pulled down, due to 9, but barely pulled together, so evidence for 4 with the 9 is lacking. The eye opening is *markedly* narrower, and the straightening and the *marked* wrinkling of the lower eyelid are much beyond the effect of the 9, and indicate a 7C.

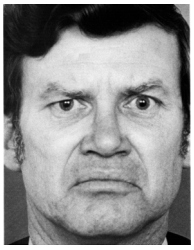
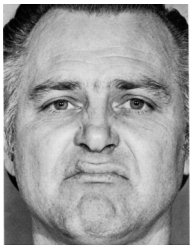
106  (Get Neutral)	Chapter 4: 4D+9D+7C+25C	The lower face clearly shows parted lips, but it is not possible to decide for certain whether there is a *trace* of a jaw drop or not, no matter how closely one looks, and therefore, 26 is not scored. Thus, the 25 is scored with reference to a closed jaw, and the *marked* to *pronounced* difference from the 25B criteria puts its intensity at C. The *severe* raising of the medial part of the infraorbital triangle, the deepened nasolabial furrow and *severe* pulling of skin up the nose, creating a pouch above the nostril wings and *severe* to *extreme* nose wrinkling, indicate 9 at a D intensity. In the upper face, the pulling down of the eyebrows is *pronounced* to *severe*, but also, the eyebrows are pulled together *severely*, allowing AU 4 at the D intensity to be scored with 9. The eye opening is narrowed to a *pronounced* degree and together with the *pronounced* straightening and wrinkling of the lower eyelid, beyond what 9 and 4 could do, indicate a 7 at the C intensity.
107  (Get Neutral)	Chapter 5: 1C+2C+5C+ 25C+26C	The lower face only shows a dropped jaw, which is roughly midway between teeth together and the most drop by relaxing possible and would barely allow the tip of the tongue through, and lips separated no more than what the jaw drop might allow, indicating a score of 25C+26C. In the upper face, the lifting of the entire eyebrow and horizontal wrinkling across the entire forehead indicate the 1+2 combination, and the intensity guidelines for this combination indicate the *pronounced* raising and exposure of the upper eyelid and cover fold should be scored at the C intensity. The lifting of the upper eyelid reveals the partially covered iris in neutral now showing entirely with *slightly* more than a hairline of sclera, indicating a C intensity.
108  (Get Neutral)	Chapter 5: 7C+9C+17A+ 25D+26A	The lower face shows a *trace* of the chin boss pushed up and *trace* wrinkling on the chin boss, indicating a 17A. The pulling up of the upper lip is *pronounced*, the nasolabial furrow is deepened and skin is pulled up on the nose to produce a sharp pouch above the nostril wings and *pronounced* nose wrinkling, indicating a 9C. The jaw is dropped *slightly*, as is clear from the gap between the teeth on the left from the canine backwards, indicating a 26A. As the jaw is dropped, the intensity of 25 is based on how much different the lip separation is from what the 26 alone would produce. A 26A does not produce much of a lip separation, but the lips are *markedly* or *pronouncedly* more parted than that, so 25D is assigned. Some *trace* anomalous stretching or skin bulging on the right side of the chin might be cited as evidence of 15, 16, or 20, but even the lighting might produce this illusion, so, conservatively, nothing is scored to account for such ambiguous signs. In the upper face, the narrowing of the eye opening is *pronounced* and wrinkling and straightening is *slight* to *marked*, more that the 9 can account for, indicating a 7C. Someone might consider 43 alone as an explanation of the decreased eye opening, but this score wold not account for the lower eyelid straightening, raising, and wrinkling. The inner corners of the eyebrows are *slightly* to *markedly* pulled down, but not pulled together, so evidence of AU 4 with 9 is not present. Score 43B to track degree of eye opening.
109  (Get Neutral)	Chapter 5: 1C+2D+5B+ 25C+26B	In the lower face, the jaw is dropped *markedly*, at most, and the lips are parted no more than a *trace* of what might be expected from this jaw drop, indicating scores of 25C+26B. In the upper face, the horizontal wrinkling across the entire forehead and the raise of the entire brow indicate the presence of 1+2, and the intensity criteria for this combination indicate the *slight* to *severe* raise of the eyebrows and exposure of the eye cover fold, with the left outer corner showing the greatest changes, should be scored at the 1C and 2D intensities. The eyelids, which partially cover the iris in neutral, are raised sufficiently to expose virtually the entire iris, especially on the left (the eyes are somewhat turned off-center). Thus, the intensity score for this 5 is B.

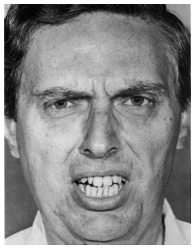
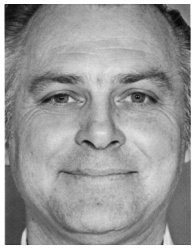
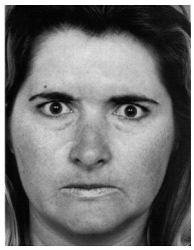
110  (Get Neutral)	Chapter 3: 6D+7C Chapter 6: 6D+7C+ 12E+25D+26B	In the upper face, the *severe* crow's feet wrinkling, particularly at the outer corner of the eye and above, together with the *extreme* raising of the infraorbital triangle clearly indicates AU 6D. The eye opening is *markedly* narrowed, but more telling is that the lower eyelid is straightened and pulled far up on the eyeball and medially, creating *severe* bulging of the lower eyelid. These appearances are much beyond what 6 would do alone, and if you look at the inner corner of either eye, where the action of AU 7 is most independent of 6, you can see the eyelids pulled together with a 7C. Score 43B to track degree of eye closure. In the lower face, *extreme* lifting upwards and laterally of the lip corners and lower nasolabial furrow, with the *extreme* infraorbital triangle raise indicate 12 at the E intensity. The jaw is dropped *markedly*, barely enough spacing for the tip of the tongue, indicating 26B and the lip separation is *markedly* more than would be produced by the jaw drop alone, sufficient for 25D. One might argue that the shape of the nasolabial furrow and the raising of the upper lip indicates the presence of AU 10, but 12 can produce these appearances and the nasolabial furrow, though deepened, is not much different in shape from neutral. The clincher is that the upper lip does not have the angular shape produced by 10 that is required to score 10 with 12.
111  (Get Neutral)	Chapter 6: 1C+2C+5E+ 25C+26D	In the lower face, the jaw is dropped *severely* by 26 (without motion, 26 is the only reasonable score for this extent of drop), enough for the tongue to fit through, or the D intensity, and the lips are parted no more than a *trace* from what this jaw drop might produce, so 25C is scored. In the upper face, the horizontal winkling across the entire forehead and lifting of the eyebrow in its entirety indicates the 1+2 combination, and the criteria for it indicate that the *marked* raise of the eyebrows, the *pronounced* increase in forehead wrinkles, and the *pronounced* increase in exposure of the eye cover fold (vastly changing the shape of the skin therein) is C intensity. The *maximum* lifting of the upper eyelid, which reveals a *maximum* amount of sclera, is an obvious 5E. You might consider scoring 7 becausse the lower lid is raised a *trace*, showing a *trace* of increased bulging, but these changes are due to the strong 5, pulling and stretching a passive lower lid on the eyeball, which shows the same contour on the eyeball in neutral, but with loose skin.
112  (Get Neutral)	Chapter 6: 6C+7C+12D+ 25D+26B	In the lower face, the *severe* upward, oblique lifting of the lip corners, infraorbital triangle, and middle to lower nasolabial furrow indicates AU 12 at the D intensity. The jaw is dropped *markedly*, or the B intensity, and the parting of the lips is *pronouncedly* greater than this jaw drop would produce alone, the D intensity, due to raising the upper lip. In the upper face, *marked* crow's feet wrinkles are apparent at the outer corner of the left eye, and even though the hair obscures the lateral extent of these wrinkles and any wrinkling on the right side, the *slight* raising of the infraorbital triangle on both sides gives no reason to think 6 is not present on both sides at the C intensity. *Marked* wrinkling, straightening, and bulging of the lower eyelid and *marked* narrowing of the eye opening, and especially the drawing together of the lids and skin at the inner corners indicates the C intensity of AU 7. Score 43A if you are tracking degree of eye closure.
113  (Get Neutral)	Chapter 6: 1B+4C+7B+L11B	In the lower face, the *slight* deepening of the middle part of the nasolabial furrow, the *trace* of lifting of the skin in the middle part of the infraorbital triangle, and the *trace* of lifting in the middle of the left lip indicate AU 11 at the B intensity. Check the subtle differences if you think this appearance is due to 10. In the upper face, the eyebrows at their inner corners are raised, evident from the horizontal wrinkling in the center of the forehead, and drawn together, evident from their position, the vertical wrinkling in the glabella, and the rippling of skin above the eyebrows, particularly the left. The *slight* raising of inner eyebrows and *slight* wrinkling indicate AU 1 at the B intensity. The revised criteria for AU 4 in 1+4 are used to score the *pronounced* drawing together and *marked* vertical wrinkling in the glabella as 4C. Notice also the characteristic triangular shape of the skin above the eye cover fold. The *slight* narrowing of the eye opening, the *slight* bagging and wrinkling of the lower eyelid, and the *trace* of straightening particularly on the right indicate an AU 7 at the B intensity. Score 43A to track degree of eye closure.

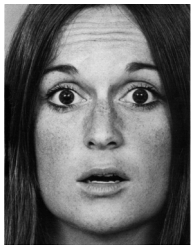
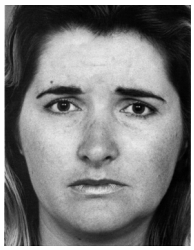
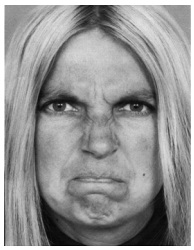
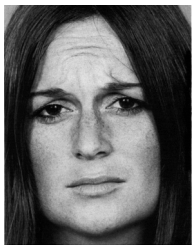
114  (Get Neutral)	Chapter 6: 1D+2D+5D+12B+ 25D+26C	In the lower face, the jaw is dropped about half the extent to which it can relax open, or the C intensity of AU 26.The upper lip is raised *slightly,* making the lip parting *slightly* more than produced by the jaw drop, or the D intensity. The middle and lower nasolabial furrow is deepened and raised *slightly,* raising the infraorbital triangle *slightly,* and the lip corners are stretched laterally and obliquely *slightly* indicating AU 12 at the B intensity. In the upper face, the *severe* horizontal wrinkles across the entire forehead, the *severe* raising of the eyebrows, and the *severe* exposure of the eye cover fold indicate AU combination 1+2 at the D intensity. The raising of the upper eyelid is *extreme* and the exposure of sclera above the iris is *severe*, indicating the presence of AU 5D. There is a *trace* of bulging in the lower eyelid, easily produced by the *extreme* 5 pulling the outer corner up.
115  (Get Neutral)	Chapter 6: R2B+5E+ R11A+25B	The lower face shows lip parting that is *slightly* greater than the criteria for 25B, not enough to change this intensity score. One might search for possible AUs that could produce this separation, but without movement, the small actions that might be responsible are difficult to detect. However, the upper right lip is raised a *trace* midway between the philtrum and lip corner, and the nasolabial furrow on the right has deepened a *trace* in its middle part, enough to score R11 at the A intensity. In the upper face, the outer corner of the right eyebrow is raised *slightly* and *slight* increases in the depth of wrinkles above it appear and there is a *slight* increase in the exposure of the skin under the eyebrow as the skin in the eye cover fold is stretched upwards, indicating 2B. The upper lid is raised to the *maximum* range by AU 5E. Again, as in item 111, you might consider scoring an AU 7 based on the *trace* evidence, but these changes are due to the strong 5's effect on this person's specific physiognomic features, which simply stretches the skin around the eyeball already shaped in neutral. If you are scoring 7A on this person in these items, it is not a serious mistake.
116  (Get Neutral)	Chapter 6: 12C	In the lower face, a *marked* to *pronounced* deepening and lateral stretching of the lower and middle nasolabial furrow, *marked* raising of the infraorbital triangle, and *marked* oblique lifting of the lip corners indicate AU 12 at the C intensity. In the upper face, *trace* lifting of the lower eyelid and a *trace* of increase in the wrinkling of the lower eyelid, at least on the right, can easily be produced by the 12C pushing up skin in the infraorbital triangle, so 7 is not needed to account for this level of change. (With a 12A, this change could easily be evidence for 7A with 12A.) Notice that most of these traces of wrinkles are in the infraorbital furrow area, not in the lid itself, another indication of 12's effect, not 7. There are no signs of the crow's feet wrinkling that can be seen in image 112.

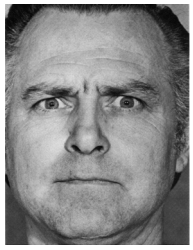
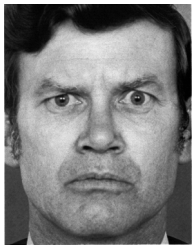
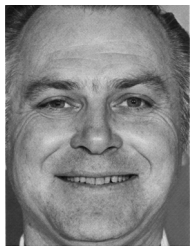
117  (Get Neutral)	Chapter 3: 1C+4C+6C+7C Chapter 6: 1C+4C+6C+7C+ 11B+L20B+25C	In the upper face, the raising and drawing together of the brows, evident in the horizontal wrinkling in the center of the forehead, and the vertical wrinkling in the glabella, and the rippling of skin above the eyebrows, indicate AU combination 1+4. The *marked* raising of the inner eyebrows and *pronounced* horizontal wrinkling indicate AU 1 at the C intensity. The revised criteria for AU 4 in 1+4 are used to score the *pronounced* drawing together and *marked* vertical wrinkling in the glabella as 4C. Notice also the characteristic triangular shape of the skin above the eye cover fold, which is produced by the raise of the inner corner of the eyebrow by 1 while its center is pulled down by 4. The *marked* crow's feet wrinkling and *marked* or *pronounced* infraorbital triangle raise indicates AU 6 at the C intensity. The *slight* straightening and *pronounced* wrinkling and bagging of the lower eyelids and the *slight* narrowing of the eye opening are beyond what AU 6 produces and indicate AU 7 at the C intensity. In the lower face, the lip separation is *markedly* greater than the criteria for 25C, indicating the C intensity score. (Evidence of a jaw drop is lacking, and at best, inconclusive.) There should be other AUs that account for this lip separation. This condition is satisfied because the *pronounced* increase in the middle part of the nasolabial furrow on the left is much more than the 6C might produce, and together with the *slight* raising of the left upper lip midway between philtrum and corner provides sufficient evidence for AU 11B, and as the nasolabial furrow has deepened *markedly* on the right also, 11 is scored bilaterally (though the changes on the right might be ascribed to 6). The left lip corner is stretched laterally *slightly,* elongating the left side of the mouth *slightly,* and *slight* flattening of the cheek and *slight* wrinkling from pulling of the lower nasolabial furrow laterally beyond the lip corner indicates L20B.
118  (Get Neutral)	Chapter 6: 7C+12D+ 25D+26B	The lower face is dominated by the mouth corners pulled obliquely upwards *extremely,* deepening and pulling the nasolabial furrow upwards and laterally *severely.* The infraorbital triangle is raised *severely.* This evidence is sufficient to score 12D. The jaw is dropped *slightly* for 26B, and the 12 has parted the lips *markedly* beyond what the jaw drop has produced, for 25D. The AU 12 has pushed the skin of the cheeks up into the infraorbital area, deepening the infraorbital furrow, and forming bags below the eyes, but AU 7 is also acting to *markedly* narrow the eye opening and pull the lower lid up, straightening and wrinkling it, enough to score 7C. The infraorbital triangle raise caused by 12 hides this sign of AU 6, and although there is a crow's toe at the outer corner of each eye, this wrinkling can be attributed to AU 7, and there is no further sign of 6. AU 6 is not needed to explain any appearance changes, so it is not scored. Score 43A to track eye closure.
119  (Get Neutral)	Chapter 3: 1C+4B+43B Chapter 6: 1C+4B+11C+ 15B+17A+43B	In the upper face, the *marked* horizontal wrinkling in the center of the forehead indicates AU 1 at the C intensity, and the *slight* pulling together and gathering of the skin in the glabella indicate AU 4. Notice the wave of skin above the left eyebrow caused by AU 4 pulling its center medially and *slightly* lowering it, helping form part of the characteristic omega shape of 1+4 and triangulating the skin above the upper eyelid. These appearances are also on the right, but only a *trace*. Using the criteria for 4 in combination 1+4, the intensity of 4 is B. The eyes are *markedly* narrowed, more than the downward gaze causes, so score 43B. In the lower face, the deepening of the middle part of the nasolabial furrow (*marked* on the left, *trace* on the right), the *trace* of skin stretching in the middle of the upper lip, and the *trace* of infraorbital triangle raise on the left indicate an asymmetrical AU 11C. The lip corners are pulled down *markedly,* causing *slight* bulging under the lip corners, indicating 15 at the C intensity. The *trace* evidence of the chin boss being pushed up and the *traces* of wrinkling, especially at the bottom of the chin indicate a 17A.

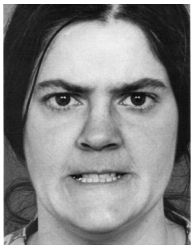
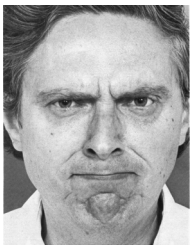
120  (Get Neutral)	Chapter 6: 1B+2B+5D+ 12A+25C+26C	The jaw is dropped about midway to the position that a most relaxed jaw could lower it, or the C intensity. The lips are separated no more than a *trace* of what the jaw drop alone might produce, or the C intensity. The lip corners are pulled a *trace* obliquely upwards, and the bottom of the nasolabial furrow has deepened and extended a *trace*. If you missed this 12A, compare the permanently downturned lip corners in neutral to their position here; moreover, notice the overall difference in the shape of the mouth and the effect it produces. The *slight* raise of the entire eyebrow and the *slight* increase in wrinkling across the entire forehead indicate AU combination 1+2, with both AUs at the B intensity. The upper eyelid is raised *extremely*, exposing an *extreme* amount of sclera, sufficient for 5D (for an intensity comparison, see the maximum in 111 and 115; it is somewhat less here). As in the previous items 111 and 115, AU 7 is not scored on the same basis.
121  (Get Neutral)	Chapter 6: 6D+7D+12E+25C	The mouth area shows *maximum* upward and lateral stretching of the lip corners producing *maximum* deepening and lifting of the lower to middle nasolabial furrow and *extreme* infraorbital triangle raise, indicating AU 12E. The 12 has lifted the upper lip quite high, but the lower lip has not been lowered, so 25 is scored at the C intensity. In the upper face, AU 6 is evident, even though whatever infraorbital triangle raise it may be producing is masked by the strong action of 12, in the *severe* to *extreme* crow's feet wrinkling and lowering of the outer corners of the eyebrows. Even though AU 12 at this intensity produces the crow's feet wrinkles below the outer eye corner and on the lateral part of the cheeks, it does not produce the crow's feet wrinkles that are evident above the eye corners, or pull them down. AU 6 is scored at the D intensity on this basis. Although AU 6 can account for the pushing up of the lower lid, deepening of the infraorbital furrow and some lower eyelid wrinkling, it is not pushing it up on the eyeball as much as is manifest, straightening it this much; nor will it pull the upper lid down, narrowing the eye opening *severely*. In particular, look at how the inner corners of the eyelid have come together as skin is gathered in this area, not something AU 6 does. AU 7 accounts for these appearances and is scored at the D intensity.
122  (Get Neutral)	Chapter 3: L6B Chapter 6: L6B+14B	In the upper face, the nasolabial furrow has increased *slightly* on the left, the infraorbital triangle is *slightly* raised on the left, and the crow's feet wrinkles have deepened *slightly* on the left, sufficient evidence to score L6B. In the lower face, the left lip corner is tightened *slightly* and the right corner is tightened a *trace* (compare with the neutral). There is *slight* evidence of bulging at the left lip corner and there is a *trace* of a depression or dimple beyond the left lip corner, evidence for scoring 14. This *slight* action of 14 has a resemblance to AU 12, especially when the action is *trace*, as here on the right. Consult the subtle differences if you confuse the two.

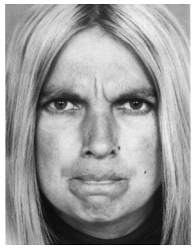
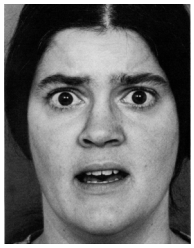
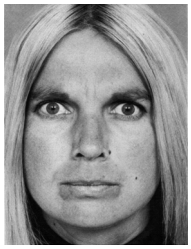
123  (Get Neutral)	Chapter 3: 4B+5C Chapter 6: 4B+5C+11B+15A	In the upper face, the eyebrows are pulled together and down *slightly*, forming *slight* vertical wrinkles in the glabella and above the middle of the eyebrow medially, sufficient to score 4B. The upper eyelid is raised, and using the criteria for 5 in AU combination 4+5, the pronounced harsh staring quality, the top of the iris revealed *slightly* more than in the neutral, and the evidence of pushed up skin in the eye cover fold is sufficient to score 5C. In the lower face, a difficult discrimination is required to account for the *slight* deepening and lifting of the nasolabial fold and the *slight* stretching and upward pulling of the middle part of the upper lip. AU 11 is the better score than AU 10 because the characteristic pouching of 10 is absent and the nasolabial furrow is straight on the left and hardly changed in shape from neutral on the right. It is the middle of the nasolabial furrow that is most affected, less in the upper end, which 10 affects as well. The evidence is sufficient to score 11B. Scoring 10 instead of 11 it is not a serious confusion because this is a difficult call. Although the inverted U shape of the lips is present in neutral and may be somewhat enhanced by the raise of 11, there is also a *trace* of pulling down of the lip corners, especially the left, lengthening of the very bottom of the nasolabial furrow, and a *trace* of increased wrinkling below the lip corners, enough evidence to score 15A. You may have considered scoring 17, but the wrinkles on the chin boss have not changed from neutral and the chin boss is not raised, ruling 17 out.
124  (Get Neutral)	Chapter 6: 9C+17C	The chin boss is pushed up *markedly*, the lower lip is pushed out, and wrinkling above and below he chin boss is *marked*, sufficient evidence to score 17C. The *pronounced* nose wrinkling, *marked* infraorbital triangle raise and nasolabial furrow deepening, lifting of the upper lip, and *marked* pulling of skin onto the nose indicate AU 9 at the C intensity. Though the inverted U shape increases, there is no evidence of lip corners being pulled down, so 15 is not scored. In the upper face, the increased wrinkling below the lower eye lid can be attributed to AU 9 pushing up skin in the cheeks, but there is no straightening of the lower eyelid, pulling it up on the eyeball or increased wrinkling on palprebral part of the lid at all, so AU 7 is not scored. This item is a good example of not needing 7 to account for changes produced by 9.
125  (Get Neutral)	Chapter 3: 1C+2B+4B+ 5E+7A Chapter 7: 1C+2B+4B+ 5E+7A+ L11C+25B	Both the inner and outer ends of the eyebrows are raised *slightly* to *markedly*, and horizontal wrinkling has increased *slightly* above the outer corners and *markedly* above the inner corners, indicating the presence of AUs 1 and 2. The inner corners of the eyebrows are drawn together *slightly*, with *slight* wrinkling and bulging in the glabella, and the center of the eyebrow is lowered by AU 4 in respect to the ends, straightening the eyebrows. Notice the medial directed vertical skin bulging above the eyebrows. The intensity criteria for AU combination 1+2+4 indicate 1 at the C intensity, 2 at the B intensity and 4 at the B intensity. The upper eyelid is raised to the *maximum* range, with close to *maximum* sclera showing, indicating a 5E. The wrinkling in the lower eyelid has increased a *trace*, and the lower eyelid is raised a *trace*, sufficient for AU 7 at the A intensity. In the lower face, the lips are parted to about 2 mm, the B intensity of 25. The middle of the nasolabial furrow on the left is deepened *markedly*, moving the infraorbital triangle *slightly*, and the left half of the upper lip is lifted at its midpoint *markedly*, indicating AU L11C.

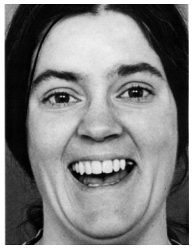
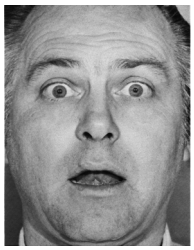
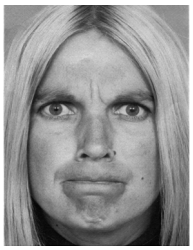
126  (Get Neutral)	Chapter 7: 4D+7B+ L10B+11C+16D+ 25E+26A	The jaw is lowered only *slightly,* with the front teeth still overlapping each other, a 26A.The lower lip is pulled down *extremely,* showing the gum below the lower teeth. The skin of the lower lip and the chin boss is pulled down and laterally *extremely,* sufficient evidence for 16D. The upper lip is raised *severely,* which together with the lowering of the lower lip, produces lip parting *extremely* beyond that which the jaw drop might produce, or 25E. The nasolabial furrow has deepened *markedly,* in the middle on the right, but in the upper and middle on the left, and is pulled obliquely upwards *slightly.* The left nasolabial furrow has a characteristic 10 pouch at the top, but this appearance is not on the right. The lip is pulled upwards more on the left. This evidence indicates AU 10 at the B intensity on the left. Evidence of 11 is present on both sides, even though 10 might account for some of it on the left, and the evidence is sufficient to score 11C. In the upper face, the eyebrows are *severely* pulled together and lowered and *pronounced* vertical wrinkles appear in the glabella, sufficient to score 4D. The lower eyelid is *slightly* pulled up and straightened, reducing the eye opening *slightly. Slight* bagging and wrinkling appear on the lower lid, enough to score 7B. If you think the gaze is harsh, it is because the 4 has pulled the brow lower onto the upper eyelid, not because of AU 5, and if you cover the eyebrows, this quality is much reduced, as there is no lifting of the upper eyelid, which can be seen at the inner corners of the eyes.
127  (Get Neutral)	Chapter 7: 6B+7B+12C	The *pronounced* obliquely upward stretching of the lip corners and deepening and raising of the lower to middle part of the nasolabial furrow, the *pronounced* raising of the infraorbital triangle, and other *marked* to *pronounced* characteristic signs of AU 12 indicate the C intensity. The lips are thinned, but this narrowing is due to 12, not 24, for which there is no other evidence. In the upper face, the AU 12 is pushing skin into the upper lateral corner of the infraorbital triangle to create and deepen the lower crow's feet wrinkles, but additional *marked* crow's feet wrinkles develop at the eye corners and above, and the eye opening is *markedly* narrowed, indicating AU 6 at the B intensity, using guidelines for 6 with 12. Additionally, the upper eyelid is pulled down, and the lower eyelid is pulled up, straightened, and wrinkled *slightly,* and beyond what the low intensity 6 might do, indicating AU 7 at the B intensity.
128  (Get Neutral)	Chapter 3: 4D+5E Chapter 7: 4D+5E+23C	In the upper face, the lowering of the eyebrows is *severe* and the pulling together is *pronounced,* with *marked* vertical wrinkles above and at the inner corners of the eyebrows, indicating AU 4 at the D (barely) intensity. The lifting of the upper eyelid reveals *markedly* more sclera than a bare hairline, and using the criteria for 5 in combination 4+5, indicates a 5E. In the lower face, a difficult discrimination is needed to account for the changes in the lips, which are narrowed and tightened *slightly* or *markedly,* showing *markedly* less red part. Short, *marked* vertical wrinkling appears across the entire upper lip at the margin of the red part, with *traces* of bulging above the upper and below the lower lip. The upper lip appears to be pulled inwards. These signs favor scoring AU 23 at the C intensity over the alternative score of 24, which might better describe the lower lip, but 24 cannot be scored in one lip. There is more lip tightening than pressing. Although the top lip is most affected, *trace* signs in the lower lip preclude scoring T23.
129  (Get Neutral)	Chapter 7: 4E+5B+24D	The *severe* pressing together of the lips producing an *extreme* narrowing and *marked* bulging below the lower lip indicate AU 24 at the D intensity. This example is very good for contrasting AU 24 with 23, as to get this much narrowing with 23 would produce a great deal of short vertical wrinkles at the lip margins, and there would be much more turning in of the lips rather than the pressing that is apparent here. The brow pulling together and lowering is in the *maximum* range, indicating 4E. All the other signs of 4 are quite obvious. The eyes have a harsh, staring quality, and looking at the inner corner of the upper eyelid, you can see that the upper eyelid is raised and is pushing on the skin of the eye cover fold. About the same amount of the top of the iris is revealed as in neutral, indicating 5B using criteria for 5 in 4+5. Bulging and other changes below the lower lip due to 24 are not to be confused with signs of 17.

130  (Get Neutral)	Chapter 7: 1D+2D+5B+ 25C+26C	The *severe* to *extreme* raising of the entire brow and formation of *extreme* horizontal wrinkles across the entire forehead, and the *extreme* exposure of the eye cover fold and skin indicates AU combination 1+2, and using the criteria for this combination, the D intensity is assigned. The upper eyelid is raised to expose virtually the entire iris, indicating a 5B. The jaw is lowered to a position about midway to that which the most relaxation might produce, or 26C, and the lips part no more than a *trace* different from what the jaw drop itself might produce, or 25C.
131  (Get Neutral)	Chapter 3: 1B+4B Chapter 7: 1B+4B	In the upper face, the *slight* drawing together of the eyebrows with the *slight* bulging and wrinkling in the glabella and rippling above the inner half of each eyebrow, and the *slight* lowering of the center of each eyebrow indicate AU 4B. The *slight* raising of the inner corners of the eyebrows, which together with the lowering of their centers produces the obliquely slanted eyebrow shape of AU combination 1+4, with the *slight* horizontal wrinkles in the center of the forehead indicate AU 1 at the B intensity. In the lower face, there is no score, even though you may have an impression of AUs 15, 23, or 24. Probably, none of these are present, and the misleading impression comes from the 1+4. Cover the brows and eyes in this item and compare the lower face with neutral to see that too little has changed for assigning a score with certainty.
132  (Get Neutral)	Chapter 7: 4D+7B+ 9C+17E+24D	The *maximum* pushing up and wrinkling of the chin boss and the *severe* pushing up of the lower lip are clear signs of AU 17, with a E intensity. AU 17 thins and presses the lips together and can create misleading signs of AU 24, but here, signs of the upper lip pressing down against the upward push of 17 are *extreme*, and *extreme* bulging below the lower lip reflects this opposition between the lips. The *extreme* pressing indicates AU 24D. AU 23 is less descriptive of the appearance changes in the lips because there is more pressing than tightening, and the lips are pitted against each other, not turned inwards. The *slight* nose wrinkling, the sharp pouching above the nostril wings, the *marked* raising of the medial infraorbital triangle, deepening of the nasolabial furrow *markedly,* and the pushing of skin onto the nose indicate AU 9C. In the upper face, the eyebrows are lowered *extremely* and drawn together *severely,* forming *marked* to *severe* vertical wrinkles and bulging in the glabella, indicating AU 4D. The lower eyelids are straightened and wrinkled *slightly* and the eye opening is narrowed as the lower lid is pulled up onto the eyeball, much more than the relatively weak 9 would produce, indicating 7B. There is a harsh staring quality to the eyes, but the intensity guidelines for 5 in 4+5 require at least as much of the iris to show as in neutral for a B, but less shows here, and the staring quality might come from the 4+7, so 5 is not a preferred score, but if you scored 5A, no one should say you are wrong.
133  (Get Neutral)	Chapter 3: 1C+4C+7A Chapter 7: 1C+4C+7A	The eyebrows are *slightly* lowered in their centers and *markedly* pulled together, forming *marked* vertical wrinkles in the glabella and vertical waves of skin above the center of the eyebrow inwards, indicating 4C. The inner corners of the eyebrows are lifted *markedly* and *marked* horizontal wrinkles appear in the center of the forehead, indicating 1C. The characteristic omega shape of the 1+4 begins to emerge. The eye opening is *slightly* narrowed, perhaps because of the AU 4, but the lower lid is raised a *trace* and a *trace* more wrinkling, especially in the left lower eyelid, and a *trace* more bulging, especially in the right lower eyelid appear, sufficient to score 7A. In the lower face, there is an impression of some change, but there is so little evidence of any specific AU that no score is assigned. The minor head tilt might have changed the lighting of features to highlight the infraorbital triangle on the left; the *trace* of wrinkles below the left eye could be due to the 7. This item illustrates the case where no score is preferred.

134  (Get Neutral)	Chapter 7: 4D+5D+7C+ 23C+24C	The lower face presents another very difficult discrimination, especially in the absence of motion, between 23 and 24 to account for the changes in the lips. The narrowing of the lips is *pronounced*, and the pressing together is at least *marked*, but tightening and inward movement are also *marked*, particularly in the upper lip. The *slight* wrinkling and bulging are ambiguous in regard to resolving the decision. The subtle differences entry for this comparison says that if signs of both AUs are present at least at the B intensity, score both, or if it appears that one AU accounts for the changes, but you cannot decide which, score the 23. In this case, both are scored at the C intensity, but scoring only the 23 is equally reasonable. The eyebrows are lowered and drawn together *severely*, forming *severe* vertical wrinkles in the glabella and vertical skin ripples above the eyebrows, especially the right, sufficient to score 4D. The upper eyelids are lifted to reveal at least *markedly* more iris than in neutral, despite the 4, and if the skin were not blocking view of the top iris, we extrapolate from what can be seen that at least some sclera above the iris could be seen, sufficient to score 5D. The lower eyelids are drawn up on to the eyelids and straightened *markedly*, and *slightly* more wrinkling and *marked* bulging appear, sufficient to score 7C.
135  (Get Neutral)	Chapter 7: 4C+5D+7A+ 23A+38A	The lips are *markedly* narrowed and *slightly* tightened, with *trace* wrinkling and bulging on the margins of the lips, indicating 23A (see the criteria for 23B without motion). The lips do not appear to be pressed, so 24 is not a good alternative to 23. The *marked* evidence of nostril flaring is sufficient in a still image for 38A, an action that you will learn about in Chapter 8, so missing this AU here is not an error now. The lowering of the brow is *pronounced* and the drawing together is *slight*, producing *slight* vertical wrinkles in the glabella and ripples of skin above the eyebrows, indicating AU 4C. The upper eyelid is raised to reveal much more of the iris than in neutral, and from what can be see, one can easily extrapolate that some sclera is below the lid, particularly in the left eye, indicating 5D. As in items 111, 115, and 120, the *trace* of evidence for AU 7 is not scored as 7A, on the same basis, even though there is more evidence here, especially in the narrowing of the angle of the eyelids at the tear duct, which creates more of a bump in the curve of the lower eyelid where it meets the sclera. It is still not certain. Item 110 shows the effect of 7 on this person.
136  (Get Neutral)	Chapter 7: 6B+7C+12D+25C	The *extreme* lateral and *slightly* upward stretch of the lip corners, the *severe* deepening and raising of the nasolabial furrow and the *extreme* infraorbital triangle raise are obvious signs of AU 12 at the D intensity. Certainty cannot be attached to any impression of a jaw drop, so with the lips parted *slightly* more than the criteria for the B intensity of 25, 25C is scored. The narrowing of the lips can easily be attributed to the stretching of 12, and should not suggest 23. In the upper face, the relatively large action of AU 12 has produced the crow's feet wrinkles on the lateral side of the cheek below the eye, but AU 6 has produced the *slight* crow's feet at the eye corners and above, the outer eyebrows are lowered *slightly*, and the eye opening is narrowed *markedly*, sufficient to score AU 6B. The lower eyelids have raised and straightened on the eyeball more than 6 at this level can cause, and wrinkling and bagging is *marked*, indicating 7C.

137  (Get Neutral)	Chapter 3: 4D Chapter 8: 4D+ 20B+23D+ 25C+29C	In the upper face, the eyebrows are drawn together and lowered *extremely,* forming *marked* wrinkles and bulging characteristic of AU 4 in the glabella and above the inner halves of each eyebrow, sufficient to score 4D. The eyes have little or no staring quality and less iris shows than in neutral, eliminating 5 from consideration. In the lower face, *extreme* tightening and turning inwards of the lips, and *pronounced* bulging and wrinkling at the margins of the lips indicates 23D. Where as 23 would usually de-elongate the lips, these lips are stretched *slightly* laterally, the lower nasolabial furrow is pulled *slightly* laterally, there is *slight* flattening of the cheeks at the lip corners, and *marked* evidence the lower lip and chin boss skin is stretched lateral, indicating 20 at the B intensity. The lower teeth are in front of the upper teeth, apparent especially by examining the gaps more laterally, but did the teeth move there or is this their normal position? AU 29 should be scored because previous items (e.g., 106) show this position is not her standard bite. Since the teeth are together at the moment of the photo, 26 is not scored. Thus, the *marked* difference of the lip parting from the criteria for 25B indicates the C intensity for 25.
138  (Get Neutral)	Chapter 3: 1C+2C+5E Chapter 8: 1C+2C+5E+ L12A	The *marked* raising of the entire brow and formation of *pronounced* horizontal wrinkles across the entire forehead, and the *marked* exposure of the eye cover fold and skin indicates AU combination 1+2, and using the criteria for this combination, the C intensity is assigned. The upper eyelid is raised to expose the *maximum* range of sclera, indicating a 5E. The lower face has changed very little from neutral, but the left lip corner is raised a *trace*, and a *trace* wrinkle at the left lip corner has formed, sufficient to score L12A.
139  (Get Neutral)	Chapter 3: 4D+7C Chapter 8: 4D+7C+ 14B+17D+ 23E+38E	In the upper face, the eyebrows are lowered and drawn together *severely,* forming *severe* characteristic vertical wrinkling of AU 4 in the glabella and above the eyebrows, sufficient for the D intensity. The lower eyelids are drawn up onto the eyeball and straightened *severely,* and the eye opening is narrowed *markedly,* with *pronounced* wrinkling and bagging, indicating AU 7C. Evidence for AU 6 is lacking; there are no crow's feet and the infraorbital triangle is not raised. Less iris shows than in neutral, eliminating AU 5. In the lower face, the *maximum* wrinkling and *extreme* pushing up of the chin boss and skin around the chin boss, and the *severe* pushing up of the lower lip indicate AU 17D. The pushing up of the lower lip is counteracted by the *maximally* tightened lips, narrowed and turned inwards *maximally,* meeting the criteria for 23E in AU combination 17+23. AU 24 is not as good a score for the lip appearance changes because there is more turning in and tightening than pressing (see 17+23 vs. 17+24 comparisons). One could argue that 23+24 is a reasonable score, based on the pressing that can be inferred. The *slight* tightening and pulling inwards of the lip corners and the *slight* wrinkling beyond and below the lip corners indicates 14B. The deepening of the middle part of the nasolabial furrow suggests AU 11, but there is no other evidence of 11, such as oblique stretching of the lip between the philtrum and the corner, oblique movement of the deepened furrow, or raising of the infraorbital triangle, and the change in the nasolabial furrow could be due to other actions present, so 11 is not scored. The nostrils are flared *maximally* for 38E.

140  (Get Neutral)	Chapter 3: 4E+7B Chapter 8: 4E+7B+ 17D+24D+38D	The eyebrows are lowered *extremely* and drawn together *maximally,* forming *extreme* to *maximum* vertical wrinkling in the glabella, sufficient to score 4E. The lower eyelid is raised *slightly* up on the eyeball, and there is *slight* bulging and a *trace* more wrinkling in the lower eyelid, and the eye opening is narrowed *slightly,* sufficient to score 7B. A harsh staring quality and sufficient revealing of iris are lacking to score AU 5. In the lower face, the *severe* pushing up and wrinkling of the chin boss and the pushing up of the lips indicate AU 17D. The pushing up of the lips by 17 is checked by the *severe* lip pressing, which creates *severe* bulging above and below the lips and *severe* lip narrowing, indicating 24D. There is much more bulging and pressing in the lips than tightening and turning inwards, so AU 23 is not as good a score for the lips. The nostrils are *extremely* flared, sufficient to score 38D. If you failed to score it, perhaps you skipped the omission check.
141  (Get Neutral)	Chapter 3: 1B+2B+4C+5B Chapter 8: 1B+2B+4C+5B+ 20A+25C+26C+ 38A	In the upper face, the eyebrows are pulled together *markedly* and the lowering of the center of the eyebrows is *pronounced*, creating the vertical waves of skin above the centers of the eyebrows and skin bunching in the glabella, indicating AU 4. The inner corners of the eyebrows are raised *slightly* and *slight* wrinkles form in the center of the forehead, indicating AU 1. The position of the outer corners of the eyebrows changes little from neutral, but *slight* wrinkles appear high above the outer corners, indicating the presence of AU 2. Consulting the guidelines for AU combination 1+2+4 indicates that the intensities 1B+2B+4C should be assigned. AU combination 1+4 might be considered as an alternative score, but not only is the evidence for 2 clear, but also, the overall shape of the brows fits with 1+2+4 much better than 1+4. In the lower face, the jaw lowering is about midway to the most that the jaw can relax open, indicating 26C. The lips are parted no more than a *trace* beyond what the jaw drop might produce, so 25C is scored. The lower lip near the corners is stretched a *trace* laterally and down, changing the shape of the lower lip and creating a *trace* of bulging at the lip corners, sufficient to score 20A. The nostrils are flared *slightly,* sufficient to score 38A.
142  (Get Neutral)	Chapter 8: 4B+5C+7A+ 24C+38D	The lips are *slightly* narrowed and pressed together, producing *slight* bulging below the lips, sufficient to score 24B. AU 23 is not a good score because there is little evidence of the tightening and turning inwards of the lips characteristic of 23. The nostrils are *extremely* flared, sufficient for 38D. If you missed this obvious change, you probably are not doing the omission check. The inner half of the brow is lowered *markedly* and the inner corners are drawn together *slightly,* producing *slight* vertical wrinkle in the glabella, sufficient for 4C. The upper eyelids are raised to show the entire top of the iris, *slightly* more than in neutral, sufficient evidence using the guidelines for 4+5 to score 5C. The lower eyelids are straightened and drawn up on the eyebrow a *trace*, and a *trace* of increase in wrinkling and bulging appears, enough to score 7A.
143  (Get Neutral)	Chapter 3: 1E+2E+5E Chapter 8: 1E+2E+5E+ 25C+26E	The raise of the entire brow indicates AU combination 1+2, and as the horizontal wrinkling in the forehead, upward movement of inner and outer eyebrow corners, and exposure of the eye cover fold are all *maximum*, the E intensity is assigned to both AUs. The upper eyelid is raised to expose a *maximum* amount of sclera above the iris, indicating AU 5E. In the lower face, the jaw is lowered about as much as possible from relaxation (remember, this degree of lowering cannot be scored 27 in a still image), so 26E is scored, and the lip parting is about what can be expected from the jaw lowering alone, so 25C is scored. You may have considered 19, but the tongue does not protrude.

144  (Get Neutral)	Chapter 8: 7C+12D+ 25D+26D	The lower face is dominated by the *extreme* lateral and obliquely upward stretching of the lip corners and nasolabial furrow, and the *severe* lifting of the infraorbital triangle and deepening of the nasolabial furrow characteristic of AU 12, at the D intensity. The lowering of the jaw is almost enough to put a finger through, or a 26D. The lip parting is increased by the 12 *markedly* beyond what the jaw drop alone might produce, sufficient to score 25D. The tongue does not protrude, excluding AU 19. Despite the high intensity of the 12, which raises the infraorbital triangle, no crow's feet wrinkles are present, and the outer corners of the brows are not lowered, thus providing no evidence for AU 6. The narrowing of the eyes is *pronounced* and the straightening, wrinkling and bulging of the lower lid is sufficient to score 7C.
145  (Get Neutral)	Chapter 8: 1D+2D+5D+ 25C+26D	The jaw has dropped almost enough to stick a finger through the teeth, or a 26D. The lip parting is not different from that which might be produced by this jaw drop, so it is scored 25C. The tongue shows, but it does not protrude, at least with certainty, so AU 19 is not scored. The entire brow is raised *severely*, producing *pronounced* horizontal wrinkles across the entire forehead, and the exposure of the eye cover fold and skin above it is *severe*, sufficient to score both AUs 1 and 2 at the D intensity. The upper eyelids are raised to expose *severely* more sclera, or 5D.
146  (Get Neutral)	Chapter 8: 4C+5C+ 17D+24E+38E	The lowering of the eyebrows is *pronounced* and the drawing together is *pronounced*, forming *pronounced* vertical wrinkling in the glabella, sufficient to score 4C. A harsh staring quality and *slightly* more revealing of the iris than in neutral is sufficient to score AU 5C. There is no bulging or more wrinkling in the lower eyelid than in neutral, and the eye opening is not changed; although the iris is closer to the lower lid, this could be due to gaze direction There is insufficient evidence to score 7, and if you look at the inner corners of the eyes and compare them with those of the 7A in item 142, you will see a difference in how the skin is drawn together, which is lacking here. In the lower face, the *severe* pushing up and wrinkling of the chin boss and the pushing up of the lips indicate AU 17D. The pushing up of the lips by 17 is checked by the *maximum* lip pressing, which creates *maximum* bulging above and below the lips and *maximum* lip narrowing, indicating 24E. There is much more bulging and pressing in the lips than tightening and turning inwards, so AU 23 is not as good a score for the lips. The nostrils are *maximally* flared, sufficient to score 38E. If you failed to score it, perhaps you skipped the omission check.
201 	Chapter 4: 6C+7D+9D+17C	The lower face shows *extreme* nose wrinkling, gathering of skin on the nose and raising of the upper lip, pouching above nostril wing, deepening of nasolabial furrow, and *extreme* infraorbital triangle raise, indicating 9D. One might claim that there is a possible 10, but there is too little evidence of 10, beyond what 9 causes, to score 10 (e.g., more curvature of the nasolabial furrow, lifting of its lateral part, lifting of lip corners), and no sequential motion allowing differentiation of these two AUs. The *pronounced* to *severe* chin boss raising, *marked* to *pronounced* chin boss wrinkling, and pushing up and out of lower lip indicate AU 17 at the C intensity. In the upper face, the infraorbital triangle raise, pulling down of the outer corners of the eyebrows, and *slight* crow's feet wrinkling evident on the left, indicate AU 6C acting in addition to 9. The *severe* straightening of the lower eyelid, *severe* wrinkling and bulging of lower eyelid beyond what 6 and 9 can produce indicate 7D. You can see some decrease of this 7 independent of 9 near the end. AU 4 is not scored here because the motion of the eyebrows is down only, due to the 9.

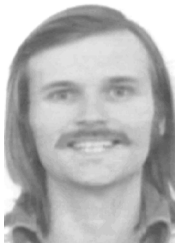
202 	Chapter 4: 1C+4B+15C	The *marked* oblique pulling down of the lip corners, and *slight* bunching of skin below the lip corners indicate 15C. The inner corners of the eyebrows are raised and straightened *markedly,* forming *pronounced* horizontal wrinkles, sufficient to score 1C, and they are pulled together *slightly* to form *slight* skin bunching and wrinkling in the glabella, sufficient to score 4B. Notice that the centers of the eyebrows are pulled down by AU 4, forming the straight, slanted brows characteristic of 1+4
203 	Chapter 3 1B Chapter 4: 1B+15B	In the upper face, the inner corners of the eyebrows are raised *slightly,* forming *slight* horizontal wrinkles high in the forehead, sufficient for scoring 1B. The eyebrows are not pulled together or down anywhere, or much straightened, and there is no vertical wrinkling or other signs of AU 4 between the eyebrows so 4 is not scored. In the lower face, the lip corners are *slightly* pulled down, and *slight* bunching below lip corners appears, sufficient to score 15B.
204 	Chapter 4: 4C+5D+6A+7D+ 10E+15D+17D	The *extreme* chin wrinkling, pushing up of the chin boss, and pushing up and out of the lower lip indicate 17D. The *pronounced* lowering of lip corners, producing a *pronounced* inverted-U shape, with *pronounced* wrinkling and bulging below lip corners indicate AU 15 at the D intensity, using the criteria for 15 with 17. *Extreme* to *maximum* nasolabial furrow deepening and raising forming the characteristic pouching of AU 10, with *extreme* raising of he upper lip and infraorbital triangle is sufficient for the E intensity. It is hard to tell if the lips part on either side of the center near the end of the item, so to be conservative, 25 is not scored. In the upper face, the eyebrows are pulled together *markedly* and the pulling down is *pronounced*, sufficient evidence for 4C. The lower lid is straightened *severely,* and raised with bulging in the lower lid enough to score 7D. The upper lid is raised *markedly*, pushing against the lowering caused by the 4 and creating a harsh glare and revealing more of the iris at the top and sclera next to it, sufficient to score 5D. The *slight* raising of the lateral part of the infraorbital triangle and skin bunching at the eye corners, and lowering of the outer end of the eyebrows and *trace* of crow's feet wrinkling is sufficient to score 6A.
205 	Chapter 4: 7B+9B+17A	The *trace* raising of the chin boss, *trace* wrinkling on the chin boss, *trace* pushing up of the lower lip indicate 17A. *Slight* pouching above the nostril wings, *slight* gathering of skin on the nose, and *slight* deepening of the nasolabial furrow indicate 9B. These small actions of AUs 9 and 10 are easy to confuse, so look in the subtle differences for these AUs. Here, the direction of skin pull is medial, towards the nose, a sign of 9. The *slight* narrowing of the eye opening, *marked* straightening of the lower eyelid, and slight bulging of the lower eyelid is sufficient evidence to score 7B.

206 	Chapter 3: 1B+4B Chapter 4: 1B+4B+17B	In the upper face, *slight* raising of the inner corners of the eyebrows, forming *slight* horizontal wrinkles in the center of the forehead, indicates a 1B. The *slight* drawing together of the inner corners of the eyebrows and *slight* bunching of skin in the glabella is sufficient to score 4B. The *slight* raising of the chin boss, *slight* wrinkling on chin boss, and *slight* pushing up of lower lip indicate 17B.
207 	Chapter 4: 10B+25B	The *slight* raising of the upper lip and *slight* deepening of the nasolabial furrow, forming the characteristic 10 shape, indicate 10B, close to a 10C on the right side. The jaw remains closed and the parting of the lips is about 2mm, indicating 25B.
208 	Chapter 4: 15E+17C	The lip corners are pulled down *severely* with *severe* bunching of skin at the lip corners, sufficient to score 15E using the criteria for 15 with 17. The chin boss is pushed up *markedly* with *pronounced* chin boss wrinkling, and the lower lip is pushed up *slightly*, indicating 17C.
209 	Chapter 5: 1B+R2A+4C+5C+ R20C+25D+26E	The jaw drops open relatively slowly, and is not pulled rapidly open or stretched, separating the teeth about as much as a finger can fit through, or as much as might occur if the muscle closing the jaw relaxed completely, or 26E. The tongue shows, but does not clearly protrude beyond the teeth, so 19 is not scored. The lips part *markedly* beyond what the jaw drop alone might produce, or 25D, because the lip is stretched laterally on the right side *pronouncedly*, producing *marked* wrinkling beyond the lip corner, indicating an R20C. The right lip corner is angled down, but no 15 is scored as it is 20 that pulls down, a possibility noted in 20secA. In the upper face, the first movement in the brows is up *slightly*, and although this movement is mostly in the center of the forehead, forming *slight* wrinkling in the center, and indicating a 1B there is a *trace* of upward movement on the right outer corner of the eyebrow, that is different from any small upward movement that AU 1 might produce alone, indicating R2A. *Marked* pulling together of the inner corners of the eyebrows is quickly added to their initial upward movement, producing *marked* bunching and wrinkling of the skin in the glabella, sufficient for scoring 4 at the C intensity. Notice that when the 4 acts, the eyebrows are pulled down from their centers, creating a more slanted shape characteristic of 1+4, and signs of the R2 disappear. The upper eyelid is raised to reveal *markedly* more of the iris, even virtually all of the iris briefly, and using the criteria for 5 in 1+4, this is scored 5C. The 5 fades off by the end of the item.

210 	Chapter 3: 6D Chapter 5: 6D+20D+25B	The infraorbital triangle is raised *severely*, creating *severe* crow's feet wrinkles on the right side, less on the left, indicating a 6D. The infraorbital furrow is deepened *severely* by AU 6, and skin of the lower eyelid is pushed *slightly* up on the eyeball, at least on the right, this increased wrinkling and pushing up of the lower eyelid can reasonably be accounted for by AU 6, so AU 7 need not be scored to account for these changes. If you scored 7A/B on the right, it would not be a serious mistake, but there is no evidence of 7 on the left. The lips are stretched laterally *extremely*, and *severe* bulges appear beyond the lip corners, indicating AU 20 at the D intensity. The lips are parted on both sides of the philtrum about 2mm or 25B. The appearance of 20 with 6 creates changes that you might confuse with AU 12, because of the oblique upward pulling on the lip corners by AU 6. This effect is more apparent on the right than the left in this item. Despite these signs in common with 12, these appearance changes are best accounted for by the score of 6+20, not 6+12 or 6+12+20. More evidence of 12 that could not be produced by 20 or 6 would be needed to score a 12 in this situation. AU 10 is not a good score because there is no characteristic AU 10 pouch and it is the lateral part of the nasolabial furrow that deepens, not near the nose, and this change can easily be explained by the 6+20.
211 	Chapter 5: 10D+20D+25C	The upper lip is raised *severely*, the infraorbital triangle is raised and the nasolabial furrow is deepened and raised *extremely*, forming the characteristic pouch of AU 10, at the D intensity. The lip corners are stretched laterally *severely*, flattening the cheeks and creating bulges at the lip corners, indicating a 20D. The lips are parted *markedly* more than the criteria for 25B, sufficient for 25C. AU 17 is not present, though you might be misled by the fact that the medial portion of the lower lip is higher than the corners. Yet, the neither the lower lip or chin boss is pushed up. Although the lower eyelid is pushed up somewhat and the infraorbital furrow is deepened, this can be accounted for entirely by the lifting of AU 10. Nothing happens in the rest if the upper face.
212 	Chapter 5: 16A+20B+25C	The initial movement of the lower lip is *slightly* down only, pulling the lower lip down almost enough to reveal the lower gum line, sufficient to score 16A. The *slight* lateral lip stretching begins just before the lower lip dips to its lowest point, creating *slight* bulging beyond the lip corners, sufficient to score 20B. As the 20 reaches its furthest excursion, sighs of the 16 disappear. The parting of the lips at its greatest is *slightly* more than the criteria for 25B, sufficient to score 25C.
213 	Chapter 5: 14D	The lip corners are tightened *extremely*, pulled inwards *severely*, characteristic of 14 at the D intensity. AU 14 stretches the skin on the chin boss, but there is no pushing up characteristic of AU 17. The lips are thinned, but nothing beyond what the 14 can produce. The wrinkling beyond and below the lip corners are typical of this strong, stereotypical 14. Nothing else happens in this item.

214 	Chapter 5: 10C+14D	The upper lip is raised *markedly*, with *marked* infraorbital triangle raise and *pronounced* deepening of the nasolabial furrow in the characteristic 10 shape, sufficient to score the C intensity. The tightening of the lip corners is *severe*, with *marked* lateral movement and the *severe* wrinkling at the lip corners and below indicates 14D. If you did not score 10 because you thought that the characteristic shape of AU 10 is not sharply defined, review the effects of AU 14 on AU 10 in 10+14secA. No other changes in the face appear.
215 	Chapter 5: 14D+17C	*Extreme* tightening of the lip corners, *severe* lateral movement of the lip corners, and *severe* wrinkling at the lip corners and below indicate 14 at the D intensity. This *extreme* 14 deepens the nasolabial furrow, which can lead to confusion with the signs of other AUs in Chapter 6. *Marked* pushing up of the chin boss and *marked* wrinkling of the chin boss, pushing up the lower lip indicates 17C.
216 	Chapter 5: 16D+20E+25C	*Maximum* lateral stretching of the lip corners, producing *extreme* flattening of the cheeks and wrinkling beyond the lip corners indicates AU 20 at the E intensity. AU 20 pulls the lips somewhat downward, but the entire skin of the chin is also pulled down *severely* and laterally, pulling the center of the lip down *extremely* to reveal the gum, not appearances produced by 20 alone, but of 16 at the D intensity. The lip parting beyond the criteria for 25B is *pronounced*, or 25C. No other actions are apparent.
217 	Chapter 6: 10D+12B+ 15C+17C	The upper lip is raised *severely*, the nasolabial furrow is deepened *extremely* in the characteristic pouch of AU 10 at the D intensity. The lips remain together because of the *marked* upward pushing of the lower lip as the raise of the chin boss is *pronounced* with *pronounced* bulging and wrinkling on the chin boss indicating 17C. The lip corners are pulled down *markedly*, producing *pronounced* wrinkling and bulging below and beyond the lip corners, indicating 15C. The lower part of the nasolabial furrow is also deepened and pulled obliquely upwards, pulling the lip corners upward in tension with the 15, and raising the lateral aspects of the infraorbital triangle, producing the characteristic appearance of 12+15, which is somewhat altered by the *extreme* 10. The contribution of 12 to what 15, or 10+15, is doing to the lips is an appearance that you should learn to recognize as a whole, after repeatedly following the procedure for combinations of 10, 15, and 17 in Chapter 6. Step I: The answer is “Yes”, 17 is involved, the evidence for 17 is clear. Step II: “Yes”, 15 is involved, if you scored 15B instead of 15C, it is a minor error. Step V: In Chart 6-2, you see that any evidence for AU 6 the AU combination in this item falls far short, but the evidence for AU 12, oblique pulling of skin beyond the lip corners and oblique raise of skin in the lower nasolabial furrow, is apparent. The B intensity is assigned to 12 as these changes are on the *slight* side, but an argument for the C intensity could reasonably be made.

218 	Chapter 6: 7B+12C	The corners of the lips are *markedly* to *pronouncedly* pulled obliquely upwards, the deepening of the nasolabial furrow is *pronounced*, and the infraorbital triangle is raised *markedly*, characteristic of AU 12 at the C intensity. AU 14 could be considered, but lip corner tightening is not evident. AU 10 is another possibility, but the characteristic pouching is not present nor is the shape of the upper lip a compromise between 10 and 12. Also, there is no evidence of 10 pulling up the center of the upper lip. *Slight* narrowing of the eye opening, *slight* straightening of the lower eyelid as it is pulled up on the eyeball, *slight* bulging and wrinkling of the lower eyelid indicate 7B. You might have considered AU 6, but the raising of the infraorbital triangle can be attributed to AU 12, and the narrowing of the eye opening, to AU 7, and no independent signs of 6 are apparent.
219 	Chapter 6: 6D+7C+12D+25B	*Severe* to *extreme* raising of the lip corners obliquely and upwards, *severe* deepening of the nasolabial furrow and raising of the infraorbital triangle are characteristic of AU 12 at the D intensity. The lips are parted about 2mm, or the B intensity. *Severe* crow's feet wrinkles that extend above the eye corner, together with the pulling down of the outer corners of the eyebrows and contraction of skin around the orbit of the eye indicate AU 6 at the D intensity, less on the left. *Marked* narrowing of the eye opening, *pronounced* straightening of the lower eyelid, *marked* bulging and wrinkling beyond what 6 might do, and raising of the lower eyelid on the eyeball indicate AU 7 at the C intensity. The action of 7 is somewhat independent of the 6.
220 	Chapter 6: 1C+11B	The middle of the nasolabial furrow deepens *slightly* and the skin of the upper lip between the philtrum and the lip corner is pulled obliquely upwards *slightly*, indicating AU 11 at the B intensity. This action is not AU10 because the characteristic pouching of AU 10 is not clearly evident, the deepening of the nasolabial furrow is more in the central than the medial part, and the lifting of the infraorbital triangle is more oblique than upwards. The inner corners of the eyebrows are raised *markedly* forming *slight* wrinkles at the center of the forehead indicating AU 1 at the C intensity. AU 2 is not present in this item; whatever movement you might detect in the lateral part of the eyebrows is from the 1 (she also moves her head *slightly* up). AU 4 is not present as there is no pulling together of the brows or vertical wrinkling.
221 	Chapter 6: 11C	The middle of the nasolabial furrow deepens *markedly* and the skin of the upper lip between the philtrum and the lip corner is pulled obliquely upwards *markedly*, indicating AU 11 at the C intensity. AU 11 is a better score than 10 for this item; see the subtle differences. The change in the shape of the lips is due to the 11, not 15 though the resulting inverted-U suggests 15. The lip corners do not move, eliminating both 15 and 20 from consideration. There is no other movement in this item.
222 	Chapter 6: 12B	The corners of the lips are pulled *slightly* upwards and obliquely, sightly lifting the lower part of the infraorbital triangle and deepening the lower part of the nasolabial furrow *slightly*, indicating AU 12 at the B intensity. The resulting shape of the lips and the direction of movement of the skin beyond the lip corners are characteristic of AU 12, not to be confused with the signs of 11.

223 	Chapter 6: 12C+15C	This appearance is characteristic of 12+15, with the upward, oblique pull of the lip corners by 12 in opposition to the downward, oblique pull of the lip corners by 15. The *pronounced* deepening of the lower and middle portion of the nasolabial furrow, lifting of the infraorbital triangle, and *marked* stretching of the lips indicate 12C. The *marked* downward pulling of the lip corners, the *pronounced* wrinkling below and beyond the lip corners indicate 15C. If you scored 15B, note that in neutral, the lips are *slightly* up and that the lip corner movement is greater than the B intensity. AU 11 might be considered an alternative to scoring 12, but the movement of skin is at and above the lip corners, not above the middle of the lip, the deepening and lifting of the nasolabial furrow is in the lateral part, not only in its middle, and the opposition to the movement of 15 together with the characteristic compromise shape of the lips is due to AU 12, and is something 11 cannot do. The infraorbital triangle lifts due to the action of 12, but there is no evidence of AUs 6 or 7 other than the very *trace* changes in the infraorbital furrow area on the right and the raising of the upper, lateral part of the infraorbital triangle, which are produced by the 12.
224 	Chapter 6: 7A+13D	The appearance changes include *severe* oblique, upward stretching of the lip corners, *pronounced* raising of the infraorbital triangle, with *severe* deepening of the nasolabial furrow, especially in the middle, and *severe* bulging of the cheeks above the lip corners. The best score for this set of appearances is 13 at the D intensity, because the raising of the lip corners is sharper than that of 12, the lips are not stretched laterally as much as in 12, and the bulging of the cheeks indicates 13, not 12. It would be hard to unequivocally dispute a claim that some 12 also occurs here, based on many of the changes above, so scoring 12+13 would not be a serious error. AU 14 should not be scored because there is no tightening or pulling in of the lip corners. The *slight* narrowing of the eye opening, the *slight* pulling up of the lower eyelid onto the eyeball, and the *slight* bulging indicate 7A (using the criteria for 7 with 13).
225 	Chapter 6: 10A+12D+16D+ 25E+26A	The corners of the lips are pulled *severely* upwards and obliquely, lifting the infraorbital triangle *severely,* and deepening the nasolabial furrow *severely* indicating AU 12 at the D intensity. The center of the lower lip is pulled down *severely,* revealing all of the lower teeth in front, the skin of the chin and lower lip is pulled down and laterally *severely,* indicating 16D. The *slight* deepening of the medial nasolabial furrow, formation of the characteristic 10 pouch, and *slight* lifting of the upper lip (all of which are a little ahead of the contraction of 12) indicate the presence of 10 at the A intensity (using criteria for 10 with 12). The baring of the upper teeth, more than 12 alone at this intensity might produce, is part of the compromise shape of 10 and 12 together, though only a *trace* of the compromise shape possible. The jaw drops *slightly* as can be seen by the *slight* separation between many teeth, though not all, indicating 26A. The separation of the lips is almost as much as can be had, given this small jaw drop, or 25E. The lifting of the infraorbital triangle by 12 is substantial, particularly on the right, and skin is pushed up on the eyeball on the right, deepening the infraorbital furrow, with a *trace* of bulging of the lower lid, especially on the right. Crow's toes wrinkles form on the right. Most of these appearance changes can be easily explained by the action of 12 alone, but the question is whether to score a 6, particularly on the right. However, the crow's toes do not extend above the outer corner of the eye, and the outer corner of the eyebrow is not pulled down, so 6 is not scored here, but if you scored R6, it is not a serious error.

226 	Chapter 3: 4B+6C+7D Chapter 6: 4B+6C+7D+ 15D+17A	*Pronounced* raising of the infraorbital triangle, *slight* crow's feet wrinkling, lowering of the outer corner of the eyebrows, and obvious gathering of the skin around the orbit of the eyes indicates AU 6 at the C intensity. The *severe* narrowing of the eye opening, *extreme* straightening of the lower eyelid and *severe* to *extreme* wrinkling and bulging of the lower eyelid are far beyond what the 6 alone is doing and indicate the action of AU 7 at the D intensity. In addition to being lowered a *trace* (which might be an effect of 6), the inner corners of the eyebrows are drawn together *slightly*, creating *slight* wrinkles and bulges in the glabella, indicating AU 4 at the B intensity *Severe* pulling down of the lip corners with *pronounced* to *severe* wrinkling and bagging beyond the lip corners forms a *pronounced*, characteristic inverted-U shape of AU 15 at the D intensity. *Slight* wrinkling on the chin boss, *trace* of pushing upward of the chin boss and skin of the lower lip (though the red parts are hardly affected) indicate AU 17 at the A intensity. The *trace* deepening of the nasolabial furrow, particularly the mid- to lower part is attributed to the actions of 15 and 6, but if you scored 6+11A, it is not a serious error, but 11 is not needed to explain this appearance change.
227 	Chapter 8: 4D+5D+17C+24E	The upward push of the chin boss and the chin boss wrinkling is *pronounced*, indicating AU 17 at the C intensity. The pushing up of the lip by 17 is countered by *extreme* to *maximum* pressing and tightening of the lips, narrowing them *markedly*, and creating *severe* bulging above and below the red parts of the lips. Because the pressing of the lips outweighs the tightening of the lips, and the lips are pressed flat rather than turned in, 24 at the E intensity is scored in this item. AU 23 should be seriously considered, but rejected because particularly with 17, the lips would be much more turned inwards, and much thinner if 23 were acting. The eyebrows are *severely* pulled together and lowered, creating *severe* wrinkling in the glabella, indicating AU 4 at the D intensity. The upper eyelid is raised to expose more of the iris and sclera adjacent to the iris indicating the action of 5 at the D intensity, using criteria for 5 with 4. The *trace* upward movement of the lower lid is easily explained by the strong action of 5, eliminating 7 from consideration.
228 	Chapter 3: 5B Chapter 7: 5B+10C+25B	In the upper face, the upper eyelid is raised, but not enough to reveal the entire iris or sclera above it, indicating AU 5 at the B intensity, using criteria for 5 alone. In the lower face, the upper lip is raised *markedly*, forming an angular shape in the upper lip, and the nasolabial furrow is deepened *slightly* in the characteristic 10 shape, sufficient to score 10C. The lips are parted *slightly* more than the 2mm criteria for the B intensity of AU 25, or 25C, using the criteria for 25 without teeth separating.
229 	Chapter 3: 4C+7C Chapter 7: 4C+7C+ 17D+26D+28B	In the upper face, the inner corners of the eyebrows are pulled together *slightly*, and their lowering is *pronounced*, forming *marked* vertical wrinkling and skin bunching in the glabella, indicating 4C. The narrowing of the eye opening is *marked* to *pronounced*, with *pronounced* straightening of the lower eyelid, and *marked* wrinkling and bulging of the lower eyelid, indicating 7C. AU 6 not present as there is no infraorbital triangle raise or crow's feet wrinkling. In the lower face, the jaw drops only enough to allow the lips to fit between the teeth, and too slowly for AU 27, so this action is scored 26D. Since the lips do not part, AU 25 is not scored. Both lips are rolled entirely into the mouth and the red parts virtually disappear, scored AU 28B. Aiding the position of the lower lip into the mouth, the skin of the lip and chin boss is pushed up *severely*, creating *severe* wrinkles on the chin boss, or 17D.

230 	Chapter 8: 4D+5D+18C+23B	The corners of the lips are pulled inwards *severely,* producing *severe* wrinkling in the lips and de-elongating the lips *severely,* indicating 18C. AU 18 produces some of the same appearance changes due to AU 23, but in this item, the narrowing and tightening of the lips is *pronounced*, and *pronounced* bulging and wrinkling appear above and below the lips, sufficient to score 23B, using the guidelines for AU combination 18+23. The changes in the skin below the lips are due to 18+23, not 17 as there is no upward push to the skin of the chin or lip. The inner corners of the eyebrows are pulled together and lowered *extremely,* forming *extreme* vertical wrinkling and skin bulging in the glabella, sufficient to score 4D. The upper eyelid is raised *extremely* to reveal sclera above the iris, sufficient to score 5 at the D intensity.
231 	Chapter 7: 4D+7B+ 10E+16D+ 22C+25E	The upper lip is pulled up *maximally,* raising the infraorbital triangle, and the nasolabial furrow is deepened *maximally* in the form of the characteristic pouching of AU 10 at the E intensity. The lower lip is pulled down *extremely* revealing virtually all of the lower teeth, and the skin of the chin and lower lip is pulled down and laterally, indicating 16 at the D intensity. Both lips, but especially the lower lip is turned out, funneled outwards *severely,* in the characteristic shape of AU 22C. The actions of 10, 16 and 22 separate the lips about as much as possible with the jaw closed, or 25E. If you scored AU 20, you might have been mislead by the lateral movement of the skin and chin, but this movement is due to 16, not 20, which would not pull down as much. If you scored AU 23, you might have noticed a hint of tightening in the lips, but this tightening is not unambiguous and could be caused by 10+22. The eyebrows are lowered *extremely* and are pulled together *severely,* forming *severe* vertical wrinkling and skin bulging in the glabella, sufficient to score 4D. The lower eyelid is straightened, pulled up onto the eyeball, with *marked* bulging and *slight* wrinkling, sufficient to score 7B. AU 5 cannot be scored because there is no evidence of the upper eyelid pushing against the lowering of the skin by AU 4 and the harsh glare is not present (cover the eyebrows to see that the eyes are not harsh). AU 6 is not scored because, although the infraorbital triangle raises due to AU 10, the lateral parts of the triangle do not raise, and there are no crow's feet.
232 	Chapter 8: 1C+5C+ 10D+23E+25C	The lips are tightened *maximally* inwards forming *maximum* bulging and wrinkling along the margins of the red parts, unmistakably indicating a 23 at the E intensity. The upper lip is raised *severely,* deepening the nasolabial furrow *severely* in the characteristic pouch of AU 10 at the D intensity. The actions of 10 and 23 separate the lips *slightly* more than the criteria for the B intensity of 25, or 25C. About the time the actions in the lower face have reached apex, the inner corners of the brows are raised *slightly* to *pronouncedly,* more on the right, forming *pronounced* horizontal wrinkles in the center of the forehead, indicting a 1C. The upper eyelid is raised to reveal a hairline of sclera in the right eye, or 5C.
233 	Chapter 8: 15D+17E+ 23C+38C	The lip corners are pulled down *severely,* creating *pronounced* bulging and wrinkling below the lip corners, forming the characteristic inverted-U of AU 15 at the D intensity. The chin boss is pushed up *maximally* creating *extreme* to *maximum* wrinkling on the chin boss, and pushing up the lower lip, sufficient to score 17E. The lips are tightened, narrowed, and turned in *markedly,* creating *marked* wrinkling around the margins of the red parts, indicating 23C. The nostrils flare *markedly,* indicating 38C.

234 	Chapter 7: 4B+16C+ 23D+25C	The lower lip is pulled down *markedly* in the center, and the skin of the chin and lower lip is pulled down and laterally *pronouncedly,* sufficient to score 16C. The red parts of the lips are tightened and narrowed *severely,* with *severe* tightening and bulging around the margins of the red parts, indicating 23 at the D intensity. The action of 16 pulls apart the lips *slightly* more than the criteria for 25B, or sufficient to score 25C. The eyebrows are *slightly* lowered and drawn together a *trace,* sufficient to score 4B.
235 	Chapter 7: 1C+4C+7B+ 17C+24C	The lower lip is pushed up *slightly,* and the chin boss and skin above it are pushed up *markedly,* creating wrinkles and bulges on the chin that are *pronounced,* sufficient to score 17C. The lips are de-elongated, pressed *markedly* together and narrowed *markedly,* opposing the upward movement of the lower lip by AU 17. This evidence indicates AU 24 at the C intensity. AU 23 is not scored because the lips are pressed, not tightened and turned inwards. The inner corners of the eyebrows are raised and pulled together, with the centers of the eyebrows pulled down *slightly,* producing the characteristic slant of AU combination 1+4. *Marked* vertical wrinkles and *slight* bulges appear in the glabella, and the pulling together is *pronounced,* indicating 4C. The raising is *pronounced,* forming *marked* horizontal wrinkles in the center of the forehead, indicating 1C. The lower eyelids are straightened, pulled up on the eyeball, and the eye opening is *slightly* narrower, with *slight* bulging and wrinkling of the lower lid, sufficient to score 7B.
236 	Chapter 3: 4C+5E+6B+7C Chapter 8: 4C+5E+6B+7C+ 14D+17D	In the upper face, the eyebrows are lowered *markedly* and drawn together *markedly,* creating *slight* vertical wrinkles and bulges in the glabella, sufficient to score AU 4 at the C intensity. The upper eyelid is raised to reveal much more than a hairline of sclera above the iris, especially evident in the left eye, which using the intensity guidelines for 4+5, is sufficient for scoring 5 at the E intensity. The infraorbital triangle is raised *markedly,* particularly evident on the lateral part, and the outer corner of the eyebrow is lowered, and wrinkling and bulging at the corners of the eye indicate AU 6 at the B intensity. The lower lid is straightened and raised on the eyeball, producing *pronounced* bulging and wrinkling, particularly in the right eye, far beyond the effects that AU 6 is causing and sufficient to score 7 at the C intensity. In the lower face, the lip corners are drawn laterally and *severely* tightened at the corners, with *severe* to *extreme* wrinkling beyond the lip corners and *pronounced* deepening of the nasolabial furrow. This evidence is best explained by AU 14 at the D intensity, and although there is some resemblance to AU 12 in the shape of the lip, 12 cannot explain the tightening or the shape of the wrinkles at the lip corners. The chin boss is pushed up *extremely,* and *extreme* wrinkling appears on the chin boss and skin of the chin, pushing up the lower lip *markedly,* sufficient evidence to score 17D. You might have considered scoring 23 or 24, but the thinning, tightening, and bulging that could be used as evidence for these AUs are explained sufficiently by the actions of 14 and 17. The lips are not turned in as AU 23 would do, nor are there wrinkles on the lip margins as 23 might produce. AU 24 might be easier to support, based on the pressing and thinning of the lips, which could be accounted for by 14 and 17, and the straightness of the lips, which implies some opposition to the pushing up of the lower lip by 17, but this opposition could be provided by 14. The criterion score does not include 24 for these reasons, but if you scored 24A/B this is not a serious error.

237 	Chapter 8: 1C+4D+7D+ 18D+25B+38D	The lips are separated about 2mm, or the B intensity of 25. The corners of the lips are drawn towards each other *extremely*, de-elongating the lips, and forming a puckered look of the red parts, characteristic of AU 18 at the D intensity. The nostrils are *extremely* flared, or 38D. The inner corners of the eyebrows are pulled together and lifted, and the lateral and central part of each eyebrow is lowered, forming the slanted shape characteristic of 1+4. *Pronounced* horizontal wrinkles form in the center of the forehead, with the *pronounced* lifting, is sufficient to score 1C. *Severe* vertical wrinkling and bulging in the glabella, with the *severe* pulling together, indicate 4 at the D intensity. The lower eyelid is lifted on the eyeball and straightened, creating *severe* bulging, especially in the right eye, and the skin around the eye is gathered together and pulled medially by AU 7 at the D intensity.
238 	Chapter 7: 22D+23D+25D	The lips are funneled out *severely* to *extremely* in a characteristic appearance of AU 22 at the D intensity. The *extreme* tightening and curling in of the red parts indicates AU 23D. The actions of 22 and 23 occur sequentially making them easy to see. The lips are parted *severely* more than the criteria for 25B with the jaw closed, or 25D.
239 	Chapter 8: 6D+7D+ 9D+R12B+ 14C+17B+24D	The lip corners are *markedly* tightened, pulled *slightly* inwards, stretched *slightly* laterally, and on the left side remain angled somewhat downwards. *Marked* muscle bulges appear at the lip corners. The lower part of the nasolabial furrow is deepened *extremely*, which is extended below the lip corners. The bulging and the tightening, with the other evidence, indicates 14C (barely). On the right side, however, the nasolabial furrow and skin at the corner of the lip are also pulled *slightly* obliquely upwards and deepened more than on the right, but no such pulling appears on the left side, leaving the signs of 14 alone. This evidence, with the other signs present, indicates the action of 12 on the right at a B intensity. The upper lip is raised, but the lips remain together. The entire infraorbital triangle is raised *severely* to *maximally.* The *severe* nose wrinkling, sharp pouch above the nostril wings, pulling of skin onto the nose, and *extreme* deepening of the nasolabial furrow indicate 9D. The lips are pressed together *severely*, forming *marked* bulges below the lower lip and wrinkles on the upper lip, indicating 24D. Finally, the chin boss is pushed up *slightly* with *slight* wrinkles appearing on the chin during the first part of this item, indicating a 17B. This action practically disappears by the end of the event, but helps keep the lips together as the 24 increases. The raising of the lateral part of the infraorbital triangle, the lowering of the outer corner of the eyebrows, and the gathering of skin around the eye, producing *severe* crow's feet wrinkles indicate AU 6 at the D intensity. The eye opening is narrowed *extremely* as the eyelids are straightened, pulled up onto the eyeball, forming *severe* bulges and wrinkles, far beyond what the action of 6 produces, indicating 7D. AU 4 is not scored because the eyebrows are not pulled together and AUs 9 and 6 explain their lowering. This item is one of the more difficult in this Practice set.
240 	Chapter 7: 12C+17C	The lip corners are raised up and drawn laterally *markedly*, and the infraorbital triangle is raised *slightly*, with *slight* wrinkling beyond the lip corners and deepening of the nasolabial furrow, forming the characteristic lip shape of AU 12 at the C intensity. The chin boss is pushed up *markedly*, forming *slight* wrinkles on the chin and pushing up the lower lip *markedly*, sufficient to score 17C. AU 24 is not scored here because the thinning and pressing of the lips is explained adequately by the actions of 12 and 17.

241 	Chapter 8: 12C+24C	The lip corners are raised up and drawn laterally *markedly,* and the infraorbital triangle is raised *slightly,* with *slight* wrinkling beyond the lip corners and *marked* deepening of the nasolabial furrow, indicating AU 12 at the C intensity. The lips are pressed *marked*ly, straightening the lip line, and *markedly* thinning the lips, forming *slight* bulges above and below the lips, indicating the action of 24 at the c intensity. AU 14 is not scored because the lip corners and the skin beyond them are not tightened, but pulled up.
242 	Chapter 7: 7E+12C+23E	The red parts of the lips are turned inwards and tightened *maximally,* narrowing the lips and forming bulges and wrinkles above and below the margins of the red parts of the lips, sufficient to score 23E. The lip corners are raised up and drawn laterally *markedly,* and the infraorbital triangle is raised *slightly,* with *slight* wrinkling beyond the lip corners and *marked* deepening of the nasolabial furrow, indicating AU 12 at the C intensity. AU 17 is not scored because there is no pushing up of the lower lip or chin boss; skin is only stretched by 23 in the chin. AU 14 is not scored because whatever tightening in the lip corners is present can be accounted for by the 23. The eyelids are narrowed to a slit, and the skin of the eyelids is gathered and pulled medially to the *maximum* extent, creating *maximum* wrinkling and bulging of the lower eyelid, indicating 7E.
243 	Chapter 3: 4B+5D Chapter 8: 4B+5D+17C+ 23E+25C+26B+ 29B+38D	In the upper face, the eyebrows are lowered and drawn together *slightly,* forming *trace* wrinkles and bulging in the glabella, sufficient to score 4B. The upper lid is raised to reveal a hairline of sclera above the iris, and using the criteria for 5 in 4+5, is scored 5D. In the lower face, the lips are turned inwards and tightened *maximally,* narrowing the red parts of the lips and forming bulges and wrinkles above and below the margins of the red parts, sufficient to score 23E. The jaw drops *slightly,* but not rapidly, or 26B, as can be seen from the position of the chin relative to the neck, and in the brief opening of the lips. The jaw's drop allows it to thrust forward *markedly,* as can be seen from the movement of the lateral parts of the mandible and bulging of the chin and lips as the jaw moves forward, or 29B. The brief, *slight* lip parting is only as much as might be produced by the jaw drop alone, or 25C. The chin boss is pushed up *severely,* forming *pronounced* wrinkling on the chin, pushing up the lower lip to unite the lips, sufficient to score 17D. This pushing up of the chin is partly hidden by the 29. The nostrils are *severely* flared, or 38D.
244 	Chapter 7: 10E+17E+23D	The upper lip is pulled up *maximally,* and *maximum* pouching of the nasolabial furrow characteristic of AU 10 forms, with *extreme* deepening of the nasolabial furrow and raising of the infraorbital triangle, sufficient to score 10E. The lower lip and chin boss are pushed up *maximally* creating *maximal* wrinkling and bulging on the chin, indicating 17E. The lips are turned inwards and tightened *severely* to *extremely,* narrowing the red parts of the lips and forming *severe* bulges and wrinkles above and below the margins of the red parts, sufficient to score 23D. The simultaneous occurrence of the AUs make seeing the 23 harder. Notice that although the skin of the lower eyelid is pushed up onto the eyeball *slightly* with a *trace* of wrinkling, this change can be adequately explained by the action of 10 pushing up the infraorbital triangle. There is no AU 7 in this item.

245 	Chapter 7: 23C+25B	The red parts of the lips are *markedly* turned in and thinned, forming the wrinkles and bulges around the lips that characterize AU 23 at the C intensity. The lips part enough to show the teeth and the jaw does not drop, indicating 25B.
246 	Chapter 8: 22C+25D+26B	The funneling out and pushing forward of the lips is *pronounced*, sufficient to score AU 22C. The jaw is dropped *slightly*, enough to see space between the teeth, sufficient to score 26B. The lips are parted *markedly* more than what this jaw drop might produce alone, or 25D.
247 	Chapter 7: 24B	The lips are pressed together *slightly* and narrowed *slightly*, sufficient to score 24B. This movement is very subtle, if you confuse it with AU 23, see the subtle differences for these two AUs.

Chapter 8: *How Others Scored Practice Items*

The four tables in this chapter provide information about how a group of six coders fared in their practice scoring. The tabulations allow you to compare yourself, and those whom you are training, with a group who succeeded in learning FACS and achieved reliability (these results were reported in Chapter 2 of the ***Guide***). You can determine whether you are making the same types or the same numbers of errors. If you are making more errors, you should spend more time studying the AU descriptions and practicing scoring.

The tables report the scoring of coders who used the original version of FACS compared with the criterion scoring based on the original version's rules (see Chapter 7 for the current scoring). Because the rules for scoring have changed, the new criterion scores (correct answers in Chapter 7) are different from the old. In most cases, these differences are minor and result from different scoring conventions. Sometimes, the original coders were prevented from scoring certain AUs, even though the evidence for the AUs was as clear then as it is today. You may see these discrepancies in A intensity AUs. In other cases, AUs that previously could not often, if ever, be scored together are now allowed in the same score (e.g., 6 and 7, 25 and 26). Some AUs no longer even exist, having been incorporated into other AUs (footnotes point these changes out). Most AUs were not scored for intensity, and the intensity notation was different, with X being today's B, Y being C or D, and Z being E. Despite these differences, it is helpful to review how another group of scorers saw the evidence that you weigh in the practice items, and their successes and mistakes. In some cases, yesterday's errors are now correct answers.

Table 8-1 compares the coders on the Chapter 3 practice movies; Table 8-2 compares the coders on the Chapter 3 practice stills. Table 8-3 provides the results for all the practice movies for Chapters 4 through 8; Table 8-4 provides the results for all the practice stills for Chapters 4 through 8.

When you review your scoring of the practice items for Chapter 8, carefully compare the errors you have made with those reported for the previous learners in Tables 8-3 and 8-4. This is the last set of practice items. Errors are to be expected, but you should not be making many more errors than those made by the coders reported in the following tables. If you are making many more errors, or making consistent errors on a particular AU or AU combination, spend more time studying the ***Manual*** before taking the Final Test described in Chapter 9.

TABLE 8-1: CODER COMPARISON OF CHAPTER 3 PRACTICE MOVIES

1	CRITER.	:	CH.3	#203	1	+		+	
2	BLOSSOM	:	CH.3	#203	1	+	2	+	
3	KATHY	:	CH.3	#203	1	+		+	
4	CHARLOT	:	CH.3	#203	1	+		+	
5	LINDA	:	CH.3	#203	1	+		+	
6	SONIA	:	CH.3	#203	1	+		+	4
7	RAINER	:	CH.3	#203	1	+		+	
	NUMBER CODERS				6		1		1
1	CRITER.	:	CH.3	#206	1	+	4		
2	BLOSSOM	:	CH.3	#206	1	+	4		
3	KATHY	:	CH.3	#206	1	+	4		
4	CHARLOT	:	CH.3	#206	1	+	4		
5	LINDA	:	CH.3	#206	1	+	4		
6	SONIA	:	CH.3	#206	1	+	4		
7	RAINER	:	CH.3	#206	1	+			
	NUMBER CODERS				6		5		
1	CRITER.	:	CH.3	#210		+	6		
2	BLOSSOM	:	CH.3	#210	5X	+	6		
3	KATHY	:	CH.3	#210		+	6		
4	CHARLOT	:	CH.3	#210		+	6		
5	LINDA	:	CH.3	#210		+	6		
6	SONIA	:	CH.3	#210		+	6		
7	RAINER	:	CH.3	#210		+	6		
	NUMBER CODERS				1		6		
1	CRITER.	:	CH.3	#226	4	+	6	+	
2	BLOSSOM	:	CH.3	#226	4	+		+	7
3	KATHY	:	CH.3	#226	4	+		+	7
4	CHARLOT	:	CH.3	#226	4	+	6	+	
5	LINDA	:	CH.3	#226	4	+	6	+	
6	SONIA	:	CH.3	#226	4	+		+	7
7	RAINER	:	CH.3	#226	4	+		+	7
	NUMBER CODERS				6		2		4

1	CRITER.	:	CH.3	#228	5X						
2	BLOSSOM	:	CH.3	#228	5Y						
3	KATHY	:	CH.3	#228	5X						
4	CHARLOT	:	CH.3	#228	5X						
5	LINDA	:	CH.3	#228	5						
6	SONIA	:	CH.3	#228	5X						
7	RAINER	:	CH.3	#228	5						
	NUMBER CODERS				6						
1	CRITER.	:	CH.3	#229	4	+	7				
2	BLOSSOM	:	CH.3	#229	4	+	7				
3	KATHY	:	CH.3	#229	4	+					
4	CHARLOT	:	CH.3	#229	4	+					
5	LINDA	:	CH.3	#229	4	+	7				
6	SONIA	:	CH.3	#229	4	+					
7	RAINER	:	CH.3	#229	4	+					
	NUMBER CODERS				6		2				
1	CRITER.	:	CH.3	#236	4	+	5Y	+	6	+	
2	BLOSSOM	:	CH.3	#236		+	5Y	+		+	
3	KATHY	:	CH.3	#236	4	+	5Y	+	6	+	
4	CHARLOT	:	CH.3	#236	4	+	5X	+	6	+	
5	LINDA	:	CH.3	#236	4	+	5	+	6	+	
6	SONIA	:	CH.3	#236	4	+	5	+	6	+	
7	RAINER	:	CH.3	#236		+	5Y	+		+	7
	NUMBER CODERS				4		6		4		1
1	CRITER.	:	CH.3	#243	4	+	5Y				
2	BLOSSOM	:	CH.3	#243	4	+	5				
3	KATHY	:	CH.3	#243		+	5X				
4	CHARLOT	:	CH.3	#243		+	5X				
5	LINDA	:	CH.3	#243		+	5Z				
6	SONIA	:	CH.3	#243		+	5X				
7	RAINER	:	CH.3	#243		+	5X				
	NUMBER CODERS				1		6				

TABLE 8-2: CODER COMPARISON OF CHAPTER 3 PRACTICE STILLS

1	CRITER. :	CH.3	#102	1	+	2	+	5Y					
2	BLOSSOM:	CH.3	#102	1	+	2	+	5Y					
3	KATHY :	CH.3	#102	1	+	2	+	5Y					
4	CHARLOT:	CH.3	#102	1	+	2	+	5Y					
5	LINDA :	CH.3	#102	1	+	2	+	5Y					
6	SONIA :	CH.3	#102	1	+	2	+	5Z					
7	RAINER :	CH.3	#102	1	+	2	+	5Y					
	NUMBER CODERS			6		6		6					
1	CRITER. :	CH.3	#110	6									
2	BLOSSOM:	CH.3	#110	6									
3	KATHY :	CH.3	#110	6									
4	CHARLOT:	CH.3	#110	6									
5	LINDA :	CH.3	#110	6									
6	SONIA :	CH.3	#110	6									
7	RAINER :	CH.3	#110	6									
	NUMBER CODERS			6									
1	CRITER. :	CH.3	#117	1	+	4	+	6					
2	BLOSSOM:	CH.3	#117	1	+	4	+	6					
3	KATHY :	CH.3	#117	1	+	4	+	6					
4	CHARLOT:	CH.3	#117	1	+	4	+	6					
5	LINDA :	CH.3	#117	1	+	4	+	6					
6	SONIA :	CH.3	#117	1	+	4	+	6					
7	RAINER :	CH.3	#117	1	+	4	+	6					
	NUMBER CODERS			6		6		6					
1	CRITER. :	CH.3	#119	1	+		+		+		+	41[1]	
2	BLOSSOM:	CH.3	#119		+		+	4	+	7	+		
3	KATHY :	CH.3	#119	1	+	2	+	4	+		+	41	
4	CHARLOT:	CH.3	#119	1	+		+	4	+	7	+		
5	LINDA :	CH.3	#119	1	+		+	4	+		+	41	
6	SONIA :	CH.3	#119		+		+	4	+		+	41	
7	RAINER :	CH.3	#119	1	+		+		+	7	+		
	NUMBER CODERS			4		1		5		3		3	

1. The original AU 41 is now 43B.

1	CRITER. :	CH.3	#122		+		+		+	L 6
2	BLOSSOM :	CH.3	#122		+	1	+	2	+	
3	KATHY :	CH.3	#122		+		+		+	6
4	CHARLOT :	CH.3	#122		+		+		+	6
5	LINDA :	CH.3	#122	0	+		+		+	
6	SONIA :	CH.3	#122		+		+		+	6
7	RAINER :	CH.3	#122		+		+		+	6
	NUMBER CODERS			1		1		1		4
1	CRITER. :	CH.3	#123		+	4	+	5Y		
2	BLOSSOM :	CH.3	#123		+	4	+	5X		
3	KATHY :	CH.3	#123		+	4	+	5Y		
4	CHARLOT :	CH.3	#123		+	4	+	5X		
5	LINDA :	CH.3	#123		+	4	+	5X		
6	SONIA :	CH.3	#123		+	4	+	5Y		
7	RAINER :	CH.3	#123	0	+		+			
	NUMBER CODERS			1		5		5		
1	CRITER. :	CH.3	#125	1	+	2	+	4	+	5Z
2	BLOSSOM :	CH.3	#125	1	+		+	4	+	5Z
3	KATHY :	CH.3	#125	1	+	2	+	4	+	5Z
4	CHARLOT :	CH.3	#125	1	+	2	+	4	+	5Z
5	LINDA :	CH.3	#125	1	+		+	4	+	5Z
6	SONIA :	CH.3	#125	1	+	2	+		+	5Z
7	RAINER :	CH.3	#125	1	+	2	+	4	+	5Z
	NUMBER CODERS			6		4		5		6
1	CRITER. :	CH.3	#128	4	+	5Z				
2	BLOSSOM :	CH.3	#128	4	+	5Z				
3	KATHY :	CH.3	#128	4	+	5Y				
4	CHARLOT :	CH.3	#128	4	+	5Y				
5	LINDA :	CH.3	#128	4	+	5Z				
6	SONIA :	CH.3	#128	4	+	5Y				
7	RAINER :	CH.3	#128	4	+	5Z				
	NUMBER CODERS			6		6				

1	CRITER. :	CH.3	#131	1	+	4		
2	BLOSSOM :	CH.3	#131		+	4		
3	KATHY :	CH.3	#131	1	+	4		
4	CHARLOT :	CH.3	#131	1	+	4		
5	LINDA :	CH.3	#131	1	+			
6	SONIA :	CH.3	#131		+	4		
7	RAINER :	CH.3	#131	1	+	4		
	NUMBER CODERS			4		5		
1	CRITER. :	CH.3	#133	1	+	4	+	
2	BLOSSOM :	CH.3	#133	1	+	4	+	
3	KATHY :	CH.3	#133	1	+	4	+	
4	CHARLOT :	CH.3	#133	1	+	4	+	
5	LINDA :	CH.3	#133	1	+	4	+	7
6	SONIA :	CH.3	#133	1	+	4	+	
7	RAINER :	CH.3	#133	1	+	4	+	
	NUMBER CODERS			6		6		1
1	CRITER. :	CH.3	#137		+	4	+	
2	BLOSSOM :	CH.3	#137	2	+	4	+	
3	KATHY :	CH.3	#137		+	4	+	5X
4	CHARLOT :	CH.3	#137		+	4	+	
5	LINDA :	CH.3	#137		+	4	+	
6	SONIA :	CH.3	#137		+	4	+	
7	RAINER :	CH.3	#137		+	4	+	
	NUMBER CODERS			1		6		1
1	CRITER. :	CH.3	#138	1	+	2	+	5Z
2	BLOSSOM :	CH.3	#138	1	+	2	+	5Z
3	KATHY :	CH.3	#138	1	+	2	+	5Z
4	CHARLOT :	CH.3	#138	1	+	2	+	5Z
5	LINDA :	CH.3	#138	1	+	2	+	5Z
6	SONIA :	CH.3	#138	1	+	2	+	5Z
7	RAINER :	CH.3	#138	1	+	2	+	5Z
	NUMBER CODERS			6		6		6

I	CRITER. :	CH.3	#139	4	+		+		+	7
2	BLOSSOM :	CH.3	#139	4	+	5X	+	6	+	
3	KATHY :	CH.3	#139	4	+		+		+	7
4	CHARLOT :	CH.3	#139	4	+		+		+	7
5	LINDA :	CH.3	#139	4	+		+		+	7
6	SONIA :	CH.3	#139	4	+		+		+	7
7	RAINER :	CH.3	#139	4	+		+		+	7
	NUMBER CODERS			6		1		1		5
1	CRITER. :	CH.3	#140	4	+		+	7		
2	BLOSSOM :	CH.3	#140	4	+	5X	+			
3	KATHY :	CH.3	#140	4	+		+			
4	CHARLOT :	CH.3	#140	4	+		+	7		
5	LINDA :	CH.3	#140	4	+		+	7		
6	SONIA :	CH.3	#140	4	+		+			
7	RAINER :	CH.3	#140	4	+		+	7		
	NUMBER CODERS			6		1		3		
1	CRITER. :	CH.3	#141	1	+	2	+	4	+	5Y
2	BLOSSOM :	CH.3	#141	1	+		+	4	+	5Y
3	KATHY :	CH.3	#141	1	+		+	4	+	5Y
4	CHARLOT :	CH.3	#141	1	+		+	4	+	5X
5	LINDA :	CH.3	#141	1	+		+	4	+	5Y
6	SONIA :	CH.3	#141		+		+	4	+	5Z
7	RAINER :	CH.3	#141	1	+		+		+	5Z
	NUMBER CODERS			5		0		5		6
1	CRITER. :	CH.3	#143	1	+	2	+	5Z		
2	BLOSSOM :	CH.3	#143	1	+	2	+	5Z		
3	KATHY :	CH.3	#143	1	+	2	+	5Z		
4	CHARLOT :	CH.3	#143	1	+	2	+	5Z		
5	LINDA :	CH.3	#143	1	+	2	+	5Z		
6	SONIA :	CH.3	#143	1	+	2	+	5Z		
7	RAINER :	CH.3	#143	1	+	2	+	5Z		
	NUMBER CODERS			6		6		6		

TABLE 8-3: CODER COMPARISON OF CHAPTERS 4-8 PRACTICE MOVIES

1	CRITER.	:	CH.4	#201	9	+	17	+								
2	BLOSSOM	:	CH.4	#201	9	+	17	+	44[2]							
3	KATHY	:	CH.4	#201	9	+		+	44							
4	CHARLOT	:	CH.4	#201	9	+	17	+								
5	LINDA	:	CH.4	#201	9	+	17	+	44							
6	SONIA	:	CH.4	#201	9	+		+								
7	RAINER	:	CH.4	#201	9	+		+								
	NUMBER CODERS				6		3		3							
1	CRITER.	:	CH.4	#202	1	+	4	+	15Y	+						
2	BLOSSOM	:	CH.4	#202	1	+	4	+	15Y	+						
3	KATHY	:	CH.4	#202	1	+	4	+	15Y	+						
4	CHARLOT	:	CH.4	#202	1	+	4	+	15Y	+						
5	LINDA	:	CH.4	#202	1	+	4	+	15Y	+	17					
6	SONIA	:	CH.4	#202	1	+	4	+	15Y	+						
7	RAINER	:	CH.4	#202	1	+	4	+	15Y	+						
	NUMBER CODERS				6		6		6		1					
1	CRITER.	:	CH.4	#203	1	+	15X									
2	BLOSSOM	:	CH.4	#203	1	+	15X									
3	KATHY	:	CH.4	#203	1	+	15X									
4	CHARLOT	:	CH.4	#203	1	+	15X									
5	LINDA	:	CH.4	#203	1	+	15Y									
6	SONIA	:	CH.4	#203	1	+	15X									
7	RAINER	:	CH,4	#203	1	+	15X									
	NUMBER CODERS				6		6									
1	CRITER.	:	CH.4	#204		+	4	+		+	7	+	10Z	+	15Z	+ 17
2	BLOSSOM	:	CH.4	#204		+	4	+		+	7	+	10Z	+	15X	+ 17
3	KATHY	:	CH.4	#204		+	4	+	6	+		+	10Y	+	15Y	+ 17
4	CHARLOT	:	CH.4	#204		+	4	+		+	7	+	10	+	15Y	+ 17
5	LINDA	:	CH.4	#204	1	+	4	+		+	7	+	10Y	+	15Y	+ 17
6	SONIA	:	CH.4	#204	1	+	4	+		+	7	+	10X	+	15X	+ 17
7	RAINER	:	CH.4	#204		+	4	+		+	7	+	10Y	+	15Y	+ 17
	NUMBER CODERS				2		6		1		5		6		6	6

2. The original AU 44 is now 7E.

1	CRITER. :	CH.4	#205		+	7	+	9	+		+		
2	BLOSSOM :	CH.4	#205		+	7	+	9	+				
3	KATHY :	CH.4	#205		+	7	+		+	10X	+		
4	CHARLOT :	CH.4	#205		+	7	+	9	+		+		
5	LINDA :	CH.4	#205		+	7	+	9	+		+	17	
6	SONIA :	CH.4	#205	4	+	7	+		+	10X	+		
7	RAINER :	CH.4	#205	4	+	7	+		+	10X	+		
	NUMBER CODERS			2		6		3		3		1	

1	CRITER. :	CH.4	#206	1	+	4	+		+	17
2	BLOSSOM :	CH.4	#206	1	+	4	+		+	17
3	KATHY :	CH.4	#206	1	+	4	+		+	17
4	CHARLOT :	CH.4	#206	1	+	4	+		+	17
5	LINDA :	CH.4	#206	1	+	4	+	15Y	+	17
6	SONIA :	CH.4	#206	1	+	4	+		+	17
7	RAINER :	CH.4	#206	1	+	4	+		+	17
	NUMBER CODERS			6		6		1		6

1	CRITER. :	CH.4	#207	10X	+	25
2	BLOSSOM :	CH.4	#207	10X	+	25
3	KATHY :	CH.4	#207	10Y	+	25
4	CHARLOT :	CH.4	#207	10X	+	25
5	LINDA :	CH.4	#207	10Y	+	25
6	SONIA :	CH.4	#207	10X	+	25
7	RAINER :	CH.4	#207	10Y	+	25
	NUMBER CODERS			6		6

1	CRITER. :	CH.4	#208	15Y	+	17
2	BLOSSOM :	CH.4	#208	15Z	+	17
3	KATHY :	CH.4	#208	15Y	+	17
4	CHARLOT :	CH.4	#208	15Z	+	17
5	LINDA :	CH.4	#208	15	+	17
6	SONIA :	CH.4	#208	15Z	+	17
7	RAINER :	CH.4	#208	15Y	+	
	NUMBER CODERS			6		5

1	CRITER.	:	CH.5	#209	1	+		+	4	+	5Y	+		+	R20Y+	26		
2	BLOSSOM	:	CH.5	#209	1	+	2	+	4	+		+		+	R20X+	26		
3	KATHY	:	CH.5	#209	1	+		+	4	+	5X	+		+	R20Y+	26		
4	CHARLOT	:	CH.5	#209	1	+	2	+	4	+	5X	+		+	R20X+	26		
5	LINDA	:	CH.5	#209	1	+		+	4	+	5X	+	R16	+	R20Y+	26		
6	SONIA	:	CH.5	#209	1	+	2	+	4	+	5X	+		+	R20X+	26		
7	RAINER	:	CH.5	#209	1	+		+	4	+		+			R20X+	26		
	NUMBER CODERS				6		3		6		4		1		6		6	
1	CRITER.	:	CH.5	#210	6	+		+	20Y	+	25							
2	BLOSSOM	:	CH.5	#210	6	+	10X	+	20Y	+	25							
3	KATHY	:	CH.5	#210	6	+		+	20Y	+	25							
4	CHARLOT	:	CH.5	#210	6	+		+	20Y	+	25							
5	LINDA	:	CH.5	#210	6	+		+	20Y	+	25							
6	SONIA	:	CH.5	#210	6	+		+	20Y	+	25							
7	RAINER	:	CH.5	#210	6	+		+	20Y	+	25							
	NUMBER CODERS				6		1		6		6							
1	CRITER.	:	CH.5	#211	10Y+		20Y	+	25									
2	BLOSSOM	:	CH.5	#211	10Y+		20Y	+	25									
3	KATHY	:	CH.5	#211	10Y+		20Y	+	25									
4	CHARLOT	:	CH.5	#211	10Y+		20Y	+	25									
5	LINDA	:	CH.5	#211	10Y+		20Y	+	25									
6	SONIA	:	CH.5	#211	10Y+		20Y	+	25									
7	RAINER	:	CH.5	#211	10Y+		20Y	+	25									
	NUMBER CODERS				6		6		6									
1	CRITER.	:	CH.5	#212		+	20X	+	25									
2	BLOSSOM	:	CH.5	#212		+	20Y	+	25									
3	KATHY	:	CH.5	#212		+	20X	+	25									
4	CHARLOT	:	CH.5	#212	16	+	20X	+	25									
5	LINDA	:	CH.5	#212		+	20Y	+	25									
6	SONIA	:	CH.5	#212	16	+	20X	+	25									
7	RAINER	:	CH.5	#212	16	+	20X	+	25									
	NUMBER CODERS				3		6		6									

1	CRITER.	:	CH.5	#213	14	+						
2	BLOSSOM	:	CH.5	#213	14	+						
3	KATHY	:	CH.5	#213	14	+	17					
4	CHARLOT	:	CH.5	#213	14	+						
5	LINDA	:	CH.5	#213	14	+						
6	SONIA	:	CH.5	#213	14	+						
7	RAINER	:	CH.5	#213	14	+						
	NUMBER CODERS				6		1					
1	CRITER.	:	CH.5	#214		+	10Y	+	14	+		+
2	BLOSSOM	:	CH.5	#214		+		+	14	+	17	+ 20X
3	KATHY	:	CH.5	#214		+	10Y	+	14	+		+ 20Y
4	CHARLOT	:	CH.5	#214		+	10Y	+	14	+		+
5	LINDA	:	CH.5	#214	7	+	10Y	+	14	+		+
6	SONIA	:	CH.5	#214		+	10Y	+	14	+		+
7	RAINER	:	CH.5	#214		+	10X	+	14	+		+
	NUMBER CODERS				1		5		6		1	2
1	CRITER.	:	CH.5	#215		+	14	+	17	+		
2	BLOSSOM	:	CH.5	#215		+	14	+	17	+		
3	KATHY	:	CH.5	#215	10Y	+	14	+	17	+	20Z	
4	CHARLOT	:	CH.5	#215		+	14	+	17	+		
5	LINDA	:	CH.5	#215		+	14	+	17	+		
6	SONIA	:	CH.5	#215		+	14	+	17	+		
7	RAINER	:	CH.5	#215	10X	+	14	+	17	+		
	NUMBER CODERS				2		6		6		1	
1	CRITER.	:	CH.5	#216	16	+	20Z	+	25			
2	BLOSSOM	:	CH.5	#216	16	+	20X	+	25			
3	KATHY	:	CH.5	#216	16	+	20Z	+	25			
4	CHARLOT	:	CH.5	#216	16	+	20Z	+	25			
5	LINDA	:	CH.5	#216	16	+	20Y	+	25			
6	SONIA	:	CH.5	#216	16	+	20Y	+	25			
7	RAINER	:	CH.5	#216	16	+	20Z	+	25			
	NUMBER CODERS				6		6		6			

1	CRITER.	:	CH.6	#217	10Z	+	12X	+	15Y	+	17
2	BLOSSOM	:	CH.6	#217		+	12X	+	15Y	+	17
3	KATHY	:	CH.6	#217		+	12Y	+	15X	+	
4	CHARLOT	:	CH.6	#217	10Z	+	12X	+	15Y	+	17
5	LINDA	:	CH.6	#217		+	12Y	+	15Y	+	17
6	SONIA	:	CH.6	#217	10Y	+	12X	+	15X	+	17
7	RAINER	:	CH.6	#217	10Y	+	12X	+	15Y	+	
	NUMBER CODERS				3		6		6		4

1	CRITER.	:	CH.6	#218		+	12Y				
2	BLOSSOM	:	CH.6	#218		+	12Y				
3	KATHY	:	CH.6	#218		+	12Y				
4	CHARLOT	:	CH.6	#218	10X	+	12Y				
5	LINDA	:	CH.6	#218	10X	+	12Y				
6	SONIA	:	CH.6	#218		+	12Y				
7	RAINER	:	CH.6	#218	10X	+	12Y				
	NUMBER CODERS				3		6				

I	CRITER.	:	CH.6	#219	6	+	12Y	+		+	25
2	BLOSSOM	:	CH.6	#219	6	+	12Y	+		+	25
3	KATHY	:	CH.6	#219	6	+		+	13	+	25
4	CHARLOT	:	CH.6	#219	6	+	12Y	+		+	25
5	LINDA	:	CH.6	#219	6	+	12Y	+		+	25
6	SONIA	:	CH.6	#219	6	+	12Z	+		+	25
7	RAINER	:	CH.6	#219	6	+	12Y	+		+	25
	NUMBER CODERS				6		5		1		6

1	CRITER.	:	CH.6	#220	1	+		+		+	11
2	BLOSSOM	:	CH.6	#220	1	+		+		+	11
3	KATHY	:	CH.6	#220	1	+	4	+	10X	+	
4	CHARLOT	:	CH.6	#220	1	+		+		+	11
5	LINDA	:	CH.6	#220	1	+		+		+	11
6	SONIA	:	CH.6	#220	1	+		+		+	11
7	RAINER	:	CH.6	#220	1	+		+		+	11
	NUMBER CODERS				6		1		1		5

1	CRITER.	:	CH.6	#221		+	11	+		+		
2	BLOSSOM	:	CH.6	#221		+		+	13	+		
3	KATHY	:	CH.6	#221		+	11	+		+		
4	CHARLOT	:	CH.6	#221	10X	+		+		+	15X	
5	LINDA	:	CH.6	#221	10X	+		+		+		
6	SONIA	:	CH.6	#221	10X	+		+		+		
7	RAINER	:	CH.6	#221		+	11	+		+		
	NUMBER CODERS				3		2		1		1	

1	CRITER.	:	CH.6	#222	12X							
2	BLOSSOM	:	CH.6	#222	12X							
3	KATHY	:	CH.6	#222	12X							
4	CHARLOT	:	CH.6	#222	12X							
5	LINDA	:	CH.6	#222	12X							
6	SONIA	:	CH.6	#222	12X							
7	RAINER	:	CH.6	#222	12X							
	NUMBER CODERS				6							

1	CRITER.	:	CH.6	#223	12Y	+	15Y					
2	BLOSSOM	:	CH.6	#223	12Y	+	15Y					
3	KATHY	:	CH.6	#223	12X	+	15Y					
4	CHARLOT	:	CH.6	#223	12X	+	15X					
5	LINDA	:	CH.6	#223	12X	+	15Y					
6	SONIA	:	CH.6	#223	12X	+	15X					
7	RAINER	:	CH.6	#223	12Y	+	15Y					
	NUMBER CODERS				6		6					

1	CRITER.	:	CH.6	#224		+	13					
2	BLOSSOM	:	CH.6	#224		+	13					
3	KATHY	:	CH.6	#224	7	+	13					
4	CHARLOT	:	CH.6	#224		+	13					
5	LINDA	:	CH.6	#224		+	13					
6	SONIA	:	CH.6	#224		+	13					
7	RAINER	:	CH.6	#224		+	13					
	NUMBER CODERS				1		6					

1	CRITER.	:	CH.6	#225		+	12Y	+	16	+		+	26
2	BLOSSOM	:	CH.6	#225		+	12Y	+	16	+		+	26
3	KATHY	:	CH.6	#225		+	12Y	+	16	+	25	+	
4	CHARLOT	:	CH.6	#225		+	12Y	+	16	+	25	+	
5	LINDA	:	CH.6	#225	R6	+	12Y	+	16	+	25	+	
6	SONIA	:	CH.6	#225	6	+	12Y	+	16	+	25	+	
7	RAINER	:	CH.6	#225	6	+	12Z	+		+		+	26
	NUMBER CODERS				3		6		5		4		2	
1	CRITER.	:	CH.6	#226	4	+	6	+		+	15Z	+		
2	BLOSSOM	:	CH.6	#226	4	+		+	7	+	15Z	+		
3	KATHY	:	CH.6	#226	4	+		+		+	15Z	+		
4	CHARLOT	:	CH.6	#226	4	+		+	7	+	15Z	+		
5	LINDA	:	CH.6	#226	4	+		+	7	+	15Z	+		
6	SONIA	:	CH.6	#226	4	+		+	7	+	15Y	+	17	
7	RAINER	:	CH.6	#226	4	+		+	7	+	15Z	+	17	
	NUMBER CODERS				6		0		5		6		2	
1	CRITER.	:	CH.8	#227	4	+	5Y	+	17	+	24			
2	BLOSSOM	:	CH.8	#227	4	+	5Y	+	17	+	24			
3	KATHY	:	CH.8	#227	4	+	5Y	+	17	+	24			
4	CHARLOT	:	CH.8	#227	4	+	5Y	+	17	+	24			
5	LINDA	:	CH.8	#227	4	+	5Y	+	17	+	24			
6	SONIA	:	CH.8	#227	4	+	5Y	+	17	+	24			
7	RAINER	:	CH.8	#227	4	+	5Y	+	17	+	24			
	NUMBER CODERS				6		6		6		6			
1	CRITER.	:	CH.7	#228	5X	+	10Y	+		+	25			
2	BLOSSOM	:	CH.7	#228	5X	+	10X	+	T22	+	25			
3	KATHY	:	CH.7	#228	5X	+	10Y	+		+	25			
4	CHARLOT	:	CH.7	#228	5X	+	10Y	+		+	25			
5	LINDA	:	CH.7	#228	5X	+	10Y	+		+	25			
6	SONIA	:	CH.7	#228	5X	+	10X	+		+	25			
7	RAINER	:	CH.7	#228	5X	+	10X	+	22	+	25			
	NUMBER CODERS				6		6		2		6			

I	CRITER. :	CH.7	#229	4	+		+	7	+	28												
2	BLOSSOM:	CH.7	#229	4	+		+	7	+	28												
3	KATHY :	CH.7	#229	4	+	6	+		+	28												
4	CHARLOT:	CH.7	#229	4	+		+	7	+	28												
5	LINDA :	CH.7	#229	4	+		+	7	+	28												
6	SONIA :	CH.7	#229	4	+		+		+	28												
7	RAINER :	CH.7	#229	4	+		+	7	+	28												
	NUMBER CODERS			6		1		4		6												
1	CRITER. :	CH.8	#230		+	4	+	5Y	+		+		+	18	+		+					
2	BLOSSOM:	CH.8	#230	1	+	4	+	5Z	+		+		+	18	+		+					
3	KATHY :	CH.8	#230		+	4	+	5Y	+	15Y	+		+	18	+		+					
4	CHARLOT:	CH.8	#230		+	4	+	5Z	+		+	16	+		+	24	+					
5	LINDA :	CH.8	#230		+	4	+	5Y	+		+		+	18	+		+					
6	SONIA :	CH.8	#230		+	4	+	5Z	+		+		+	18	+		+					
7	RAINER :	CH.8	#230		+	4	+	5Y	+		+		+	18	+		+	S26[3]				
	NUMBER CODERS			1		6		6		1		1		5		1		1				
1	CRITER. :	CH.7	#231	4	+		+	7	+	10Z	+	16	+		+	22	+	25				
2	BLOSSOM:	CH.7	#231	4	+		+		+	10Z	+	16	+		+	22	+	25				
3	KATHY :	CH.7	#231	4	+	5X	+		+	10Z	+		+	20Y	+	22	+	25				
4	CHARLOT:	CH.7	#231	4	+		+		+	10Z	+		+	20X	+	22	+	25				
5	LINDA :	CH.7	#231	4	+		+		+	10Y	+	16	+		+		+	25				
6	SONIA :	CH.7	#231	4	+		+		+	10Z	+		+		+	22	+	25				
7	RAINER :	CH.7	#231	4	+		+	7	+	10X	+	16	+		+	22	+	25				
	NUMBER CODERS			6		1		1		6		3		2		5		6				
1	CRITER. :	CH.8	#232	1	+		+	5Y	+		+	10Y	+		+	23	+	25	+		+	
2	BLOSSOM:	CH.8	#232	1	+	4	+		+	7	+	10Y	+	18	+		+	25	+		+	38
3	KATHY :	CH.8	#232	L1	+		+		+		+	10Z	+		+	23	+	25	+	32	+	
4	CHARLOT:	CH.8	#232	1	+		+	5X	+		+	10Z	+		+	23	+	25	+	32	+	
5	LINDA :	CH.8	#232	1	+		+	5X	+		+	10Y	+		+	23	+	25	+		+	
6	SONIA :	CH.8	#232	1	+		+	5X	+		+	10Z	+		+	23	+	25	+		+	
7	RAINER :	CH.8	#232	1	+		+	5Y	+		+	10Z	+		+		+	25	+	32	+	
	NUMBER CODERS			6		1		4		1		6		1		4		6		3		1

3. The prefix “S” is no longer used; this score is now 26 alone.

I	CRITER. :	CH.8	#233	15Y	+	17	+	23	+		+	38														
2	BLOSSOM:	CH.8	#233	15Z	+	17	+	23	+		+															
3	KATHY :	CH.8	#233	15Y	+		+	23	+	29	+															
4	CHARLOT:	CH.8	#233	15X	+	17	+		+		+															
5	LINDA :	CH.8	#233	15Y	+	17	+	23	+		+															
6	SONIA :	CH.8	#233	15Z	+	17	+	23	+		+															
7	RAINER :	CH.8	#233	15X	+	17	+	23	+		+															
	NUMBER CODERS			6		5		5		1		0														
1	CRITER. :	CH.7	#234	4	+		+	16	+	23	+	25														
2	BLOSSOM:	CH.7	#234	4	+		+		+	23	+	25														
3	KATHY :	CH.7	#234		+		+		+	23	+	25														
4	CHARLOT:	CH.7	#234	4	+		+		+	23	+	25														
5	LINDA :	CH.7	#234	4	+	5X	+		+	23	+	25														
6	SONIA :	CH.7	#234	4	+		+		+	23	+	25														
7	RAINER :	CH.7	#234	4	+		+		+	23	+	25														
	NUMBER CODERS			5		1		0		6		6														
1	CRITER. :	CH.7	#235	1	+	4	+	7	+	17	+		+	24												
2	BLOSSOM:	CH.7	#235	1	+	4	+		+	17	+		+	24												
3	KATHY :	CH.7	#235	1	+	4	+		+	17	+		+	24												
4	CHARLOT:	CH.7	#235	1	+	4	+	7	+	17	+		+	24												
5	LINDA :	CH.7	#235	1	+	4	+		+	17	+	22	+													
6	SONIA :	CH.7	#235	1	+	4	+		+	17	+	22	+													
7	RAINER :	CH.7	#235	1	+	4	+		+	17	+		+	24												
	NUMBER CODERS			6		6		1		6		2		4												
I	CRITER. :	CH.8	#236	4	+	5Y	+	6	+		+		+	14	+	17	+		+							
2	BLOSSOM:	CH.8	#236	4	+	5X	+		+	7	+	12Y	+		+	17	+		+							
3	KATHY :	CH.8	#236	4	+	5X	+		+	7	+	12Y	+		+	17	+		+							
4	CHARLOT:	CH.8	#236	4	+	5Y	+		+	7	+		+	14	+	17	+	20X	+							
5	LINDA :	CH.8	#236	4	+	5Y	+		+	7	+		+	14	+	17	+		+							
6	SONIA :	CH.8	#236	4	+	5X	+		+	7	+		+	14	+	17	+		+	23						
7	RAINER :	CH.8	#236	4	+	5Y	+		+	7	+	12Y	+		+	17	+		+							
	NUMBER CODERS			6		6		0		6		3		3		6		1		1						

1	CRITER.	:	CH. 8	#237	1	+	4	+	7	+	18	+	25	+		+	38	
2	BLOSSOM	:	CH. 8	#237	1	+	4	+	7	+	18	+	25	+	35	+		
3	KATHY	:	CH. 8	#237	1	+	4	+	7	+	18	+	25	+		+	38	
4	CHARLOT	:	CH. 8	#237	1	+	4	+	7	+	18	+	25	+		+	38	
5	LINDA	:	CH. 8	#237	1	+	4	+	7	+	18	+		+		+	38	
6	SONIA	:	CH. 8	#237	1	+	4	+	7	+	18	+	25	+		+	38	
7	RAINER	:	CH. 8	#237	1	+	4	+	7	+	18	+	25	+		+	38	
	NUMBER CODERS				6		6		6		6		5		1		5	
1	CRITER.	:	CH.7	#238	22	+	23	+	25	+								
2	BLOSSOM	:	CH.7	#238	22	+	23	+	25	+								
3	KATHY	:	CH.7	#238	22	+	23	+	25	+								
4	CHARLOT	:	CH.7	#238	22	+	23	+	25	+								
5	LINDA	:	CH.7	#238	22	+	23	+		+	26							
6	SONIA	:	CH.7	#238	22	+	23	+	25	+								
7	RAINER	:	CH.7	#238	22	+	23	+	25	+								
	NUMBER CODERS				6		6		5		1							
1	CRITER.	:	CH.8	#239		+	9	+	12Y	+		+	17	+		+		
2	BLOSSOM	:	CH.8	#239		+	9	+	12Y	+		+	17	+		+	44[4]	
3	KATHY	:	CH.8	#239		+	9	+	12Y	+		+		+	24	+		
4	CHARLOT	:	CH.8	#239	6	+	9	+		+		+		+	24	+		
5	LINDA	:	CH.8	#239		+	9	+		+		+	17	+		+		
6	SONIA	:	CH.8	#239		+	9	+	12Y	+		+		+		+		
7	RAINER	:	CH.8	#239		+	9	+	12Y	+	15Y	+		+		+		
	NUMBER CODERS				1		6		4		1		2		2		1	
1	CRITER.	:	CH.7	#240	12Y	+	17											
2	BLOSSOM	:	CH.7	#240	12Y	+	17											
3	KATHY	:	CH.7	#240	12Y	+	17											
4	CHARLOT	:	CH.7	#240	12Y	+	17											
5	LINDA	:	CH.7	#240	12Y	+	17											
6	SONIA	:	CH.7	#240	12Y	+	17											
7	RAINER	:	CH.7	#240	12Y	+	17											
	NUMBER CODERS				6		6											

4. This score is obsolete; it would now be scored 7E.

1	CRITER.	:	CH.8	#241	12Y+	24											
2	BLOSSOM	:	CH.8	#241	12Y+	24											
3	KATHY	:	CH.8	#241	12Y+	24											
4	CHARLOT	:	CH.8	#241	12X+	24											
5	LINDA	:	CH.8	#241	12X+	24											
6	SONIA	:	CH.8	#241	12Y+												
7	RAINER	:	CH.8	#241	12Y+	24											
	NUMBER CODERS				6	5											
1	CRITER.	:	CH.7	#242	+	12Y+	+	+	23	+	+	44[5]					
2	BLOSSOM	:	CH.7	#242	6 +	12Y+	+	+	23	+	+						
3	KATHY	:	CH.7	#242	+	+	14 +	+	23	+	+	44					
4	CHARLOT	:	CH.7	#242	+	12Y+	+	+	23	+	42 +						
5	LINDA	:	CH.7	#242	6 +	+	+	20Y+	23	+	+						
6	SONIA	:	CH.7	#242	+	12Y+	+	+	23	+	+	44					
7	RAINER	:	CH.7	#242	+	12Y+	+	+	23	+	+	44					
	NUMBER CODERS				2	4	1	1	6		1	3					
1	CRITER.	:	CH.8	#243	4 +	5Y +	+	17 +	23	+	29 +	38					
2	BLOSSOM	:	CH.8	#243	4 +	5Y +	+	17 +	23	+	29 +	38					
3	KATHY	:	CH.8	#243	4 +	5Y +	+	+	23	+	29 +						
4	CHARLOT	:	CH.8	#243	4 +	5X +	+	17 +	23	+	+						
5	LINDA	:	CH.8	#243	4 +	5Y +	7 +	17 +	23	+	29 +						
6	SONIA	:	CH.8	#243	4 +	5Y +	+	17 +	23	+	29 +						
7	RAINER	:	CH.8	#243	4 +	5Y +	+	17 +	23	+	29 +	38					
	NUMBER CODERS				6	6	1	5	6		5	2					
1	CRITER.	:	CH.7	#244	10Z+	17 +	23										
2	BLOSSOM	:	CH.7	#244	10Y+	17 +	23										
3	KATHY	:	CH.7	#244	10Z+	17 +	23										
4	CHARLOT	:	CH.7	#244	10Y+	17 +	23										
5	LINDA	:	CH.7	#244	10Y+	17 +	23										
6	SONIA	:	CH.7	#244	IOY+	17 +											
7	RAINER	:	CH.7	#244	10Y+	17 +	23										
	NUMBER CODERS				6	6	5										

5. This score is now obsolete; it would now be scored 7E.

1	CRITER. :	CH.7	#245		+	23	+	25			
2	BLOSSOM:	CH.7	#245		+	23	+	25			
3	KATHY :	CH.7	#245		+	23	+	25			
4	CHARLOT:	CH.7	#245	R14	+	23	+	25			
5	LINDA :	CH.7	#245		+	23	+	25			
6	SONIA :	CH.7	#245		+	23	+	25			
7	RAINER :	CH.7	#245		+	23	+	25			
	NUMBER CODERS			1		6		6			
1	CRITER. :	CH.8	#246		+	22	+		+	26	
2	BLOSSOM:	CH.8	#246		+	22	+	25	+		
3	KATHY :	CH.8	#246	18	+		+		+	26	
4	CHARLOT:	CH.8	#246		+	22	+		+	26	
5	LINDA :	CH.8	#246		+	22	+		+	26	
6	SONIA :	CH.8	#246		+	22	+		+	26	
7	RAINER :	CH.8	#246		+	22	+		+	26	
	NUMBER CODERS			1		5		1		5	
1	CRITER. :	CH.7	#247		+		+	24			
2	BLOSSOM:	CH.7	#247		+	14	+				
3	KATHY :	CH.7	#247	0	+		+				
4	CHARLOT:	CH.7	#247		+		+	24			
5	LINDA :	CH.7	#247		+		+	24			
6	SONIA :	CH.7	#247		+		+	24			
7	RAINER :	CH.7	#247		+		+	24			
	NUMBER CODERS			1		1		4			

TABLE 8-4: CODER COMPARISON OF CHAPTERS 4-8 PRACTICE STILLS

1	CRITER. :	CH.4	#101		+	9	+		+				
2	BLOSSOM :	CH.4	#101		+	9	+		+				
3	KATHY :	CH.4	#101		+	9	+	17	+				
4	CHARLOT :	CH.4	#101		+	9	+	17	+				
5	LINDA :	CH.4	#101		+	9	+		+				
6	SONIA :	CH.4	#101	6	+	9	+	17	+	R25			
7	RAINER :	CH.4	#101		+	9	+		+				
	NUMBER CODERS			1		6		3		1			
1	CRITER. :	CH.4	#102	1	+	2	+	5Y	+	26			
2	BLOSSOM :	CH.4	#102	1	+	2	+	5X	+	26			
3	KATHY :	CH.4	#102	1	+	2	+	5Y	+	26			
4	CHARLOT :	CH.4	#102	1	+	2	+	5Y	+	26			
5	LINDA :	CH.4	#102	1	+	2	+	5Y	+	26			
6	SONIA :	CH.4	#102	1	+	2	+	5Y	+	26			
7	RAINER :	CH.4	#102	1	+	2	+	5Z	+	26			
	NUMBER CODERS			6		6		6		6			
1	CRITER. :	CH.4	#103	4	+	6	+	9	+		+	25	
2	BLOSSOM :	CH.4	#103	4	+	6	+	9	+	16	+	25	
3	KATHY :	CH.4	#103	4	+	6	+	9	+		+	25	
4	CHARLOT :	CH.4	#103	4	+	6	+	9	+		+	25	
5	LINDA :	CH.4	#103		+	6	+	9	+	16	+	25	
6	SONIA :	CH.4	#103	4	+	6	+	9	+		+	25	
7	RAINER :	CH.4	#103	4	+	6	+	9	+		+	25	
	NUMBER CODERS			5		6		6		2		6	
1	CRITER. :	CH.4	#104	4	+	7	+		+	10Y	+	17	
2	BLOSSOM :	CH.4	#104	4	+	7	+		+	10Y	+	17	
3	KATHY :	CH.4	#104		+	7	+	9	+		+	17	
4	CHARLOT :	CH.4	#104		+	7	+		+	10X	+	17	
5	LINDA :	CH.4	#104	4	+	7	+		+	10Y	+	17	
6	SONIA :	CH.4	#104		+		+		+	10Y	+	17	
7	RAINER :	CH.4	#104		+	7	+		+	10Y	+	17	
	NUMBER CODERS			2		5		1		5		6	

1	CRITER. :	CH.4	#105		+	9	+	17							
2	BLOSSOM:	CH.4	#105		+	9	+	17							
3	KATHY :	CH.4	#105	4	+	9	+	17							
4	CHARLOT:	CH.4	#105		+	9	+	17							
5	LINDA :	CH.4	#105		+	9	+	17							
6	SONIA :	CH.4	#105		+	9	+	17							
7	RAINER :	CH.4	#105		+	9	+	17							
	NUMBER CODERS			1		6		6							
1	CRITER. :	CH. 4	# 106	4	+	9	+	25	+						
2	BLOSSOM:	CH. 4	# 106	4	+	9	+	25	+						
3	KATHY :	CH. 4	# 106	4	+	9	+	25	+						
4	CHARLOT:	CH. 4	# 106	4	+	9	+	25	+						
5	LINDA :	CH. 4	# 106		+	9	+	25	+						
6	SONIA :	CH. 4	# 106	4	+	9	+		+	26					
7	RAINER :	CH. 4	# 106	4	+	9	+	25	+						
	NUMBER CODERS			5		6		5		1					
1	CRITER. :	CH.5	#107	1	+	2	+	5Y	+	26					
2	BLOSSOM:	CH.5	#107	1	+	2	+	5X	+	26					
3	KATHY :	CH.5	#107	1	+	2	+	5X	+	26					
4	CHARLOT:	CH.5	#107	1	+	2	+	5Y	+	26					
5	LINDA :	CH.5	#107	1	+	2	+	5Y	+	26					
6	SONIA :	CH.5	#107	1	+	2	+	5Y	+	26					
7	RAINER :	CH.5	#107	1	+	2	+	5Y	+	26					
	NUMBER CODERS			6		6		6		6					
1	CRITER. :	CH.5	#108		+	9	+		+		+		+	26	
2	BLOSSOM:	CH.5	#108		+	9	+		+		+		+	26	
3	KATHY :	CH.5	#108	4	+	9	+	16	+		+		+	26	
4	CHARLOT:	CH.5	#108		+	9	+		+	17	+	25	+		
5	LINDA :	CH.5	#108	4	+	9	+		+		+		+	26	
6	SONIA :	CH.5	#108		+	9	+		+		+		+	26	
7	RAINER :	CH.5	#108	4	+	9	+		+	17	+		+	26	
	NUMBER CODERS			3		6		1		2		1		5	

1	CRITER. :	CH.5	#109	1	+	2	+	5X	+	26				
2	BLOSSOM :	CH.5	#109	1	+	2	+	5X	+	26				
3	KATHY :	CH.5	#109	1	+	2	+	5X	+	26				
4	CHARLOT :	CH.5	#109	1	+	2	+	5X	+	26				
5	LINDA :	CH.5	#109	1	+	2	+	5X	+	26				
6	SONIA :	CH.5	#109	1	+	2	+	5X	+	26				
7	RAINER :	CH.5	#109	1	+	2	+		+	26				
	NUMBER CODERS			6		6		5		6				
1	CRITER. :	CH.6	#110	6	+		+	12Z	+	26				
2	BLOSSOM :	CH.6	#110	6	+		+	12Z	+	26				
3	KATHY :	CH.6	#110	6	+		+	12Z	+	26				
4	CHARLOT :	CH.6	#110	6	+		+	12Z	+	26				
5	LINDA :	CH.6	#110	6	+	10	+	12Y	+	26				
6	SONIA :	CH.6	#110	6	+		+	12Y	+	26				
7	RAINER :	CH.6	#110	6	+		+	12Y	+	26				
	NUMBER CODERS			6		1		6		6				
1	CRITER. :	CH. 6	#111	1	+	2	+	5Z	+	7	+		+	26
2	BLOSSOM :	CH.6	#111	1	+	2	+	5Z	+		+		+	26
3	KATHY :	CH.6	#111	1	+	2	+	5Z	+		+	10X	+	26
4	CHARLOT :	CH.6	#111	1	+	2	+	5Z	+		+	10X	+	26
5	LINDA :	CH.6	#111	1	+	2	+	5Y	+		+		+	26
6	SONIA :	CH.6	#111	1	+	2	+	5Z	+		+		+	26
7	RAINER :	CH.6	#111	1	+	2	+	5Z	+		+		+	26
	NUMBER CODERS			6		6		6		0		2		6
1	CRITER. :	CH.6	#112	6	+	12Y	+		+	26				
2	BLOSSOM :	CH.6	#112	6	+	12Z	+		+	26				
3	KATHY :	CH.6	#112	6	+	12Z	+		+	26				
4	CHARLOT :	CH.6	#112	6	+	12Z	+	25	+					
5	LINDA :	CH.6	#112	6	+	12Y	+		+	26				
6	SONIA :	CH.6	#112	6	+	12Z	+		+	26				
7	RAINER :	CH.6	#112	6	+	12Y	+		+	26				
	NUMBER CODERS			6		6		1		5				

1	CRITER. :	CH.6	#113	1	+	4	+	6	+		+		+		+				
2	BLOSSOM :	CH.6	#113	1	+	4	+		+		+	L10X	+		+				
3	KATHY :	CH.6	#113	1	+	4	+		+		+		+	11	+	15X			
4	CHARLOT :	CH.6	#113	1	+	4	+	6	+		+		+		+				
5	LINDA :	CH.6	#113	1	+	4	+	6	+		+		+		+				
6	SONIA :	CH.6	#113	1	+	4	+		+	7	+		+		+				
7	RAINER :	CH.6	#113	1	+	4	+		+		+	L10X	+		+				
	NUMBER CODERS			6		6		2		1		2		1		1			
1	CRITER. :	CH.6	#114	1	+	2	+	5Y	+	12X	+	26							
2	BLOSSOM :	CH.6	#114	1	+	2	+	5Y	+	12X	+	26							
3	KATHY :	CH.6	#114	1	+	2	+	5Y	+	12X	+	26							
4	CHARLOT :	CH.6	#114	1	+	2	+	5Y	+	12X	+	26							
5	LINDA :	CH.6	#114	1	+	2	+	5Y	+	12X	+	26							
6	SONIA :	CH.6	#114	1	+	2	+	5X	+	12Y	+	26							
7	RAINER :	CH.6	#114	1	+	2	+	5Z	+	12X	+	26							
	NUMBER CODERS			6		6		6		6		6							
1	CRITER. :	CH.6	#115		+	R 2	+	5Z	+	7	+		+		+	25			
2	BLOSSOM :	CH.6	#115		+		+	5Z	+		+		+		+	25			
3	KATHY :	CH.6	#115	1	+	2	+	5Z	+		+	10X	+		+	25			
4	CHARLOT :	CH.6	#115		+		+	5Z	+		+		+	11	+	25			
5	LINDA :	CH.6	#115		+		+	5Z	+		+		+	11	+	25			
6	SONIA :	CH.6	#115		+		+	5Y	+		+		+		+	25			
7	RAINER :	CH.6	#115		+		+	5Z	+		+		+		+	25			
	NUMBER CODERS			1		1		6		0		1		2		6			
1	CRITER . :	CH.6	#116		+	12Y													
2	BLOSSOM :	CH.6	#116		+	12Y													
3	KATHY :	CH.6	#116	7	+	12Y													
4	CHARLOT :	CH.6	#116		+	12Y													
5	LINDA :	CH.6	#116		+	12X													
6	SONIA :	CH.6	#116		+	12Y													
7	RAINER :	CH.6	#116	7	+	12X													
	NUMBER CODERS			2		6													

1	CRITER.	:	CH.6	#117	1	+	4	+	6	+		+		+	L20X	+	25										
2	BLOSSOM	:	CH.6	#117	1	+	4	+	6	+	10X	+		+	L20X	+	25										
3	KATHY	:	CH.6	#117	1	+	4	+	6	+		+		+		+	25										
4	CHARLOT	:	CH.6	#117	1	+	4	+	6	+	10X	+		+		+	25										
5	LINDA	:	CH.6	#117	1	+	4	+	6	+		+		+		+	25										
6	SONIA	:	CH.6	#117	1	+	4	+	6	+	10	+	12X	+		+	25										
7	RAINER	:	CH.6	#117	1	+	4	+	6	+		+		+		+	25										
	NUMBER CODERS				6		6		6		3		1		1		6										
1	CRITER.	:	CH.6	#118		+	7	+		+	12Y	+	26														
2	BLOSSOM	:	CH.6	#118		+		+		+	12Y	+	26														
3	KATHY	:	CH.6	#118	6	+		+	10	+	12Y	+	26														
4	CHARLOT	:	CH.6	#118		+	7	+		+	12Y	+	26														
5	LINDA	:	CH.6	#118		+	7	+		+	12Y	+	26														
6	SONIA	:	CH.6	#118	6	+		+		+	12Y	+	26														
7	RAINER	:	CH.6	#118	6	+		+		+	12Y	+	26														
	NUMBER CODERS				3		2		1		6		6														
1	CRITER.	:	CH.6	#119	1	+		+		+		+	L11	+		+	15Y	+		+	41[6]						
2	BLOSSOM	:	CH.6	#119	1	+		+		+	L10X	+		+		+	15X	+		+	41						
3	KATHY	:	CH.6	#119	1	+	2	+	4	+		+	L11	+		+	15X	+	17	+	41						
4	CHARLOT	:	CH.6	#119	1	+		+		+		+	L11	+		+	15X	+		+	41						
5	LINDA	:	CH.6	#119	1	+		+	4	+		+	L11	+		+	15Y	+		+	41						
6	SONIA	:	CH.6	#119		+		+	4	+		+		+	12X	+	15Y	+		+	41						
7	RAINER	:	CH.6	#119	1	+		+		+		+	11	+		+		+	17	+	41						
	NUMBER CODERS				5		1		3		1		4		1		5		2		6						
1	CRITER.	:	CH.6	#120	1	+	2	+	5Y	+	7	+		+		+	26										
2	BLOSSOM	:	CH.6	#120	1	+	2	+	5Y	+		+		+		+	26										
3	KATHY	:	CH.6	#120	1	+	2	+	5Z	+	7	+	10X	+		+	26										
4	CHARLOT	:	CH.6	#120	1	+	2	+	5Y	+		+		+	12X	+	26										
5	LINDA	:	CH.6	#120	1	+	2	+	5Z	+		+		+	12X	+	26										
6	SONIA	:	CH.6	#120	1	+	2	+	5Y	+		+		+		+	26										
7	RAINER	:	CH.6	#120	1	+	2	+	5Z	+		+		+		+	26										
	NUMBER CODERS				6		6		6		1		1		2		6										

6. This score is obsolete; it would now be scored 43B.

1	CRITER. :	CH.6	#121	6	+	12Z	+	25	+					
2	BLOSSOM :	CH.6	#121	6	+	12Z	+	25	+					
3	KATHY :	CH.6	#121	6	+	12Z	+		+	26				
4	CHARLOT :	CH.6	#121	6	+	12Z	+	25	+					
5	LINDA :	CH.6	#121	6	+	12Z	+		+	26				
6	SONIA :	CH.6	#121	6	+	12Z	+		+	26				
7	RAINER :	CH.6	#121	6	+	12Z	+		+	26				
	NUMBER CODERS			6		6		2		4				
1	CRITER. :	CH.6	#122		+		+	L6	+	14	+			
2	BLOSSOM :	CH.6	#122		+		+		+	L14	+			
3	KATHY :	CH.6	#122		+		+	6	+	14	+	17		
4	CHARLOT :	CH.6	#122		+		+	L6	+	14	+			
5	LINDA :	CH.6	#122		+		+		+	14	+			
6	SONIA :	CH.6	#122		+		+	L6	+	14	+			
7	RAINER :	CH.6	#122	1	+	2	+		+	14	+			
	NUMBER CODERS			1		1		3		6		1		
1	CRITER. :	CH.6	#123	4	+	5Y	+		+	11	+			
2	BLOSSOM :	CH.6	#123	4	+	5Y	+		+		+	15Y		
3	KATHY :	CH.6	#123	4	+	5X	+	10Y	+		+			
4	CHARLOT :	CH.6	#123	4	+	5X	+	10Y	+		+	15X		
5	LINDA :	CH.6	#123	4	+	5X	+	10X	+		+			
6	SONIA :	CH.6	#123	4	+		+	10Y	+		+	15Y		
7	RAINER :	CH.6	#123	4	+	5Y	+	10X	+		+			
	NUMBER CODERS			6		5		5		0		3		
1	CRITER. :	CH.6	#124		+	9	+		+	17				
2	BLOSSOM :	CH.6	#124		+	R9	+		+	17				
3	KATHY :	CH.6	#124	6	+	9	+		+	17				
4	CHARLOT :	CH.6	#124		+	9	+	15X	+	17				
5	LINDA :	CH.6	#124		+	9	+	15X	+	17				
6	SONIA :	CH.6	#124		+	9	+	15X	+	17				
7	RAINER :	CH.6	#124		+	9	+		+	17				
	NUMBER CODERS			1		6		3		6				

1	CRITER. :	CH.7	#125	1	+	2	+	4	+	5Z	+		+		+	L11	+	25	+	
2	BLOSSOM :	CH.7	#125	1	+	2	+	4	+	5Z	+		+		+	L11	+	25	+	
3	KATHY :	CH.7	#125	1	+		+	4	+	5Z	+	6	+		+		+	25	+	
4	CHARLOT :	CH.7	#125	1	+	2	+	4	+	5Z	+		+	L10X	+		+	25	+	
5	LINDA :	CH.7	#125	1	+	2	+	4	+	5Y	+	6	+		+		+	25	+	
6	SONIA :	CH.7	#125	1	+	2	+	4	+	5Y	+		+		+	L11	+		+	26
7	RAINER :	CH.7	#125	1	+		+		+	5Z	+		+	10Y	+		+		+	26
	NUMBER CODERS			6		4		5		6		2	2			2		4		2
1	CRITER. :	CH.7	#126	4	+		+	7	+	10X	+	16	+	26						
2	BLOSSOM :	CH.7	#126	4	+		+	7	+	10X	+	16	+	26						
3	KATHY :	CH.7	#126	4	+	6	+		+		+	16	+	26						
4	CHARLOT :	CH.7	#126	4	+		+	7	+	10Y	+	16	+	26						
5	LINDA :	CH.7	#126	4	+	6	+		+	+		16	+	26						
6	SONIA :	CH.7	#126	4	+	6	+		+	+		16	+	26						
7	RAINER :	CH.7	#126	4	+		+	7	+	10Y	+		+	26						
	NUMBER CODERS			6		3		3		3		5		6						
1	CRITER. :	CH.7	#127	6	+	12Y														
2	BLOSSOM :	CH.7	#127	6	+	12Y														
3	KATHY :	CH.7	#127	6	+	12Y														
4	CHARLOT :	CH.7	#127	6	+	12X														
5	LINDA :	CH.7	#127	6	+	12X														
6	SONIA :	CH.7	#127	6	+	12Y														
7	RAINER :	CH.7	#127	6	+	12X														
	NUMBER CODERS			6		6														
1	CRITER. :	CH.7	#128	4	+	5Z	+	23	+											
2	BLOSSOM :	CH.7	#128	4	+	5Z	+	23	+											
3	KATHY :	CH.7	#128	4	+	5Z	+		+	24										
4	CHARLOT :	CH.7	#128	4	+	5Z	+		+	24										
5	LINDA :	CH.7	#128	4	+	5Y	+		+	24										
6	SONIA :	CH.7	#128	4	+	5Y	+		+	24										
7	RAINER :	CH.7	#128	4	+	5Y	+		+	24										
	NUMBER CODERS			6		6		1		5										

1	CRITER. :	CH.7	#129	4	+	5X	+		+		+	24
2	BLOSSOM:	CH.7	#129	4	+	5X	+	17	+	23	+	
3	KATHY :	CH.7	#129	4	+		+		+		+	24
4	CHARLOT:	CH.7	#129	4	+		+	17	+		+	24
5	LINDA :	CH.7	#129	4	+	5Y	+		+		+	24
6	SONIA :	CH.7	#129	4	+		+		+	23	+	
7	RAINER :	CH.7	#129	4	+	5X	+		+		+	24
	NUMBER CODERS			6		3		2		2		4
1	CRITER. :	CH.7	#130	1	+	2	+	5Y	+		+	26
2	BLOSSOM:	CH.7	#130	1	+	2	+	5X	+	16	+	26
3	KATHY :	CH.7	#130	1	+	2	+	5Y	+		+	26
4	CHARLOT:	CH.7	#130	1	+	2	+	5Y	+		+	26
5	LINDA :	CH.7	#130	1	+	2	+	5Y	+		+	26
6	SONIA :	CH.7	#130	1	+	2	+	5X	+		+	26
7	RAINER :	CH.7	#130	1	+	2	+	5X	+		+	26
	NUMBER CODERS			6		6		6		1		6
1	CRITER. :	CH.7	#131	1	+	4						
2	BLOSSOM:	CH.7	#131	1	+	4						
3	KATHY :	CH.7	#131	1	+	4						
4	CHARLOT:	CH.7	#131	1	+	4						
5	LINDA :	CH.7	#131	1	+							
6	SONIA :	CH.7	#131		+	4						
7	RAINER :	CH.7	#131	1	+	4						
	NUMBER CODERS			5		5						
1	CRITER. :	CH.7	#132	4	+	9	+	17	+			
2	BLOSSOM:	CH.7	#132	4	+	9	+	17	+			
3	KATHY :	CH.7	#132	4	+	9	+	17	+			
4	CHARLOT:	CH.7	#132	4	+	9	+	17	+	23		
5	LINDA :	CH.7	#132	4	+	9	+	17	+	T23		
6	SONIA :	CH.7	#132	4	+	9	+	17	+	23		
7	RAINER :	CH.7	#132	4	+	9	+	17	+			
	NUMBER CODERS			6		6		6		3		

1	CRITER.	:	CH.7	#133	1	+	4	+		+					
2	BLOSSOM	:	CH.7	#133	1	+	4	+		+					
3	KATHY	:	CH.7	#133	1	+	4	+		+					
4	CHARLOT	:	CH.7	#133	1	+	4	+		+					
5	LINDA	:	CH.7	#133	1	+	4	+	7	+					
6	SONIA	:	CH.7	#133	1	+	4	+		+	15X				
7	RAINER	:	CH.7	#133	1	+	4	+		+					
	NUMBER CODERS				6		6		1		1				
1	CRITER.	:	CH.7	#134	4	+	5Y	+	7	+	23				
2	BLOSSOM	:	CH.7	#134	4	+	5Y	+	7	+	23				
3	KATHY	:	CH.7	#134	4	+	5Y	+	7	+	23				
4	CHARLOT	:	CH.7	#134	4	+	5Y	+	7	+	23				
5	LINDA	:	CH.7	#134	4	+	5Y	+	7	+	23				
6	SONIA	:	CH.7	#134	4	+	5X	+		+	23				
7	RAINER	:	CH.7	#134	4	+	5Y	+	7	+		+	24		
	NUMBER CODERS				6		6		5		5		1		
1	CRITER.	:	CH.7	#135	4	+	5Y	+		+		+		+	
2	BLOSSOM	:	CH.7	#135	4	+	5Y	+	7	+		+	T23	+	
3	KATHY	:	CH.7	#135	4	+	5Y	+		+		+	23	+	
4	CHARLOT	:	CH.7	#135	4	+	5Y	+		+		+	23	+	
5	LINDA	:	CH.7	#135	4	+	5Y	+		+		+		+	24
6	SONIA	:	CH.7	#135	4	+	5X	+		+	15X	+	T23	+	
7	RAINER	:	CH.7	#135	4	+	5Y	+		+		+	T23	+	
	NUMBER CODERS				6		6		1		1		5		1
1	CRITER.	:	CH.7	#136	6	+	12Y	+		+	25	+			
2	BLOSSOM	:	CH.7	#136	6	+	12Y	+		+		+	26		
3	KATHY	:	CH.7	#136	6	+	12Y	+		+	25	+			
4	CHARLOT	:	CH.7	#136	6	+	12Y	+		+	25	+			
5	LINDA	:	CH.7	#136	6	+	12X	+		+	25	+			
6	SONIA	:	CH.7	#136	6	+	12Z	+		+		+	26		
7	RAINER	:	CH.7	#136	6	+	12Y	+	23	+	25	+			
	NUMBER CODERS				6		6		1		4		2		

1	CRITER. :	CH.8	#137	4	+		+	20X	+	23	+	25	+		+						
2	BLOSSOM :	CH.8	#137	4	+		+	20X	+	23	+	25	+		+						
3	KATHY :	CH.8	#137	4	+	5X	+		+	23	+	25	+		+						
4	CHARLOT :	CH.8	#137	4	+		+	20X	+	23	+	25	+		+						
5	LINDA :	CH.8	#137	4	+		+	20X	+	23	+	25	+		+						
6	SONIA :	CH.8	#137	4	+		+		+	23	+	25	+	29	+						
7	RAINER :	CH.8	#137	4	+		+	20Y	+	23	+	25	+	29	+	38					
	NUMBER CODERS			6		1		4		6		6		2		1					
1	CRITER. :	CH.8	#138	1	+	2	+	5Z	+												
2	BLOSSOM :	CH.8	#138	1	+	2	+	5Y	+												
3	KATHY :	CH.8	#138	1	+	2	+	5Z	+	38											
4	CHARLOT :	CH.8	#138	1	+	2	+	5Z	+												
5	LINDA :	CH.8	#138	1	+	2	+	5Y	+												
6	SONIA :	CH.8	#138	1	+	2	+	5Z	+												
7	RAINER :	CH.8	#138	1	+	2	+	5Z	+												
	NUMBER CODERS			6		6		6		1											
1	CRITER. :	CH.8	#139	4	+		+	7	+		+	14	+	17	+	23	+	38			
2	BLOSSOM :	CH.8	#139	4	+		+	7	+		+	14	+	17	+	23	+				
3	KATHY :	CH.8	#139	4	+	5X	+	7	+		+		+	17	+	23	+	38			
4	CHARLOT :	CH.8	#139	4	+		+	7	+	10X	+		+	17	+	23	+				
5	LINDA :	CH.8	#139	4	+		+	7	+		+	14	+	17	+		+	38			
6	SONIA :	CH.8	#139	4	+		+	7	+		+	14	+	17	+	23	+	38			
7	RAINER :	CH.8	#139	4	+	5X	+	7	+		+	14	+	17	+	T23	+				
	NUMBER CODERS			6		2		6		1		4		6		5		3			
1	CRITER. :	CH.8	#140	4	+		+	7	+	17	+		+	24	+	38					
2	BLOSSOM :	CH.8	#140	4	+		+	7	+	17	+		+	24	+	38					
3	KATHY :	CH.8	#140	4	+	5X	+	7	+	17	+		+	24	+	38					
4	CHARLOT :	CH.8	#140	4	+		+	7	+	17	+		+	24	+	38					
5	LINDA :	CH.8	#140	4	+		+	7	+	17	+	23	+		+	38					
6	SONIA :	CH.8	#140	4	+		+	7	+	17	+	23	+		+						
7	RAINER :	CH.8	#140	4	+		+	7	+	17	+		+	24	+	38					
	NUMBER CODERS			6		1		6		6		2		4		5					

1	CRITER. :	CH. 8	#141	1	+	2	+	4	+	5Y	+		+	26	+				
2	BLOSSOM :	CH.8	#141		+		+	4	+	5X	+		+	26	+				
3	KATHY :	CH.8	#141		+		+	4	+	5Y	+		+	26	+	38			
4	CHARLOT :	CH.8	#141	1	+	2	+	4	+	5Y	+		+	26	+				
5	LINDA :	CH.8	#141	1	+		+		+	5X	+	20X	+	26	+				
6	SONIA :	CH.8	#141	1	+	2	+	4	+	5X	+		+	26	+	38			
7	RAINER :	CH.8	#141	1	+		+	4	+	5Z	+		+	26	+	38			
	NUMBER CODERS			4		2		5		6		1		6		3			
1	CRITER. :	CH.8	#142	4	+	5Y	+		+		+	24	+	38					
2	BLOSSOM :	CH.8	#142		+	5Y	+	7	+		+	24	+	38					
3	KATHY :	CH.8	#142	4	+	5X	+		+		+	24	+	38					
4	CHARLOT :	CH.8	#142	4	+	5Y	+		+	23	+		+	38					
5	LINDA :	CH.8	#142	4	+	5X	+		+		+	24	+	38					
6	SONIA :	CH.8	#142	4	+	5X	+		+		+	24	+	38					
7	RAINER :	CH.8	#142	4	+	5Y	+		+		+	24	+	38					
	NUMBER CODERS			5		6		1		1		5		6					
1	CRITER. :	CH.8	#143	1	+	2	+	5Z	+	26									
2	BLOSSOM :	CH.8	#143	1	+	2	+	5Z	+	26									
3	KATHY :	CH.8	#143	1	+	2	+	5Z	+	26									
4	CHARLOT :	CH.8	#143	1	+	2	+	5Z	+	26									
5	LINDA :	CH.8	#143	1	+	2	+	5Y	+	26									
6	SONIA :	CH.8	#143	1	+	2	+	5Z	+	26									
7	RAINER :	CH.8	#143	1	+	2	+	5Z	+	26									
	NUMBER CODERS			6		6		6		6									
1	CRITER. :	CH.8	#144		+		+		+	7	+		+	12Y	+	26	+		
2	BLOSSOM :	CH.8	#144		+		+		+	7	+		+	12Y	+	26	+		
3	KATHY :	CH.8	#144		+		+		+	7	+	10	+	12Y	+	26	+		
4	CHARLOT :	CH.8	#144		+		+		+	7	+		+	12Y	+	26	+		
5	LINDA :	CH.8	#144	1	+	2	+		+	7	+		+	12Y	+	26	+		
6	SONIA :	CH.8	#144		+		+		+		+		+	12Y	+	26	+		
7	RAINER :	CH.8	#144		+		+	6	+		+		+	12Z	+	26	+	41[7]	
	NUMBER CODERS			1		1		1		4		1		6		6		1	

7. This score is obsolete; it would now be scored 43B.

1	CRITER. :	CH.8	#145	1	+	2	+	5Y	+		+	26						
2	BLOSSOM:	CH.8	#145	1	+	2	+	5Y	+		+	26						
3	KATHY :	CH.8	#145	1	+	2	+	5Z	+	19	+	26						
4	CHARLOT:	CH.8	#145	1	+	2	+	5Z	+	19	+	26						
5	LINDA :	CH.8	#145	1	+	2	+	5Y	+		+	26						
6	SONIA :	CH.8	#145	1	+	2	+	5Z	+		+	26						
7	RAINER :	CH.8	#145	1	+	2	+	5Z	+		+	26						
	NUMBER CODERS			6		6		6		2		6						
1	CRITER. :	CH.8	#146	4	+	5Y	+		+	17	+		+	24	+	38		
2	BLOSSOM:	CH.8	#146	4	+	5Y	+		+	17	+		+	24	+	38		
3	KATHY :	CH.8	#146	4	+	5X	+		+	17	+		+	24	+	38		
4	CHARLOT:	CH.8	#146	4	+	5Y	+	7	+	17	+	23	+		+	38		
5	LINDA :	CH.8	#146	4	+	5X	+	7	+	17	+	23	+		+	38		
6	SONIA :	CH.8	#146	4	+		+		+	17	+		+	24	+	38		
7	RAINER :	CH.8	#146	4	+	5X	+		+	17	+		+	24	+	38		
	NUMBER CODERS			6		5		2		6		2		4		6		

Chapter 9: *FACS in Relation to Other Facial Measurement Systems*

Methods for measuring facial action[1]

by

Paul Ekman

9.1. Introduction

Of all the nonverbal behaviors – body movements, posture, gaze, proxemics, voice – the face is probably the most commanding and complicated, and perhaps the most confusing. In part, the face is commanding because it is always visible, always providing some information. There is no facial equivalent to the concealment maneuver of putting one's hands in one's pockets. Whereas sounds and the body movements that illustrate speech are intermittent, the face even in repose may provide information about some emotion or mood state. Many nonverbal behaviors simply do not occur when a person is alone, or at least do so very rarely. For example, it would be unusual for someone to shrug or gesture hello when totally alone. Yet facial expressions of emotion may be quite intense even when a person is alone. They are not occasioned only by the presence of others. In fact, social situations can dampen facial expression of emotion (Ekman, 1972; Ekman & Friesen, 1975, chap. 11).

The face is commanding also because it is the location for the senses of smell, taste, sight, and hearing. It is the site of the intake organs for inputs of air, water, and food necessary to life. It is the output source for speech, and what we hear in part is determined by the lip movements we see with the speech (McGurk & MacDonald, 1976). It commands attention because it is the symbol of the self. The faces of those we care about are hung on walls, displayed on desks, carried in wallets.

Multimessage-multisignal system

This commanding focus of attention is quite complex. The face can be considered as a multimessage, multisignal semiotic system (Ekman, 1978). The face conveys not only the message of individual identity, but also messages about gender and race. Certain changes in the face reveal, more or less truthfully, age. There are standards for beautiful and ugly, smart and

1. This chapter was first published in K. R. Scherer & P. Ekman (Eds.), Handbook of Methods in Nonverbal Behavior Research. Cambridge: Cambridge University Press, 1982. Reprinted with the permission of Cambridge University Press.

stupid, strong and weak faces. And apart from stereotypes, there have been claims for accurate information about personality traits, psychopathology, and intelligence from facial behavior.

These different messages (identity, gender, beauty, traits, etc.) have as their source one of four types of facial signal systems: static, slow, artificial, and rapid. *Static* signs include the size, shape, and relative locations of the features and the contours produced by the underlying bony structure. These static signs are the likely vehicles for transmitting information about identity and beauty. Examples of slow sign vehicles would be the accumulation of wrinkles, pouches, and bags, which occur with and convey information about age. *Artificial* signs, such as cosmetics and plastic surgery, attempt to disguise these slow age signs. The *rapid* signs include the actions produced by the muscles (typically called expressions), as well as changes in muscle tonus, blood flow, skin temperature, and coloring.

Most research on the face has focused just upon these rapid signs, in particular, the momentary movements of the face and the muscle tonus changes as sign vehicles for information about emotion and mood. Rapid signs may also be relevant sources for other messages, for correct or incorrect information about traits, attitudes, personality, and so on.[2] Our focus in this chapter is upon the methods for measuring momentary facial movement (expressions). Later such methods will be compared with electromyographic measures of muscular activity.

Two methodological approaches

Ekman and Friesen (Ekman, 1964, 1965; Ekman & Friesen, 1968, 1969; Ekman, in press) distinguished two methodological approaches for studying nonverbal behavior, namely, measuring judgments about one or another message and measuring the sign vehicles that convey the message.[3] Often either method can be used to answer a question. Take, for example, the question whether facial expressions vary with psychopathology. Suppose a sample was available of facial behavior during interviews with patients who had a diagnosis of schizophrenia or depression, and with a control group who had no psychiatric problems. To utilize the *message judgment* approach, the facial movements in these interviews would be shown to a group of observers, who would be asked whether each person they viewed was normal, schizophrenic, or depressive. If the judgments were accurate, this would answer the question, showing that facial expressions do convey messages about psychopathology. To utilize the *measurement of sign vehicles* approach, some or all of the facial movements would be classified or counted in some fashion. If the findings showed, for example, that depressives raised the inner comers of their eyebrows more than the other two groups, whereas schizophrenics showed facial movements that very slowly faded off the face, this would also answer the question affirmatively.

Although both approaches can answer the same question, each provides different information. The message judgment approach would show that people can tell from viewing a face whether a person is schizophrenic, depressive, or normal. That cannot be learned from the other approach, which does not determine whether observers can accurately judge this message. But by measuring the sign vehicles it is possible to find out exactly what differs in the faces of the two groups: Is it the timing or the particular movements, or both, that show whether a person is depressive or schizophrenic? That cannot be learned from the first approach, which never determines exactly what the observers respond to when making their judgments.

2. Findings and hypotheses about the messages provided by static, slow, and rapid signals are discussed in Ekman, 1978.
3. Over the years I have proposed a number of different phrases to distinguish these two approaches. In previous discussions the *message judgment* approach has been labeled the stimulus, communicative, or judgment approach, and the *measurement of sign vehicles* approach has been labeled the response, indicative, or components approach. It is to be hoped that the present terms, taken from semiotics, allow a more lucid differentiation of these two methods.

Let us turn now to some of the other relationships between the outcomes of these two approaches. Consider these cases:

1. Negative findings with message judgment and positive findings with sign vehicle measurement. This suggests that people (at least those used in the study) do not know what to look for or cannot see the differences in facial behavior. Careful measurement of the facial sign vehicles might have revealed hitherto unknown differences. Once known, these clues to psychopathology might make it possible for observers to make judgments accurately. Or perhaps the clues are such that people will never be able to make this judgment accurately when viewing the behavior at real time. The differences in facial behavior might be too subtle to be seen without repeated or slowed viewing and precise measurement.

2. Positive findings with message judgment and negative findings with sign vehicle measurement. The positive results show that there must be some difference in the facial sign vehicles, for how else would the observers achieve accuracy in their judgment? This outcome shows that something must be faulty in the measurement of the sign vehicles. Either the measurement was not reliable or it was selective rather than comprehensive, and there was bad luck in selecting just those facial movements that did not differ.

3. Negative findings with message judgment and negative findings with sign vehicle measurement. This all-too-frequent outcome may occur because the face simply does not provide information about the topic being studied. Or something may have been faulty in the sampling. For example, there may not have been sufficient care in obtaining high agreement among experts about the diagnosis of the patients. Or perhaps the patients were receiving medications that suppressed some behavioral differences. Also, this outcome does not eliminate the possibility that there were differences in facial movement related to psychopathology that the observers did not know about or could not see (thus the message judgment approach failed), and that were missed by a faulty technique for measuring the facial sign vehicle. Was the measurement of sign vehicles comprehensive rather than selective? If it was selective, the possibility always remains that movements unrelated to psychopathology were measured.

The difference between these two approaches - message judgment and the measurement of sign vehicle - has sometimes been confusing, because both may involve observers (Rosenthal, for example, concluded there is little difference between the two; see Rosenthal, 1982). It is what the observers do that matters. In message judgment they make *inferences* about something underlying the behavior - emotion, mood, traits, attitudes, personality, and the like. In measuring sign vehicles the observers *describe* the surface of behavior; they count how many times the face moves, or how long a movement lasts, or whether it was a movement of the frontalis or corrugator muscle. (Describing which muscle produced a movement may require an inference, but it is an inference about a physical characteristic, not about underlying psychological phenomena.) Observers who describe behavior are supposed to function like machines, and indeed might someday be replaced by an optical scanner. Techniques for measuring sign vehicles that fail to remove inferences about meaning from the description of behavior will be faulted in the evaluation that follows.

It is not accident that in message judgment studies observers typically are shown a sample of facial behavior at real time, because the purpose usually is to generalize to more natural interpersonal perception. (An exception is the use of still photographs in message judgment studies. These experiments cannot claim any relevance to usual life circumstances.) In sign vehicle measurement there is usually repeated and slowed-motion viewing, because the object is precise description, not observation under natural circumstances.

Though the two approaches can both answer the same questions, they can also answer different questions, for they focus on different phenomena. Message judgment research is not typically focused on the face. The face is but an input, although there may be study of different types of faces, as in the psychopathology example. In message judgment studies the focus is instead on the person observing the face and/or on the message obtained. Questions have to do with whether a difference is detectable or accurate; there are individual differences among observers, reflecting skill, gender, personality, and the like; messages obtained are best represented as dimensions or categories; and so on.

Facial sign vehicles are measured when the focus is upon unearthing something fairly specific about facial behavior itself, not about the perception of the face. It is the only method that can be used to answer such questions as:

1. To what extent is the facial activity shown by newborns and young infants systematic, not random, and which particular actions first show such systematic organization? To answer this question, facial behavior shown during samples taken at different developmental points or in different situational contexts can be measured. Then the probabilities of particular co-occurrences and sequential patterns of facial actions can be evaluated (see Oster & Ekman, 1978).

2. Which particular facial actions are employed to signal emphasis in conversation? Facial actions that co-occur with verbal or vocal emphasis must be measured to determine if there are any actions that consistently accompany any emphasis (see Ekman, 1980).

3. Is there a difference in the smile during enjoyment as compared to a discomfort smile? The particular facial actions evident in smiling movements must be measured when persons are known, by means other than the face, to be experiencing positive and negative affect (see Ekman, Friesen, & Ancoli, 1980).

4. Are there differences in heart rate that accompany nose wrinkling and upper lip raising versus opening the eyes and raising the brows? Facial behavior must be measured to identify the moments when these particular facial configurations occur in order to examine coincident heart rate activity (see Ancoli, Kamiya, & Ekman, 1980; Malmstrom, Ekman, & Friesen, 1972).

These examples are not intended to convey the full range of issues that can be addressed only by measuring facial sign vehicles. They should, however, serve to illustrate the variety of questions requiring this approach. One might expect the measurement of sign vehicles approach to have been followed often, as it is required for study of many different problems. But there have been only a few such studies compared to the many that have measured the messages judged when viewing the face. It is much easier to perform the latter sort of study. The investigator need not tamper with the face itself, other than by picking some sample to show. Data are obtained quickly: One can measure observers' judgments much more quickly than one can describe reliably the flow and variety of facial movement.

Perhaps the most important obstacle to research measuring sign vehicles has been the lack of any accepted, standard, ready-for-use technique for measuring facial movement. Each investigator who has measured facial movement has invented his technique in large part de novo, rarely making use of the work of his predecessors. Some have seemed to be uninformed by the previous literature. Even the more scholarly have found it difficult to build upon the methods previously reported, because descriptions of facial activity are often vaguer than they appear upon first reading. A facial action may seem to be described in sufficient detail and exactness until an attempt is made to apply that description to the flow of facial behavior.

Coverage

The 14 techniques for measuring facial actions reviewed in this chapter cover a span of 55 years, from Landis's 1924 report to the study by Izard that became available from the author in late 1979. Five were not presented by the authors as methods that could be used by others, but were reported in the course of describing substantive results. They have been included for various reasons. Landis is included because he was among the first to build a measurement system based on the anatomy of muscle action, and his negative findings were influential for the next forty years. Frois-Wittmann (1930) and Fulcher (1942) were both innovative for their times, but their methods and findings have been largely forgotten by the current generation of researchers. McGrew's (1972) behavioral checklist has influenced those studying children from an ethological viewpoint. Nystrom (1974) has been included because there is much interest today in measuring facial action in infants. The other 9 techniques reviewed represent all of the systems for measuring facial movement that have been proposed, some of which have attracted considerable interest and research activity.

A few reports describing facial actions in detail have been omitted Discussions of facial behavior that did not report a procedure for measurement – such as Hjorstjo (1970), Lightoller (1925), and Seaford (1976), all of which provided very enlightening discussions of the anatomical basis of facial movement – are not included. Depictions of facial expressions primarily designed to train observers to recognize emotion, rather than measure facial movement (Ekman & Friesen, 1975, are excluded even though some investigators have used them to measure the face (Hiatt, Campos, & Emde, 1977). Izard's Affex (previously called FESM) has also been excluded because observers are required to judge emotion rather than describe the appearance of facial movement. Unlike most message judgment approaches to the measurement of the face, Izard's Affex provides the observers with training about the various clues believed to signal each emotion. There is no way to know, of course, what clues the observers actually rely upon when they make their emotion judgments, because all the investigator obtains is the end point in the observers' inferences. Though the aim of Affex is to provide quick data about emotions, it cannot allow investigation of what indeed are the facial clues to each emotion. Other techniques designed to provide economical measures of emotion (Ekman & Friesen's EMFACS and Izard's MAX) are considered in this chapter because they involve describing facial appearance rather than making direct inferences about underlying states. Reports that used but did not add new methodological features to one of the techniques here reviewed are excluded. Also omitted (except for a later discussion of electromyography [EMG]] are techniques that intrude by attaching something to the subject' s face, marking the subject's face, or moving the subject around in front of a camera (Rubenstein, 1969).

The measurement techniques that are reviewed share the features of being unobtrusive; requiring a permanent visual record (video or cinema) that allows slowed or multiple viewing, rather than being applicable to behavior as it occurs; and relying upon an observer who scores or codes behavior according to a set of predetermined categories or items.

This chapter cannot teach the reader how to measure facial actions. Nor does it fully describe most of the measurement techniques, many of which would require a whole chapter, and some an entire book. (Exceptions are the techniques of Birdwhistell, Landis, and Nystrom, each of whom provided little more detail than what is reported here.) Instead, the emphasis is upon the criteria to be considered in evaluating any measurement technique, either one of those available or one that the reader might devise. The strengths and weaknesses of each technique will be made evident, so that the reader is better able to choose which might be best for a particular research problem. Already (Scherer & Ekman, 1982) some mention has been made of the need for reliability and the virtues of a comprehensive measurement system. We will begin, however, with a different criterion, one that is at the heart of each system: How was it discovered? What basis did the investigator have for proposing his or her technique?

9.2. The basis for deriving units

Each of the 14 measurement techniques contains a list of facial actions such as a brow raise, nose wrinkle, lip comers down, and so on. Measurement includes noting whether any action (or, with some techniques, combination of actions) is present. Later we will consider how each technique describes actions and differentiates one action from another, but here we are concerned with the question how the author decided upon his or her particular list. The lists vary in number of items from a low of 22 to a high of 77. Some actions appear in all techniques, other actions in only some techniques, and still others in just one technique. Sometimes behavior that is treated as a single action by one technique appears subdivided as two distinct actions by. others. For example, raising the eyebrows is treated as one behavioral unit by some techniques, but appears as three separate units - inner brow raise, outer brow raise, and the combination of inner and outer brow raise - in other techniques. Most authors did not explain what they considered when they included or excluded a facial action, what basis they had for subdividing a unit another researcher had treated as a single action, or why they found it wise to collapse a distinction drawn by another investigator. In fact, most did not acknowledge the work of their predecessors, but instead acted as if they had invented their system and had no knowledge of differences between it and the systems of their earlier or contemporary colleagues.[4]

Investigators – often failing to specify the sample, setting, or persons viewed – usually said only that they looked at behavior and that their list of facial actions was simply the product of what they saw. Something more is needed, however, to account for the differences among these techniques, even allowing for the fact that each investigator observed a different behavior sample. What stood out, which attributes were noticed when an action occurred, how the flow of behavior was segmented by the investigator probably depended upon theoretical commitments. Only a few were explicit.

Birdwhistell (1952) tried to organize units and select behavior to construct a system paralleling linguistic units.[5] Grant (1969) advocated the selection and organization of measurement units according to function. This puts the cart before the horse, because the measurement technique so constructed was to be used to discover the function of those very behaviors. Among ethologists, Blurton Jones (1971) was most explicit in considering the anatomical basis for facial actions, although he did not say that this was the final or even the major basis for his decisions about what to include, and he did not specify how he arrived at his list of minimal units of behavior.

Ekman, Friesen, and Tomkins (1971), in contrast to the aforementioned investigators, derived their list of facial actions from explicit theory about the facial actions relevant to emotion, rather than from observation of some sample of behavior. The cart-before-horse criticism applies to them also. Although they could find out whether the actions proposed for one emotion do or do not accurately reflect that emotion, they could not discover signals for emotion that they did not know about in advance. Izard, eight years later, also used theory about emotion signals as the basis for selecting actions to score in his measurement technique MAX. His decisions were based on inspection of still photographs of posed emotions that had yielded high agreement among observers who made global judgments about emotion.[6]

The anatomical basis of facial action provided a third totally different basis for deriving units of behavior. The measurement units were presumably based on what the muscles allow the face to do. Because we all have the same muscles (for all practical purposes), this approach might be expected to have led the investigators who followed it to arrive at the same listings of facial actions. This is not the case. For example, Landis had 22 actions and FroisWittmann 28, and yet they both claimed to have based their measurement units on the anatomy of facial action. In part, the discrepancies occurred because of explicit decisions to select only certain actions. Most standard, anatomy texts list many, usually not all, facial muscles with rather simple, only partially correct, and usually quite incomplete accounts of how each muscle changes appearance. Most investigators who based their technique on anatomy selected only some muscles, and usually did not explain the basis for their selection. Ekman and Friesen (1976, 1978) and Ermiane and Gergerian (1978) were exceptions, each attempting to determine all the actions the anatomy allows. Both studies attempted to determine this by systematically exploring the activity of each single muscle; Ekman and Friesen also resurrected Duchenne's (1862) technique of determining how muscles change appearance by inserting a needle into and electrically stimulating muscles.

The discrepancies among the most recent techniques (Ekman & Friesen; Ermiane & Gergerian; Izard's MAX) are due to differences in purpose and in procedure for obtaining reliability. Both Ekman and Friesen and Ermiane and Gergerian attempted to include in their lists changes in appearance that are independent of each other. If a muscle contraction would produce two or three changes in appearance, these were gathered together as multiple indexes of the activity of one unit or muscle. For example, when the entire frontalis muscle acts, it will (1) raise the eyebrows; (2) produce horizontal furrows running across the forehead (except in infants, who have a fatty pad in the forehead blocking such wrinkles); and (3) expose more of the eye cover fold (the skin between the upper eyelid and the eyebrow). Both Ekman and Friesen and Ermiane and Gergerian listed these multiple signs together as different ways of recognizing that this one action had

4. Izard (personal communication, 1979) said that as part of an attempt to establish independent discovery, he deliberately did not examine Ekman & Friesen's Facial Action Coding System, even though it had already been published at the time when he was developing his measurement techniques.
5. See Kendon (1982) for a praiseworthy account of Birdwhistell, and Rosenfeld (1982) for a critique of Birdwhistell's methods.
6. Though neither of Izard's techniques (Affex or MAX) has been published as of late 1980, he has furnished information about both to those who inquire. Included are scoring manuals and illustrative material. An earlier version of MAX, FMCS (Facial Movement Coding System), is not available to others and is not discussed in this chapter.

occurred. Izard, however, treated signs (1) and (2) of frontalis muscle activity as separate measurement units, giving each equal, independent, separate status, failing to recognize that they are signs of the same action. He ignored sign (3).

Izard also differed from the others in selecting only movements that he judged relevant to emotion. Ekman and Friesen and Ermiane and Gergerian intended to include all the possible appearance changes that the muscles can produce. This sometimes meant creating more than one measurement unit, if use of different strands of a single muscle or different portions of that muscle was found to produce visibly different changes in appearance. For example, Ekman and Friesen and Ermiane and Gergerian distinguished a number of different facial action units that are based on various uses of what anatomists have termed one muscle – the orbicularis oris, which circles the lips. Izard included only some of these separate appearance changes. Strangely, Izard excluded specific actions that are said by many theorists to signal emotions and that are shown by Ekman and Friesen's data to be emotion signals. Izard and Dougherty (1981) say that actions were dropped that were not efficient, but inspection of that article and of earlier versions of lzard's scoring technique (FMCS) suggests instead that Izard never considered a number of facial actions important to differentiating among emotions.

The Ekman and Friesen technique differed from the others in another important respect. Anatomy was only part of their basis for the derivation of measurement units. They also determined whether observers could reliably distinguish all of the appearance changes resulting from the various muscles. If two appearance changes could not be reliably distinguished, they were combined, even if different muscles were involved. If Ekman and Friesen erred, it was on the side of caution, by excluding distinctions that observers with considerable training might perhaps be able to distinguish. The opposite error may have been made by Ermiane and Gergerian and by Izard. They included distinctions without reporting exploration or test of whether each and every distinction could reliably be made by those who learn their system (see Section 9.7 on reliability).

Tables 9.1, 9.2, and 9.3 and the chapter appendix compare the 14 measurement techniques on each of the criteria (arranged as columns) that are discussed. The basis for deriving units provides the order in which the 14 techniques appear: first the one system that is linguistically based; then those that are ethologically based; then one that is theoretically based; and finally those based on the anatomy of facial action.

9.3. Comprehensiveness or selectivity

Three aspects of facial movement can be measured either selectively or comprehensively. Most investigators have considered how to measure only the type of action, not its intensity or its timing. *Type* refers to whether it was a brow raise, or an inner corner brow raise, or a brow lower, or some other action. *Intensity* refers to the magnitude of the appearance change resulting from any single facial action. *Timing* refers to the duration of the movement, whether it was abrupt or gradual in onset, and so on.

Type of action

A technique for measuring the type of facial action can be selective, measuring only some of the actions that can occur, or it may claim to be comprehensive, providing a means of measuring all visible facial action. There are advantages and disadvantages in each case. If the technique is selective, it is important to know what has been excluded; and if it claims to be comprehensive, there must be some evidence to establish that this is indeed the case.

The great advantage of a selective technique is economy. Because only some of the mass of facial actions must be attended to, the work can be done more quickly. Suppose an investigator wants to measure whether fear is reduced by exposure to one set of instructions versus another. A measurement technique that allows measurement of just the occurrence of three or four fear facial expressions would be ideal, because it will not matter if the occurrence of anger, disgust, distress, or some other emotion is missed. Even if the technique does not include *all* of the fear facial expressions (and at

this time there is no conclusive or even definitive evidence about all the facial actions for any emotion), a selective technique could be useful. It might not matter that some or even most fear expressions were not scored, nor that blends of fear with other emotions were not scored; enough might be measured to show the effect. If the findings were negative, however, the investigator would not know whether the cause was an inadequate experimental treatment (in this example, the instructions might not have differed sufficiently) or failure to measure all of the fear expressions. In such an instance the investigator might want to turn to a comprehensive technique.

Table 9. 1. Summary of methods for measuring facial behavior for units and comprehensiveness

		Comprehensiveness		
	Basis for deriving units	**Type of action**	**Intensity of action**	**Timing of action**
Linguistically based				
Birdwhistell (1952)	Observation of interpersonal behavior; parallel linguistic units	Not claimed to be comprehensive; 53 actions	No provision	No provision
Ethologically based				
Blurton Jones (1971)	Observation of 500 still photographs of 2-5-year-old children	Measures any child's facial expressions; 52 actions	6 degrees of eye openness; 4 degrees of lip separation; 2 degrees of frowns	No provision
Brannigan & Humphries (1972)	Observation of children and adults	Not claimed to be comprehensive; 70 actions	No provision	No provision
Grant (1969)	Observation of children and adults	Not claimed to be comprehensive; 53 actions	No provision	No provision
McGrew (1972)	Observation of 3-4-year-old children	Not claimed to be comprehensive; 31 actions	No provision	No provision
Nystrom (1974)	Observation of 1-month-old infants	Not claimed to be comprehensive; 35 descriptors	No provision	No provision
Young & Decarie (1977)	Observation of 36 infants	Measures 42 facial configurations; selected only to be relevant to emotion in the last quarter of first year in six test situations	No provision	No provision
Theoretically based				
Ekman, Friesen, & Tomkins (1971)	Theory about emotion expression	Measures signs of just 6 emotions; 77 descriptors	No provision	Start-stop
Izard MAX (1979b)	Theory about emotion signals; data from posed still photographs	Measures just actions needed to identify emotion in infants; 27 descriptors	No provision	Start-stop

		Comprehensiveness		
	Basis for deriving units	**Type of action**	**Intensity of action**	**Timing of action**
Anatomically based				
Ekman & Friesen (1976, 1978)	Muscular	Measures all visible movements; 44 action units that singly or in combination can score any observed action	Four actions have 3-point rating on intensity; provision to rate intensity in other actions	Start-stop and onset-apex-offset
Frois-Wittmann (1930)	Muscular	Not claimed to be comprehensive; 28 descriptors	No provision	No provision
Fulcher (1942)	Muscular	Not claimed to be comprehensive; absence/presence of 16 muscular actions	Amount of movement in each of three facial areas rated	No provision
Ermiane & Gergerian. (1978)	Muscular	Measures all visible movements; 27 muscle actions	Each action rated on 3-point intensity scale	No provision
Landis (1924)	Muscular	Not claimed to be comprehensive; 22 descriptors	Each action rated on 4-point intensity scale	No provision

Some questions require a comprehensive technique and cannot be answered with a selective one. Suppose the investigator wishes to discover which facial actions signal fear, anger, sadness, and so on.[7] Or perhaps he or she wishes to discover whether different actions are employed to serve a linguistic rather than an emotive function, or to learn what people show on their faces when their heart rates show a sharp acceleration, or whether there are cultural or social class differences in facial actions during a greeting. A comprehensive technique would have to be employed. Once there was reasonably conclusive evidence on any of these issues, then such evidence could provide the basis for selective use of portions of a comprehensive system. For example, Ekman, Friesen, and Simons (in preparation), building upon the earlier research of Landis and Hunt (1939), have strong evidence about the particular combination of facial actions and the timing of those actions that index the startle reaction.[8] Once that has been replicated by other laboratories, those interested in the startle in particular could utilize just that portion of Ekman and Friesen's comprehensive scoring technique.

7. Investigators studying the face of course do not agree about whether there is definitive evidence regarding the particular facial actions that do and do not signal each emotion. Ekman and Oster (1979, p. 543), in reviewing the last decade of research on this topic, concluded that it is still a question of whether "facial expressions provide accurate information about the distinctions among several negative and positive emotions. The only evidence [indicating that] facial expressions [provide such discrete information] is for posed expressions." Izard (1979b) takes a much more positive view in describing what his measurement technique can do: "The content universe sampled by MAX consists of all the facial movements or appearance changes that signal affect" (p. 38). The evidence to support that claim is weak, however. One finding cited as evidence of validity is that scoring with MAX correlates with observers' judgments of emotion using Affex, but there is no validity evidence for Affex. The other validity evidence claimed is that infant facial expressions selected to correspond to adult poses and thus identified by MAX as representing one or another emotion are judged by observers to show those emotions. Here the limitation in evidence is threefold: (1) Judge agreement only establishes consensus; it does not demonstrate that the actions actually represent the emotions they are judged to show; (2) because the scoring technique was selective, there is no way of knowing whether other actions not scored might predict observers' message judgments just as well or better; (3) because the observers' choices were restricted, there is no way of knowing whether they would have described the infants' faces with the same emotion terms, or with any emotion terms at all, if they had been allowed free description.

8. In part because of its very uniformity, Ekman and Friesen consider the startle reaction to be not an emotion but instead a reflex. Other writers about emotion (e.g., Tomkins, 1962) disagree and classify startle with the emotion of surprise.

Only a comprehensive technique allows for discovery of actions that the investigator did not know about in advance and permits a complete test of an a priori theory about facial sign vehicles. A third advantage of a comprehensive technique is that it provides a common nomenclature for descriptions of facial behavior. If many investigators were to use the same comprehensive technique, comparison of findings would be facilitated because investigators, even those who used it selectively, would key their units to a single list of facial actions. Investigators considering selective scoring might well want first to study a comprehensive technique, in order to become acquainted with the entire array of facial actions, so that they could be explicit about what it is they are choosing not to measure.

Wedded to these advantages of comprehensive facial scoring is the disadvantage of cost. It takes more time to learn a comprehensive technique, and it takes more time to apply it, for nothing (presumably) is left out

It is no accident that the only techniques that claim to be comprehensive – Ekman and Friesen and Ermiane and Gergerian – were anatomically based. An inductive approach would be too costly if comprehensiveness was the goal. Too large a sample of diversified behavior would have to be observed to have a reasonable likelihood of achieving completeness. By contrast, it should be possible to achieve comprehensiveness by exploring how each muscle works, because the muscles produce the actions observed. This is not as simple as it might first seem, because muscles can act in concert, not just singly. Facial expressions are rarely the consequence of the activity of a single muscle. Even the smile, which is principally the work of the single zygomatic major muscle, typically involves two or three other muscles as well, and not every smile involves the same other muscles. Moreover, what happens to appearance when muscles act in concert is not always the sum of the changes associated with each of the components. And the activity of one muscle may obscure the presence of another. It is important, therefore, that a comprehensive technique list not simply the ways of recognizing how each single facial action appears, but also the ways of scoring the occurrence of these units of facial action when they combine in simultaneous or overlapping time. Only the Ekman and Friesen technique has done so.

A last issue regarding how comprehensively a technique measures the *type* of facial action is what evidence is provided to demonstrate that the system is what it claims to be. One wants to know whether the universe of facial movement can be described by the technique, or at least what part of the universe has been omitted. If there is uncertainty about comprehensiveness it should be clear whether it is about just some or all actions. An empirical answer would be possible if either of the techniques claiming comprehensiveness (Ekman and Friesen and Ermiane and Gergerian) had scored large samples of facial actions of males and females of diverse ages, from various cultural, ethnic, and class backgrounds, in a wide variety of social and individual settings. Neither has been used this extensively.

Alternatively, comprehensiveness could be determined by experimentally generating all possible permutations of facial actions. Ekman and Friesen explored the comprehensiveness of their technique by producing voluntarily on their own faces more than 7,000 different combinations of facial muscular actions. These included all permutations of the actions in the forehead area, and for the lower face all of the possible combinations of two muscles and of three muscles. Although they believe their system is relatively comprehensive[9] only time and application to diverse samples of facial behavior will establish it to be so.

Ermiane and Gergerian did not provide any evidence of comprehensiveness. They determined only that their system would describe the actions of single muscles, and a few of the combined actions of two or three muscles.

Intensity of action

Actions vary not only in type (inner comer brow raise versus raise of the entire brow) but also in intensity. A brow raise may be weak or strong; the lift of the brow, the extent of exposure of the eye cover fold and gathering of skin on the forehead, may be very slight or great. The intensity of a facial action may be of interest for a variety of reasons. For example,

9. They acknowledge that for certain actions – for example, the movements of the tongue – their technique is not complete.

Ekman et al. (1980) found that the intensity of zygomatic major muscle action was correlated with retrospective self-reports about the intensity of happiness experienced.[10]

Ermiane and Gergerian was the only one of the 13 other techniques to provide for comprehensive measurement of intensity. Nine of the techniques treated facial action as an all-or-nothing phenomenon, or as if there were evidence that variations in intensity are without significance. One (Grant) even confused intensity with type of action, listing as different action types appearance changes that are due only to variations in intensity. A few made provision for scoring the intensity of four or five actions (see Table 9.1). In recent unpublished work, Ekman and Friesen found that the logic provided in their scoring system for measuring the intensity of four actions can be extended to the other facial actions, but evidence has not yet been provided that such extensions can be made reliably for all the actions in their technique.

Timing of action

A facial action has a starting and a stopping point. It is often more difficult to ascertain the exact determination of these points than to decide which action occurred (see the discussion of timing in Section 9.6 below). From start to stop, other aspects of timing may be distinguished:

1. Onset time: the length of time from the start until the movement reaches a plateau where no further increase in muscular action can be observed

2. Apex time: the duration of that plateau

3. Offset time: the length of time from the end of the apex to the point where the muscle is no longer acting

Onsets and offsets may vary not only in duration but in smoothness; for example, an offset may decline at a steady rate, or steps may be apparent. Similarly, an apex may be steady or there may be noticeable fluctuations in intensity before the offset begins. When examined closely the separate actions that compose a facial expression do not start, reach an apex, and stop simultaneously. In even a common expression, such as surprise, the raising of the eyebrows may reach an apex while the dropping of the jaw is still in onset.

For some questions it is possible that simple counts of the occurrence of particular actions may be sufficient, without measurements of onset, apex, and offset. The investigator may want to know only how often or for how long a person raised the brow, wrinkled the nose, or depressed the lip comers. Even when interest is limited to simple summary measures of the occurrence of single actions, there is no rationale for using frequency rather than duration measures (which require stop-start determination) other than economy. A frequency count will underrepresent those actions which go on for long periods of time and overrepresent frequent brief actions.

Limiting measurement to single actions is hazardous regardless of whether frequency or duration is measured. Nose wrinkling, for example, may signify one thing when it occurs in overlapping time with a lower lip depression (disgust) and something quite different when it flashes momentarily while the lip corners are pulled upwards (an action that Ekman and Friesen suggest functions like a wink to accentuate a smile). A pulling down of the lip corners may signify sadness when it accompanies raised inner corners of the brows with drooping upper eyelids. When this same action occurs with the entire brow raised and the lower lip pushed up it may be a disbelief gesture. These interpretations, which have not all been tested, cannot be tested unless the timing of actions is measured. What evidence does exist (Ekman & Friesen, 1978) suggests that it is unwise to measure the face as if each action can be counted separately, as if each action has an invariant meaning apart from other actions that overlap in time.

10. Frequency and duration measures also correlated with retrospective self report, and the highest correlation was obtained with a score that combined intensity, frequency, and duration.

Measurement of combinations of facial actions (what is usually meant by an expression) requires at least a determination that actions overlap, if not precise determination of the stopping and starting points of each action. Ekman and Friesen (1978) further suggest that it is overlap in the apex that is crucial to determining whether actions that co-occur are organized as part of the same event, signal, or expression. Their reasoning is that when one action begins (onset) while another action is fading (offset), it is not likely that they have been centrally directed as part of the same signal. Suppose, for example, that there has been an overlap in the apex of brow lowering, tightening and pressing together of the red parts of the lips, and raising the upper eyelid. Ekman and Friesen have hypothesized that these elements compose one of the anger expressions. Overlap in the apex of these actions would support their notion that an anger signal had occurred and that these actions should be so counted, and not tallied separately. Let us suppose that there was also a nose wrinkle, with an apex overlapping these anger actions. Ekman and Friesen suggest that this would be a blend of disgust with anger. If the nose wrinkling reached its apex as these anger actions were in offset, they suggest that it be characterized as a sequence of anger followed by disgust. Test of these hypotheses requires precise measurement of onset, apex, and offset.

A number of other research questions also require comprehensive measurement of the timing of facial actions. For example, does a brow raise and upper eyelid raise occur before or during an increase in loudness in speech or a deceleration in heart rate? Ekman, Friesen, and Simons (in preparation) have found that onset time is crucial in isolating from idiosyncratic facial actions those muscular actions which always occur in unanticipated startle reactions. Only actions that began within 0.1 second were evident in all unanticipated startles; offset time did not distinguish the idiosyncratic from uniform facial actions. In another situation offset time, rather than onset, may be crucial; for example, Ekman and Friesen (1975, chap. 11) hypothesized that stepped offsets occur more often in deceptive than in felt emotional expressions.

Most of the 14 techniques do not describe procedures for measuring starting and stopping points and totally ignore onset, offset and apex measurement. The data reported usually consists only of frequency counts. Ekman and Friesen's technique is the only one to describe how to measure these different aspects of timing. In a study now in progress these authors are comparing the relative validity scores of such comprehensive measurements of timing with a more economical frequency checklist version of their Facial Action Coding System (see Section 9.9).

9.4. Depicting facial measurement units

It is not as easy as it may at first seem to depict clearly what is referred to by a facial measurement unit. Some authors did not bother, because they did not expect others to try to use their methods. Regrettably, this lack of clarity also has caused some uncertainty about their substantive results. Take the example "down comers mouth," which is found in the measurement techniques of Birdwhistell, Brannigan and Humphries (1972), Grant, and Nystrom. Does this phrase describe instances in which the mouth corners have been pulled down? Or those in which the mouth corners are down because the chin and lower lip have been pushed up in the middle? Or does it refer just to expressions in which the mouth corners are down because the center of the upper lip has been raised? Or is it all of them?

The first column in Table 9.2 describes how measurements were depicted in each of the 14 techniques. The chapter appendix lists how a particular facial action (brow raise) was depicted by each technique.

Most techniques used but a few words to describe each measurement unit. Some supplemented this description with a few still photographs. Only three techniques went beyond this step to provide more thorough illustration of each unit. Ekman and Friesen, Ermiane and Gergerian, and Izard's MAX technique all provided visual illustrations of every measurement unit. All provided some explanations of the anatomical basis of each action, Ekman and Friesen and Ermiane and Gergerian more thoroughly than Izard. Ermiane and Gergerian provided still photographs of each action and combination considered; Izard provided video, photographs, and drawings; and Ekman and Friesen provided still photographs, cinema, and video illustrations.

9.5. Separating inference from description

Although many investigators have been interested in inferring something about the signal value or function of facial actions, not all have recognized that such inferences should not be intermixed with descriptions in their measurement techniques. The measurement must be made in noninferential terms that describe the behavior, so that inferences about underlying states, antecedent events, or consequent actions can be tested by empirical evidence.

Mixing inference with description may also make the measurements quite misleading. Few single-muscle actions have an invariant meaning. Take the example of the so-called frown (lowering and drawing the brows together). This action is not always a sign of negative affect; depending upon the timing of the action, what other actions co-occur with it, and the situational context, it may signify quite different matters. It would be misleading to be identifying the occurrence of a frown when the brow lowering is signaling concentration, or conversational emphasis.

Because humans make the measurement, inferences cannot be eliminated, but they need not be encouraged or required. If the person scoring a face identifies the brows being lowered and/or drawn together, the scorer may still make the inference that he or she is describing a frown. But Ekman and Friesen (1978) reported that when people use a measurement technique that is solely descriptive, as time passes the scorer increasingly focuses on the behavioral discriminations and is rarely aware of the possible meaning of the behavior. Although there can be no guarantee that inferences are not being drawn, a measurement technique should neither encourage nor require inferences about meaning by the terminology or descriptions it employs.

Table 9.2. Summary of methods for measuring facial behavior: unit depiction,inference/ description, and application

	Way in which each unit is depicted	Use of inference or description	Types of records and persons to which measurement has been applied
Linguistically based			
Birdwhistell (1952)	Two or three words	Mixed: e.g., *pout, smile, sneer*	Not known
Ethologically based			
Blurton Jones (1971)	Verbal description of changed appearance of features, a few drawings and illustrative photos	Mostly description but a few inferential terms: e.g., *frown, pout*	Infants and children
Brannigan & Humphries (1972)	Verbal description	Mixed: e.g., wry *smile, angry frown, sad frown, threat*	Children and adults
Grant (1969)	Primarily verbal description, some photos	Mixed: *sad frown, aggressive frown, smile, sneer,* etc	Children and adults
McGrew (1972)	Verbal description; compared to Grant, Blurton Jones	Mostly description but a few inferential terms: e.g., pout, *frown, grin*	Children
Nystrom (1974)	Verbal description	Description	Neonates
Young & Decarie (1977)	Verbal description	Mixed: *fear face, sad face, shy smile,* etc.	Infants in last quarter of first year
Theoretically based			

	Way in which each unit is depicted	Use of inference or description	Types of records and persons to which measurement has been applied
Ekman, Friesen, & Tomkins (1971)	Photographs of descriptor	Description	Video and still photos of adults' posed and spontaneous expressions
Izard MAX (1979b)	Verbal description, photos, drawings, and video	Description	Video of infants
Anatomically based			
Ekman & Friesen (1976, 1978)	Verbal description, still photos, and cinema illustrations of each action and certain combinations of actions	Description	Spontaneous, deliberate, and posed video and photos of neonates, children, adults, deaf stut terers, mental patients
Frois-Wittmann (1930)	Verbal description; very brief	Only one inferential term: *frown*	Still photos of poses by one adult
Fulcher (1942)	Verbal description; very brief	Description	Films of poses by blind and sighted children
Ermiane & Gergerian (1978)	Verbal description, still photos	Description	Adult poses and patients' spontaneous photographs
Landis (1924)	Verbal description	Description	Neonates

Both Ekman and Friesen and Izard separated their hypotheses about the signal value of facial actions from the descriptive materials to be used in training a person to measure facial behavior. Ermiane and Gergerian intermixed inferences about the meaning of behavior with the information necessary to learn their descriptive system. Theirs is the only technique to contain inferences about how given facial actions are indicative of specific personality processes and types of psychopathology. Birdwhistell, Blurton Jones, Brannigan and Humphries, Grant, McGrew, Young and Decarie (1977), and Frois-Wittmann all used some inferential or emotional terms (e.g., *frown, smile, sneer, angry frown)* mixed in with descriptive terms. (This is not always evident from the chapter appendix, because not all who mixed inference with description did so for the brow raise.)

Both Ekman and Friesen and Izard listed hypotheses about the emotion signaled by particular facial actions. Ekman and Friesen were explicit about the particular combinations of units they considered as emotion signals; 1,000 such predictions were included in their published system, and more than 2,000 more are contained in a forthcoming report (Friesen & Ekman, in preparation). Izard's MAX contains only those facial actions which, he claims, distinguish among the emotions. Ekman and Friesen have evidence that Izard is wrong, that he has excluded a number of actions relevant to emotions. For example, Izard does not include levator labii superioris caput infraorbitalis, an action relevant to both disgust and anger, except when this muscle acts unilaterally. Ekman, Friesen, and Ancoli (1980) found that bilateral evidence of this muscle correlated with the subjective report of disgust. Ekman and Friesen also found that when this action is accompanied by the narrowing of the red margins of the lips (another action ignored by Izard), the signal changes from disgust to anger. These errors are the product of limited sampling: Izard chose his actions on the basis of what he observed in a set of photographs of posed emotions.

9.6. Types of records and persons to which measurement has been applied

Still or motion records

Although a number of techniques claim that they can be used with motion records, most have not dealt with the complexities in the timing of facial action that a motion record reveals. These investigators may never have been confronted with the type of record they examined. If only posed expressions were measured (as in the case of Ermiane & Gergerian), variations in timing might not be apparent. Posers generally try to perform all the required movements at once, in overlapping time, with similar very short onsets, long-held apexes, and abrupt short offsets. Variations would not be apparent, nor would the reason to measure them. An investigator who used his or her method only to score still photographs also might not know of these complexities in timing, because the camera shutter freezes all action. Though Izard has scored some motion records, he preselected only certain brief segments of videotape to score, segments in which the infants seemed to be emitting expressions that looked like those in posed photographs of adults. Thus he has not dealt with the complexities that a motion record reveals. Other investigators may have failed to consider the timing of facial movement because they tried to apply their systems in real time, as the behavior occurred, and even if they had videotape or film, they may not have examined the records in slowed or repeated replay.

It will be most important for investigators to make use of motion measuring the timing of facial actions whenever they want to study spontaneous behavior, taking a strictly descriptive approach; or interrelate facial activity and some other simultaneous behavior (speech, respiration, body movement, etc.); or distinguish configurations in which the temporary organization of multiple facial actions suggests that they be considered parts of the same signal or expression. (See the discussion of the research questions that require measurement of timing in Section 9.3.)

Modifications for varying age levels

Ideally, a facial measurement system should be applicable to the study of individuals of any age, by making provision for any modifications needed to measure infants or the aged. The appearance of certain facial actions is quite different in neonates and infants from what it is in young children and adults. Oster (1978; Oster & Ekman, 1978), who worked with Ekman and Friesen during the final stages in the development of their measurement system, has studied the neuroanatomical basis for these differences. She has provided (Oster & Rosenstein, in preparation) a set of transformations for utilizing the Ekman and Friesen system with neonates and infants. Izard's MAX technique is specifically limited to measuring infants, but he provides only a few overly general descriptions of potentially confusing infant-adult differences. No other investigator has attended to this problem, not even those who measured young infants and neonates.

Parallel problems may occur in measuring facial activity in quite elderly people, because age signs may necessitate some modifications in scoring rules to avoid mistakes in identifying certain actions. No one has considered this.

9.7. Reliability

The need for reliability is obvious to psychologists. To some anthropologists and sociologists the quest for reliability has seemed a peculiar madness that deflects psychologists from the real problem at hand. For example, Margaret Mead, in the last years of her life, wrote "Psychologists ... are more interested in validity and reliability than in what they are actually studying" (1975, p. 211). Yet if a measurement system cannot be shown to be reliable, there is no way of knowing whether even the investigator who invented the system recognizes the same facial action when it twice occurs. The need to demonstrate reliability seems especially important with facial behavior. For here there is an enormous variety of behaviors that can occur, with no names for most. And those who have observed facial actions have produced very different catalogs.

Some ethologists (e.g., Young & Decarie) have argued that if the same finding is obtained in two independent studies, there is no need to demonstrate that the measurement technique was reliable. This reasoning should not be applied to the area of facial measurement, where there have been completely contradictory reports by different investigators (e.g., the argument about universality between Birdwhistell and Ekman). If we knew that Birdwhistell and Ekman had each used a reliable measurement technique (preferably the same one), at least we could be certain about what was seen, and search differences in sampling, situation, or interpretation as sources of their disagreement. When a measurement technique is

intended to be usable by other investigators, it is especially important for its originator to demonstrate that he or she as well as others can use it reliably. (See also Section 9.1, where reliability was discussed in the context of the relationship between the outcomes of message judgment studies and measurement of sign vehicle studies.)

Let us consider now various aspects of reliability, for it is not a simple matter to establish. A number of requirements can be enumerated:

1. The researcher, rather than just giving an overall index of agreement, should provide data to show that high agreement can be reached about the scoring of specific facial actions. Typically, some actions are easier to recognize than others. Unless reliability data are reported for the scoring of each facial unit, it is not possible to evaluate which discriminations may be less reliable.

2. Data on reliability should be reported from the measurement of spontaneous, not just posed, behavior, and from the flow of behavior as revealed in a motion record, not just from still photographs or slices abstracted from video or cinema, which may yield higher agreement.

3. Reliability data should be provided for *(a)* infants, *(b)* children, *(c)* adults, and *(d)* aged populations, because reliability on just one group does not guarantee reliability on the others.

4. The most common source of unreliability in behavioral measurement, whether it be of face or of body, is the failure of one person to see what another scores. Usually this occurs when an action is small in size. This source of disagreement can be attenuated if the technique specifies a threshold that must be surpassed for the action to be scored. Specifying minimum thresholds alerts the persons doing the scoring to subtle signs and provides explicit bases for decisions about when a change in appearance is likely to be ambiguous. A technique that provides such threshold definitions should therefore yield higher agreement.

5. Reliability should be reported not only for the person(s) who developed the technique, but also for learners who did not previously have experience with facial measurement. Data about the range of reliabilities achieved by new learners should be provided and compared to those for experienced or expert scorers. A technique will be more generally useful if it can be learned independently, without direct instruction from the developer. This usually requires a self-instructional set of materials, practice materials with correct answers, and a final test for the learner to take.

6. Reliability should be reported for the scoring of not just *(a)* the type of action, but also *(b)* the intensity of actions and *(c)* the timing of actions.

Of the 14 measurement techniques, 5 did not report data on any aspect of reliability. The other 9 provided fairly sparse data on reliability, with the exception of Ekman and Friesen and Izard. Even these techniques did not meet all the requirements just listed. Table 9.3 lists the specific reliability requirements met by each technique.

Table 9.3. Summary of methods for measuring facial behavior: reliability and validity

		Validity			
	Reliability	**Descriptive**	**Emotional**	**Conversational**	**Other**
Linguistically based					
Birdwhistell *(1952)*	Not reported	None	None	None	None
Ethologically based					

		Validity			
	Reliability	**Descriptive**	**Emotional**	**Conversational**	**Other**
Blurton Jones *(1971)*	Data reported on requirements *1, 2, 3b, 6a*	None	None	None	None
Brannigan & Humphries *(1972)*	Not reported	None	None	None	None
Grant *(1969)*	Not reported	None	None	None	Predicts severity of mental illness, but no data reported
McGrew *(1972)*	Data reported on requirements *1, 2, 3b, 6a*	None	Spontaneous	None	Predicts gender differences & *re*lation to agonistic interaction
Nystrom *(1974)*	Data reported on requirements *1, 2, 3b, 6a*	None	None	None	None
Young & Decarie *(1977)*	Not determined by authors	None	Spontaneous, but no data reported	None	Said to differentiate infants' response when mother departs and when she frustrates, but no data reported
Theoretically based					
Ekman, Friesen, & Tomkins *(1971)*	Data reported on requirements *2* and *3c*	None	Posed and spontaneous: positive vs. negative, stressful vs. neutral film conditions; differentiates patterns of heart rate	None	Predicts attribution of emotion
Izard MAX *(1979b)*	Data reported on requirements *2, 3a-b, 5, 6a*	None	Posed	None	Provides preliminary data on relations to vocalization and body movement in infants
Anatomically based					

		Validity			
	Reliability	**Descriptive**	**Emotional**	**Conversational**	**Other**
Ekman & Friesen *(1976, 1978)*	Data reported on requirements *1, 2, 3a-c, 4, 5, 6a & c*	Meets performed actions and EMG criteria	Posed and spontaneous; measures intensity and type of emotion; differentiates startle reaction; differentiates certain deliberate from spontaneous expressions	Measures syntactic and emphasis signals	None
Frois-Wittmann *(1930)*	Not reported	None	Posed	None	Predicts developmental changes; compares blind and sighted
Fulcher (1942)	Data reported on requirements 2, 3b, 6a	None	Posed	None	None
Ermiane & Gergerian (1978)	Data reported only on scoring photos of poses and on requirement 3c	None	Posed	None	None
Landis (1924)	Not reported	None	None	None	Predicts individual differences
Linguistically based					
Birdwhistell *(1952)*	Not reported	None	None	None	None

9.8. Validity

Descriptive validity

The validity of a technique designed to measure facial movement entails questions on a number of levels. Most specifically (and concretely), validity requires evidence that the technique actually measures the behavior it claims to measure. When a technique claims to measure brow raise, are the brows actually raised, or is it just the inner comers that are raised? If the technique claims to measure the intensity of an action, such as whether the brow raise is slight, moderate, or extreme, do such measurements correspond to known differences in the intensity of such an action? The problem, of course, is how to know what facial action occurs, what criterion to utilize independently of the facial measurement technique itself. Two approaches have been taken:

1. Performed action criterion: Ekman and Friesen trained people to be able to perform various actions on request. Records of such performances were scored without knowledge of the performances requested. Ekman and Friesen's Facial Action Coding System (FACS) accurately distinguished the actions the performers had been instructed to make.

2. Electrical activity criterion: Ekman and Friesen, in collaboration with Schwartz (Ekman, Schwartz, & Friesen, in preparation), placed surface EMG leads on the faces of performers while the performers produced actions on request. Utilizing the extent of electrical activity observed from the EMG placements as the validity criterion, they found that FACS scoring of facial movement accurately distinguished the type and the intensity of the action. (This study is described in more detail in Section 9.10.)

Utility or validity

Some measurement techniques contain hypotheses about the particular facial actions that signal particular emotions (Ekman and Friesen; Ekman, Friesen, and Tomkins; Ermiane and Gergerian; Izard). For these techniques it is appropriate to ask whether the hypotheses are correct, but the answer does riot pertain to the validity of the techniques, only to that of the hypotheses. Suppose the facial behaviors found to signal emotion were exactly the opposite of what had been hypothesized by the developer of the technique. Such evidence would not show that the technique was invalid, only that the hypotheses were wrong. In fact, the discovery that the hypotheses were wrong would itself require that the technique measure facial movement accurately. Suppose a study not only failed to support the investigator's hypotheses about the actions that signal emotions but found that there were no facial actions related to emotion. If one could discount the possibility that the sample did not include emotional behavior, this might suggest that the facial measurement technique was not *relevant* to emotion. It might have measured just those facial behaviors which are unrelated to emotion. Another technique applied to the same sample of facial behavior might uncover the actions related to emotion.

Two techniques (Ekman and Friesen and Ermiane and Gergerian) claim not to be specific to the measurement of any one type of message, such as emotion, but to be of general utility, suitable for the study of any question for which facial movement must be measured. Such a claim can be evaluated by evidence that the technique has obtained results when studying a number of different matters.

Posed emotions. Many techniques have been shown to be able to differentiate poses of emotion or judgments of emotion poses: Ekman and Friesen; Ekman, Friesen, and Tomkins; Ermiane and Gergerian; Frois-Wittmann; Fulcher; Izard. In the studies that used a selective technique it is not possible to know whether there might have been other facial actions not included in the scoring technique that might have predicted the emotion poses or judgments just as well or better. The two comprehensive techniques – Ekman and Friesen and Ermiane and Gergerian – provided that information. They were able to show that it was the movements they specified as emotion-relevant, not other movements, that were signs of particular emotions. Ekman and Friesen's FACS also predicted not only *which* emotion was posed or judged, but the *intensity* of emotion as well.

Poses, however, by definition are artificial. Although they may resemble spontaneous facial expressions in some respects (see Ekman, in press), one difference is that they are likely to be easier to score. The onset may be more coordinated and abrupt, the apex frozen, and the scope very intense or exaggerated (see the discussion in Section 9.6). Evidence that a technique is a valid measure of emotion cannot rest just upon measurement of poses; it is necessary to determine that the measurement will be valid when it measures spontaneous emotional expression.

Spontaneous emotions. A number of studies have shown the validity of Ekman and Friesen's FACS in measuring the occurrence of spontaneous emotional expressions. Ancoli (Ancoli, 1979; Ancoli et al., 1980) studied autonomic nervous system (ANS) responses when subjects watched a pleasant or stress-inducing film. A different pattern of ANS response during the two films was found only during the times in each film viewing period when the face registered maximal emotional response. In another study of that data, Ekman et al. (1980) found that FACS accurately predicted the subjects' retrospective reports of their emotional experience while watching the films: the intensity of happy feelings, the intensity of negative feelings, and, specifically, the intensity of the emotion disgust. Ekman, Friesen, and Simons (in preparation) differentiated the specific facial actions that signify a startle reaction from the emotional reactions subsequent to being startled. Both the type of actions and the onset time were crucial to this distinction. They also were able to differentiate a genuine from a simulated startle accurately. Ekman, Hager, and Friesen *(1981)* examined the differences between deliber-

ate facial movements and spontaneous emotional expressions. Scoring the intensity of each specific facial action on each side of the face, they found that requested facial movements were asymmetrical more often than spontaneous emotional expressions: The actions usually were more intense on the left side of the face for the deliberate, but not for the spontaneous, emotional expressions. Krause (1978) utilized FACS to measure facial actions during conversations among stutterers and nonstutterers. As he predicted, the facial actions specified in FACS as relevant to anger occurred more often among the stutterers. There is little or no comparable evidence that the other facial measurement techniques listed in Table 9.3 can be used to measure spontaneous emotional expressions.

The only exception is Izard's use of his MAX technique to study infants. He found that observers scoring brief segments of videotape showing infant expressions *selected* to correspond to adult posed expressions could reliably identify the actions making up those expressions. This shows that his technique can be used to identify at least those particular expressions when they occur in spontaneous behavior. At this point, however, there is no evidence to support Izard's claim that an infant producing a particular expression is experiencing a particular emotion or blend of emotions. Because Izard has not described infants' facial behavior comprehensively, he cannot even specify how representative the selected expressions are in the behavior of infants of a given age and in a variety of situations.

Oster (1978; Oster & Ekman, 1978) has provided more complete information about the range of facial muscle activity observed in young infants and about the young infant's capacity for coordinated facial movement. Unlike Izard, she began not by looking for adult posed expressions but by analyzing the configurations and sequences of facial actions actually produced by infants in a variety of situations. Oster found that almost all of the single facial actions included in FACS are apparent early in life. Though certain combinations of facial action common in adult facial expression can be observed in the newborn period, others have not been observed in young infants. Oster (1978; Oster & Ekman, 1978) has argued that the only way to determine the affective meaning and signal function of infants' facial expressions is by a detailed description of the expressions themselves – including the timing and sequencing – combined with a thorough functional analysis of their behavioral correlates and stimulus context. Though far from complete, Oster's work has provided evidence that complex, spontaneous facial actions observed in young infants (e. g., smiling brow knitting, pouting) are not random but represent organized patterns and sequences of facial muscle activity that are reliably related to other aspects of the infants' behavior (e.g., looking at or away from the care giver, motor quieting or restlessness, crying). Such relationships can provide insights into the infant's affective state and cognitive processes.

Conversational signals

Ekman and Friesen's FACS has been found useful in studying facial actions that play a role as conversational rather than as emotional signals.[11] Camras (1977) found differences in the syntactic form of questions that do and do not contain facial actions functioning as "question markers." Ekman, Camras, and Friesen (in preparation) found that the semantic context predicts which of two facial actions is used to provide speech emphasis. Baker (1979) used FACS to measure the facial actions shown by deaf persons when they sign. She has isolated particular combinations of facial actions that appear to serve syntactic functions.

Stable individual characteristics

Although Ermiane and Gergerian intended their facial measurement technique to differentiate personality and psychopathology, they have not reported any validity evidence. There is no evidence that any of the other facial measurement techniques are valid measures of any stable personal characteristic.

11. The distinction between emotional and conversational signals, with examples of how the same eyebrow movements can play either role, is given in Ekman, 1979.

9.9. Costs

This last criterion for evaluating measurement techniques was not included in Table 9.3 because Ekman and Friesen was the only study to provide information about time costs for learning to measure and for scoring a specified sample of behavior. It takes approximately 100 hours to learn FACS. More than half of that time is spent scoring practice materials (still photographs and cinema) included in FACS at the end of each chapter in the instructional manual. Ekman and Friesen do not know whether people will still achieve high reliability if they skip such practice; they do know that high reliability was achieved when all the instructional steps were followed.

The costs for using a measurement technique once it is learned are much more difficult to estimate. For FACS and probably any other technique, the costs depend upon how densely the facial behaviors are packed in the time sample to be scored. Consider first comprehensive scoring in which FACS is used to measure all visible facial activity in a 15-second period. This could take as little as 1 minute if only one or two easily distinguished actions occurred and the investigator wanted only to locate start-stop points for each action. It could take as long as 10 hours, however, if the behavior was as densely packed as it is in the facial activity of deaf persons signing, and if onset-apex-offset was scored for every action. Ekman and Friesen have not observed any other instances in which facial behavior is so densely packed over so many seconds.

If selective rather than comprehensive scoring is done, the costs are lower. Presume that the investigator wants to score only actions that are said to be indicative of disgust, and he or she selects the actions listed in the *Investigator's Guide* to FACS (in Ekman & Friesen, 1978) that are predicted to be prototypic for that emotion. A 2:1 ratio, 30 seconds of scoring time for every 15 seconds of live action, is probably a reasonable estimate.

Ekman and Friesen have recently developed a more economical system for measuring the occurrence of single emotions, based on FACS. Occurrences of actions considered to be the most common signs of anger, fear, distress and/or sadness, disgust and/or contempt, surprise, and happiness are noted. In what they call EMFACS (EM standing for emotion), time is saved in three ways:

1. Scoring does not extend to the particular action, but only to whether a member of a group of specified actions occurred. For example, there are seven signs grouped together that Ekman and Friesen consider relevant to disgust. EMFACS does not differentiate among nose wrinkling, nose wrinkling plus upper lip raising plus lower lip depression, nose wrinkling plus lower lip elevation, and so on. If any of these is seen, a check is made for that grouping. All actions not in one of the groupings are ignored.

2. Intensity of action is not scored, although intensity is included in the requirements for particular actions within a grouping. For example, a slight depression of the lip comers with slight pushing up of the lower lip is included in the sad grouping, but when those two actions are moderate or strong they are not included.

3. The timing of actions is not measured; only a frequency count is taken. EMFACS takes one-fifth the time of FACS, but of course it suffers from all of the problems already discussed in detail for selective as compared to comprehensive measurement techniques.

Izard's MAX technique is similar to Ekman and Friesen's EMFACS. It, too, groups actions presumed to be relevant to the same emotion, and makes no provision for scoring the timing or the intensity of action. Unlike FACS, it requires the scorer to examine different regions of the face separately, and admittedly, it includes in some regions changes in appearance that are due to actions in another region. By contrast, FACS and EMFACS alert the scorer to all the appearance changes resulting from. particular muscles. Rather than inspecting an arbitrary division of the face in three regions, the scorer learns where to look in the face for those changes. Izard's MAX technique was developed by collapsing some of the distinctions he had made in his earlier FMCS technique, but FMCS was itself selective, not comprehensive.

The virtue of EMFACS compared to Izard's MAX and other selective techniques is that what has been excluded is exactly specified. Work in progress by Ekman and Friesen will compare the validity of EMFACS with FACS scoring of the same videotapes of spontaneous facial actions obtained during interviews with depressed patients. This study will show how the two techniques compare in differentiating interviews at the time of admission to a mental hospital from interviews at time of discharge, in agreement with psychiatric diagnosis and in relationship to patients' self-reports of affect and mood.

9.10. Other techniques for facial measurement

EMG

A number of recent studies (see especially the work of Schwartz, Fair, Salt, Mandel, & Klerman, 1976a, 1976b) used surface EMG to measure facial activity in relation to emotion. In this procedure, quite small electrodes, about 1 cm. in diameter, are taped onto the surface of the skin, which is first prepared by a slight scraping and application of paste or solution to enhance electrical contact. Wires or leads are run from the electrodes to the recording machine. Four methodological difficulties are encountered in EMG measurement of facial activity.

First, the placement of leads on the face may itself inhibit facial activity. Movement of the head may loosen the electrodes, as may large facial muscular movements. To prevent these problems, subjects usually have been studied in isolation, or at least not when freely partaking in a conversation. Typically, subjects have been measured when trying to pose, imagine, remember, or create for themselves an emotional experience. Even in these situations, if a subject makes a large expression he will feel the tape that holds the electrode in place pull or tear. The use of surface EMG probably thus inhibits large expressions even if the experimenter does not explicitly do so by instruction or by choice of task for the subject to perform.

A second problem has to do with ambiguities about just what is being measured by surface EMG. Placing leads on the surface of the face often has the consequence, for most facial areas, of picking up activity in more than just the muscle targeted by the investigator. There is more than one muscle in most of these facial areas, and often their fibers interweave or they lie on top of each other. Although investigators using surface EMG have usually been careful to talk about a *region* rather than a muscle, their reasoning and much of their interpretation assumes success in isolating the activity of specific muscles. Ekman and Friesen, in a joint study with Schwartz (Ekman, Schwartz, & Friesen, in preparation), found that in the corrugator region the activity of many muscles other than corrugator itself was recorded by the electrode placed in this region: orbicularis oculi; levator labii superioris alaeque nasi; frontalis, pars medialis. The activity of these other muscles can be distinguished from that of corrugator, and they can be distinguished from each other, but these distinctions require more electrodes, some of which must be placed in adjacent facial regions. Another way to obtain measurement of specific muscles is to insert fine wires into a muscle, a procedure which though not as painful as it sounds, is not practicable for many studies.

The third problem – whether EMG can provide measurement of more than just one or two emotional states – is fundamental to the complexity of facial activity. Most emotions cannot be identified by the activity of a single muscle. Happiness may be the only exception, but even here evidence (Ekman et al., 1980) suggests that the differentiation of felt from simulated happiness, of controlled from uncontrolled happiness, and of slight from extreme happiness requires measurement of more than one muscle. Disgust might be measured by the activity of two muscles, and surprise by the activity of three. To measure anger, or fear, or sadness, many muscles need to be measured. There are limits, however, to the number of leads that can be placed on a person's face – limits dictated both by the necessity of monitoring so many channels of activity and by the number of wires that an investigator can paste on someone's face without being totally outrageous. The present state of surface EMG measurement is not likely to allow more than either the gross distinction between positive and negative affect or the targeting of only one or two emotions for study. (Just such findings have been reported for imagined and posed emotions.) Surface or even fine-wire EMG does not seem a method that lends itself to the study of situa-

tions in which an investigator wants to know about the occurrence of three, four, or more emotions, especially if the investigator does not wish to miss various manifestations of each emotion and blends among them. And, of course, EMG imposes the additional constraints of intrusiveness and limitations on the potential for movement.

Davidson (in press) raised a fourth problem common to studies using EMG to measure facial behavior. There is no standard system, as there is for EEG, for specifying exactly where to place an EMG electrode in order to detect activity in a particular facial region. Though investigators know roughly where each muscle is located, there is considerable latitude about exactly where to put an electrode. Without rather precise guidelines about electrode placement, research is vulnerable to error owing to unknown variations in electrode placement within and between subjects.

Consider the use of surface EMG to measure whether there is more or less activity in the zygomatic major region on the two sides of the face. Any differences obtained might not be due to the greater involvement of the right or left hemisphere but might to an unknown extent reflect differences in placement of the EMG electrode in relation to the muscle mass on the two sides of the face. Between-subjects designs, in which, for example, a measure of zygomatic major was correlated with a personality test score, would also be vulnerable to error owing to electrode placement. These problems can be circumvented by utilizing research designs in which EMG activity is compared in two or more conditions for each subject.

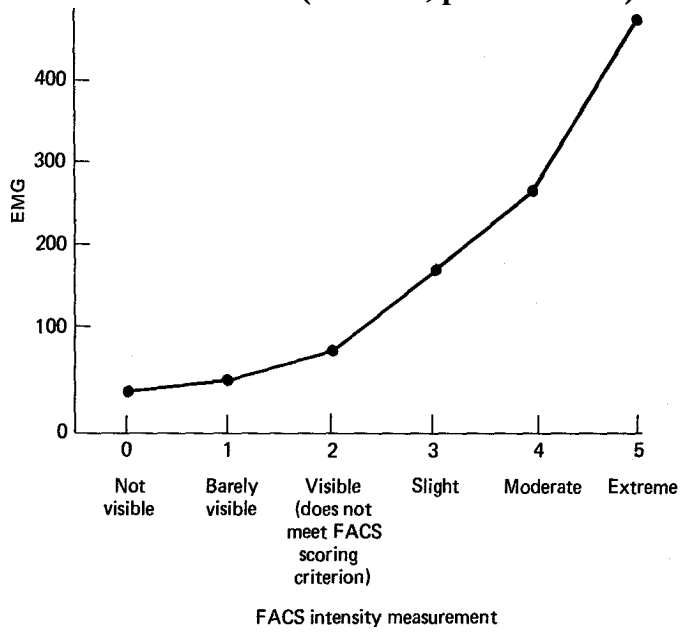
When EMG is used to measure change over time, and the leads must be placed on the face more than once, variations in placement of the leads on each occasion can introduce errors. Miller (1981-1982) has solved this problem by devising a template that can be attached to a subject repeatedly to ensure that electrode placement is identical on different occasions.

Surface EMG can play an important role in certain methodological studies of facial behavior. Mention was made earlier of Ekman and Friesen's use of fine-wire EMG to stimulate and record facial movement in order to discover how the muscles work to change appearance. Surface EMG could be used to help teach people how the muscles work as part of the process of teaching them a visual measurement procedure such as FACS. Surface EMG can also be used to calibrate and investigate measurement of visible facial behavior. As mentioned earlier, Ekman and Friesen, in joint work with Schwartz (Ekman, Schwartz, and Friesen, in preparation), verified that the intensity scoring embodied in FACS is reliably related to changes in electrical activity. Persons highly skilled in the ability to activate specific muscles (Ekman and Oster) moved specific muscles on command at different intended intensity levels, while a video record was made and surface EMG was recorded. FACS scoring was later found to be highly correlated with the EMG readings (Pearson r = 0.85). Figure 9.1 shows an example from this data, a plot of the relationship between EMG measures of electrical activity and FACS scoring of the intensity of action for a specific muscle.

The major use for surface EMG is, however, not for such methodological studies, but for measures of phenomena that are difficult or impossible to measure with techniques based on visible movements. Ekman, Schwartz, and Friesen (in preparation) were able to show that there are reliable electrical changes associated with muscle tonus changes that are not visible. For two muscles studied systematically (corrugator and frontalis, pars medialis), there were significant changes in EMG without any visible sign of activity when the performer was instructed just to think about each muscle. This study also showed that there are visible clues to muscle tension, measurable by EMG, when there is no movement. The persons measuring the faces with FACS guessed which muscle had been tensed when they could not see any movement. Sometimes the person guessing felt that there was no basis for the guess. At other times there seemed to be evidence of very slight tightening or bulging of skin. Analyses showed that when these guesses were correct – when the scorer predicted which muscle the performer was tensing, even though no movement was visible – there was a greater increase in EMG than when the guesses were incorrect.

EMG, then, may be the only method for measuring nonvisible changes in muscular tension, and for measuring changes that, while barely visible, involve not movement but bulging of the skin and would be hard to measure with any of the techniques described in Table 9.1.

Figure 9.1. Plot of relationship between FACS and EMG measurement of performances of Action Unit 1 (frontalis, pars medialis)



Measurement of contour

Lasko (1979) has recently developed a method for measuring changes in the contour of different facial features (lips) or areas (infraorbital triangle). The researcher places a grid over each film or video frame in order to measure angles and area changes precisely. The method is designed to study changes resulting from muscular tension, blood flow gravity changes, or swellings owing to other causes. The technique appears promising for study of changes in appearance that are too small and too gradual to be measured readily with the techniques designed to measure movement. There is little reliability or validity data yet available, however. Also, the technique may be quite limited in its application, because only frames in which the subject's head position is exactly the same can be compared.

Other possible measures

There are other visible changes in the face that have not been systematically measured, that is, perspiration, blushing, and blanching. Thermal changes also could be measured, but no one yet has done so systematically.

9.11. Conclusions

This chapter has reviewed measurement techniques for only one type of signal: rapid, not slow or static. Among these, only one kind of rapid signal – visible movement – has been considered. Most of the studies that have used one or another technique to measure visible movement were concerned with only one of the many messages rapid signs may convey: information about emotion. Presumably, future research will expand to consider other messages and to develop methods for measuring rapid signals other than movement, as well as the variety of slow and static signals.

A few techniques have become available recently – those of Ekman and Friesen, Ermiane and Gergerian, and Izard. The first two were designed to be applicable to the study of any message, not just emotion. The availability of these techniques should encourage many more studies of facial movement. Wedding such studies of facial sign vehicles to studies using the more traditional message judgment approach should allow discovery of the particular actions that form the basis for cor-

rect and incorrect inferences when people judge facial expression. These techniques may also allow discovery of particular facial actions that are not customarily known or even knowable by the usual observer, movements that are too subtle and/or complex to notice or interpret when seen once at real time.

If research is generated by these facial measurement techniques, then the techniques themselves may well not survive: As a larger empirical base develops, it should become possible to improve, modify, or replace the techniques now in use. The methodological issues discussed in this chapter, however, should endure as guidelines for what to consider in developing or evaluating any procedure for measuring facial movement.

Appendix. How the facial action **brow raise** *is described in each of the 14 measurement techniques*

Birdwhistell

Raised Brows

Blurton Jones

A very conspicuous movement of raising the eyebrows which can be rather difficult to judge on photographs because of the individual variations in the resting position of the brows. One or more of the following criteria could apply: a) The height of the brow above the eye corner appears to be equal or more than the width of the open eye. (Fig. 3a measure B equal or greater than A). b) Horizontal lines visible across the forehead above the brows. c) There is an enlarged area between the brow and the eyelids which is often highlighted (very pale) in photographs. d) There is a less sharp fall from the brow into the eye socket (orbit) because the brow is raised beyond the edge of the orbit which it normally covers. Therefore there is less shadow between brow and eye than usual e) The shape of the eyebrows change, becoming more curved when thye are raised (but they are not curved when the brows are slanted or oblique as well as raised).

Brow raising is presumably a result of contraction of the frontal belly of the occiptofrontalis, which can occur simultaneously with corrugator or orbicularis occuli contraction. Thus many oblique brows were also scored as raised.

Brannigan & Humphries

One or both eyebrows are raised and are held, at least briefly, in the raised position. They are not drawn in towards the midline and are not tilted.

Grant

The eyebrows are raised and stop in the raised position for an appreciable time (see plate 10A).

Flash. A quick raising and lower of eyebrows.

These two elements are very similar in use. They seem to have an attractive function, drawing the attention of the other person to the face. They are concerned with regulation and timing of speech.

Nystrom

- horizontal wrinkles

- elevated brows

(Note: These are fisted by Nystrom as separate scoring items in his technique.)

Young & Decarie

Brow raise stare:

Brow: the eyebrows are raised and held giving them a curved appearance and creating horizontal creases on the brow. There is no inward movement of the eyebrows and no vertical furrow.

Eyes: The eyes may be held wide open but not sparkling, wrinkling at the comers and forming of pouching under the eyes. Blinking may be decelerated, and the head is definitely held in its regular forward position. Visual fixation on a specific target is characteristic of this expression.

Mouth: as in normal face.

Other: as in normal face.

(Note: Young & Decarie present this as a total face score. No provision is made for scoring if the brow raise action occurs without the eye action or with some other mouth action.)

Ekman, Friesen, & Tomkins

(Note: Two photographs depict this scoring item. The authors' Facial Affect Scoring Technique contains only visual, not verbal, descriptions.)

Izard: MAX (Maximally Discriminative Facial Movement Coding System)

Code 20: The brows are raised in their normal shape. The forehead shows some thickening and the tissue under the eyebrows some thinning out as a result of the eyebrows being raised. The thickening or massing of tissue in the forehead gives way to long transverse furrows with increasing age. The nasal root is narrowed. The skin directly below the eyebrows is stretched upward.

Code 30: The eyes have a widened and roundish appearance. The furrow above the eyelashes of the upper lid may be visible. The widened, roundish appearance of the eyes is brought about mainly by the eyebrow raise of code 20 that lifts and stretches the tissue between the eyebrow and the eyelid. The upper eyelid is not raised. The artist's drawing for 20 also illustrates 30.

(Note: Izard furnishes video examples of this action in addition to the artist's drawing.)

Ekman & Friesen: FACS (Facial Action Coding System)

There is one large muscle in the forehead area which raises the eyebrows. The medial (or central) portion of this muscle (Action Unit [AU] 1) can act separately from the lateral portion of this muscle (AU 2). The photograph on the left in Figure 2-1 shows the muscular basis of AU 1 and AU 2. The photograph on the right in Figure 2-1 shows the direction in which the muscle pulls skin when it contracts. The movement of AU 1 is to pull the medial part of the brow and center of the forehead upwards. The movement of AU 2 pulls the brow and the adjacent skin in the lateral portion of the forehead upwards towards the hairline. The combination of these two actions raises the inner (Action Unit 1) and the outer comers (Action Unit 2) of the eyebrows [2] producing changes in appearance which are the product of their joint action.

Appearance Changes Due 1 + 2

(1) Pulls the entire eyebrow (medial to lateral) upwards.

(2) Produces an arched appearance to the shape of the eyebrow.

(3) Bunches the skin in the forehead so that horizontal wrinkles appear across the entire forehead. The wrinkles may not appear in infants and children.

(4) Stretches the eye cover fold so that it is more apparent.

(5) In some people (those with deeply set eyes) the stretching of the eye cover fold reveals their upper eyelid, which usually is concealed by the eye cover fold.

Compare the photograph of AU 1 + 2 with the photograph of a neutral face.

Inspect the film depiction of AU 1 + 2 How to do 1 + 2

(Note: Ekman & Friesen's technique teaches learners how to perform each action so that they can utilize their own facial actions to understand the mechanics and appearance of the face.)

This should be easy to do. Simply lift your eyebrows up, both ends as high as you can. Note the wrinkling in your forehead. In some people the wrinkling does not occur but the skin is still bunched up. In some people these wrinkles are permanently etched (see photographs 0 and Ow) but they deepen noticeably when 1 + 2 acts.

Minimum requirements for scoring 1+2

The minimum requirements listed earlier in the MANUAL for scoring AU 1 alone and those for AU 2 alone are altered significantly in this combination.

(1) Entire brow raised slightly

If you did not see the brows move it must also meet the additional requirements:

(2) *Slight* horizontal wrinkles or muscle bunching reaching across forehead. If horizontal wrinkles are evident in the neutral face, change from the neutral appearance must be *slight.*

and (3) *Slightly* more exposure of the eye cover fold than in neutral. or (4) If there is no wrinkling or bunching in the brow, but the brow raise and exposure of the eye cover fold is *marked, you* can score 1 + 2.

(Note: The extent of action required by the terms *slightly, marked, extreme,* and *maximal is* defined visually in both photographs and motion picture film examples.)

Frois-Wittmann

Brows raised.

Fulcher

Frontalis which raises the brows wrinkling the forehead transversely.

Ermiane & Gergerian

Frontalis - the eyebrow levator. Externalized emotionality.

(Raises the eyebrows).

Letting himself go to an impression. *(Note: A* few photographic illustrations show this action.)

Landis

Frontalis. This is the vertical sheet muscle of the forehead, the contraction of which produces transverse wrinkles ("the wrinkled brow").

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Chapter 10: *FACS Measurement Units Compared to Others*

A Comparison of Units for Measuring Facial Actions Visually[1]

by

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Abstract: Visual inspection and categorization of facial appearances constitute the most frequent and useful technique for measuring facial activity. The techniques developed, however, have different units with varying characteristics. In this paper, I discuss categorical and scalar units for facial measurement and show the relationship of categorical units listed by different researchers.

Techniques that enable investigators to precisely describe and quantify facial muscular actions are essential for exploring the relationships between facial behaviors and emotion, nonverbal communication, personality, neural activity, etc. A recent surge of interest in the face (e.g., Fridlund, Ekman & Oster, 1985) has fostered searches for improved measurement methods and has increased the number of such techniques. This article examines units of measurement that categorize facial behaviors based on their visual appearance. To aid detailed comparison of units, Appendixes A and B show the relationship of units of several important methods. Only methods of measuring quickly occurring facial changes, or "rapid sign vehicles" (Ekman, 1978), are considered here; I do not consider methods for assessing slower changes arising from aging or other factors (e.g., Todd, Mark, Shaw, & Pittenger, 1980).

My focus is on the units of measurement: their characteristics and correspondence across methods. More general aspects of facial measurement methods are not discussed here, in part, because Ekman (1982 – as Chapter 9 in this *Guide*) presents a thorough review. He compares 14 measurement methods on general characteristics such as theoretical rationales; methods of devising units; comprehensiveness of methods in capturing possible behaviors, timing, and intensity of expressions; adequacy of the units' descriptions; reliability; and validity. All the measurement methods translated here in Appendixes A and B are compared in Ekman's tables, to which the reader should refer for a complementary analysis.

The translation of units is based on their definitions, not empirical comparisons (this distinction is discussed in detail below). To show the background for translating units, I first examine the rationale for categorical units and their important features. Then, I discuss scalar measurement units to show that they can extend the power of categories and to complete an overview of facial measurement units. A discussion of comparing and translating categorical units follows. Finally, some examples illustrate how to use the appendixes.

1. This chapter reprints an article that appeared in Behavior Research Methods, Instruments, & Computers, 1985, 17(4), 450-468. Reprinted with permission. Thanks to Paul Ekman, Robert Levenson, Wallace V. Friesen, and anonymous reviewers for reading previous versions of this manuscript.

Visual Categorical Measurement

Most techniques that measure facial actions or expressions use a set of categories to distinguish among visible facial changes. For example, an expression in the forehead might be categorized as "raised brows" or "puzzled frown"; a movement of the lips may be categorized as action of zygomatic major or triangularis. The emphasis on visible appearances reflects the fact that much of the interest in facial expressions is related to their value as social signals, and the visual aspects of facial action are of the greatest significance in this regard. The complexity of expressive configurations and their transformations is challenging to investigators seeking alternatives to the human visual and nervous systems for categorizing facial expressions.[2]

Reliance on category scores (nominal measurement units) reflects the limitations of known quantitative continua for discriminating the diversity of facial muscular activities and patterns. Some quantitatively oriented psychologists (e.g., Nunnally, 1967) suggest that nominal units should be considered a way to identify or describe rather than to measure. Yet, in the present instance, the value of categorical versus scalar units as the basis for measurement is related more to the research question than to the mathematical properties of the measurements. Many of the important aspects of facial behavior seem to be represented best by qualitative differences that can be detected visually. The need for quantitative or scalar measurement units becomes apparent, however, as new questions arise about the relation of facial expression to neural action (Hager & Ekman, 1985), emotional feelings (Schwartz, Ahern, & Brown, 1979; Ekman, Friesen, & Ancoli, 1980), and other phenomena. For these issues, the visual and social aspects of expression become less important, and more subtle gradations in actions of targeted facial muscles become more important.

Despite the need for improved scalar measurement units, categorical units represent what happens qualitatively in the face, and these distinctions are often crucial precursors to quantifying how much happens. Although categorical units do not express any quantity of an attribute (except binary presence or absence), frequency counts, rates, and durations of category scores provide the basis for quantitative analysis. The ideas behind the mathematics of sets have proved useful to investigators who have grouped nominal units into subsets which reflect various types of behaviors. For example, Ekman (1979) discusses distinctions among brow movements. He notes that brow raises in response to feeling sad, fear, and surprise, can be distinguished from anger brows, which are lowered. However, distinguishing among sad, surprise, and fear brow raises requires units that can identify different brow raises. Ekman examines the intersection of these subsets. Anger, fear, and sad brows, but not surprise brows, may include action of corrugator. Fear and surprise brows, but not sad and anger brows, may include action of the lateral frontalis. Other mathematical approaches also can extend the value of category scores. Applying time-series analysis to category scores, Gottman (1981) shows how sophisticated data analysis can detect relations among behaviors over time.

Category scores are refinements of more informal ways for categorizing facial behaviors, such as Darwin's (1872) and Tomkins's (1962) descriptive classifications of emotional expressions. These authors, by careful observation and inference, were able to specify the essential differences in facial appearance that distinguish emotions. They used drawings, photographs, and verbal descriptions to convey these appearances, but did not create a systematic method for analyzing how an observed expression could be matched to one of these categories.

Categorical measurement is different from using the informal judgments of naive observers to assess facial signals and appearances (e.g., Tomkins & McCarter, 1964). Unlike such observers' judgments of the meanings of expressions, facial measurement techniques attempt to specify what the face does rather than what meanings observers infer from it (see Ekman, Friesen, & Ellsworth, 1982, and Ekman, 1982, for a discussion of facial measurement versus message judgment approaches). For their application, measurement units require standard rules rather than idiosyncratic decisions of judges.

2. Although this discussion emphasizes visual scoring by a trained observer, recent advances in computer simulations suggest that it may be possible to score facial movements automatically by computer, substituting pattern recognition intelligence for human vision. As a first step, some computer scientists have been able to create artificial faces and simulate muscular action in them (Parke, 1975; Platt & Badler, 1981). While computer scoring might be more automatic and objective, the human visual system and brain will probably remain a superior alternative for the foreseable future. Computer recognition might be employed initially when only a limited range of specific behaviors needs to be measured.

All the methods discussed here are measurement techniques, not judgment approaches. (For an analysis of judgment studies, see Ekman et al., 1982 and Rosenthal, 1982.)

To create categorical units, the researcher must choose whether to define measurement units by simple, elementary movements or by larger gestalts. This decision leads to variation in the "size" of units (i.e., the number of activities included in units). Size of units varies within a technique as well as between different techniques, but methods that attempt to measure elementary units generally use smaller units than methods that catalog observed behaviors. For example, Young and DeCarie's (1977) units classify the face as a whole. Ekman, Friesen, and Tomkins (1971) separately classify each of three areas of the face. Ekman and Friesen (1978) classify appearances produced by individual muscular actions.

The meaning of units is related to their size. Many units that are gestalts were constructed on the basis of the meaning the author attributed to them, such as shifty eyes, weeping, aggressive frown, sneer, and pout (see Appendix B). Izard, Dougherty, and Hembree's Affex (1983) is based entirely on inferential units. In this technique, observers make inferences about the emotional meanings of expressions rather than categorize the specific actions involved in the expression. Ekman (1982) discusses the problematic nature of scores that are based on inference, including the possibility of biasing scorers, the multiple or ambiguous meanings of single muscular actions, and the lack of comprehensive coverage of possible actions (especially for nonemotional messages).

Elementary units, in contrast to gestalts, are often based on anatomical or visual distinctions rather than meaning. To fit into these elementary units, facial expressions composed of multiple muscular actions are typically broken down into their components by scorers. One problem with elementary units is that, after being scored, they need to be reconfigured into a representation of the original expression, and then meaning is assigned to the reconfigured scores. This reconfiguration may depend upon the category, timing, and intensity of the units measured. Another problem with elementary units is that scoring all the possible facial actions may be too detailed for an investigator's purpose, such as the need to measure only actions relevant to emotion. Ekman and Friesen (1978) are the only investigators who have systematically addressed these problems.

Friesen and Ekman (1984) created EMFACS to solve the problems of configuring elementary units into events and assigning meaning to these configurations. EMFACS is a guide for scoring only those units in Ekman and Friesen's (1976, 1978) Facial Action Coding System (FACS) that are thought to be relevant to emotion. Using EMFACS, the scorer focuses on critical actions that Friesen and Ekman determined, on theoretical and empirical grounds, to be involved in emotional expressions (see Table 1). Other actions occurring with the critical actions are also scored if they meet explicit criteria for timing and intensity. With the help of these rules, the coder decides what actions in the stream of behavior belong together and constitute a single event. Later, a "dictionary" is used to look up the combinations scored as an event and to determine how the event should be interpreted. There are currently several thousands of combinations possible in the dictionary, too many to count accurately.

The rationale for visual, categorical units for facial measurement has been reviewed. Units are *visual* because facial expressions are an important visual signal system and because the human visual system is the best way to analyze these complex signals. They are *categorical* because assignment of facial expressions to categories is the best way to describe and represent many aspects of facial behavior and because categorization is the precursor to quantification and scalar units. One important characteristic of measurement units is the use of explicit, formal rules for their assignment, in contrast to the use of informal judgments of untrained observers. When considering the relationship between different units, the sizes and bases of the units are useful distinctions. Two important bases for units are the muscular actions that produce the expression and the investigator’s inferred meaning of the expression.

Table 1: Key Facial Behaviors for Measuring Emotion

Emotions	Friesen &Ekman (1984) EMFACS	Izard (1979) MAX	Ermiane & Gergerian, (1978) HANEST*	Hjortsjo (1969)
Happy	12	38+52	6 Lps	11
	6+12		7 Pret	12
	7+12		9 Wink	13
			18 Zygmaj	14
			19 Bucc	
Sadness,	1 or 1+4	23+33	10 Orb	1
Distress	15	33	11 Pres	4
	6+15	38	17 Zygmin	15
	11+17	23+56	23 Tri	17
	11+15	38+56		20+21
Fear	1+2+4	22+53	1 Fron	1+2
	20	22+31+53	3 Corsup	4
		31	6 Lps	18+19
		53	10 Orb	22
			11 Pres	
			13 Cnaris	
			17 Zygmin	
			21 Plat	
			23 Tri	
			27 Ment	
Anger,	4+5	25+54 or 55	3 Corsup	2
Rage	4+7	25 +32+54 or 55	6 Lps	3
	4+5+7	32+54 or 55	9 Wink	5
	17+24		10 Orb	15
	23		13 Cnaris	16
			14 Dsepti	17
			15 Levlasupan	20+21
			16 Levlasup	23
			21 Plat	
			22 Cani	
			23 Tri	
			25 Ooris	
			27 Ment	
Surprise	1+2+5(low)	50	1 Fron	1+2
	1+2+26	20+30+50	2 Extfr	18+19
	1+2+5(low)+26		6 Lps	22

Table 1: Key Facial Behaviors for Measuring Emotion

Emotions	Friesen &Ekman (1984) EMFACS	Izard (1979) MAX	Ermiane & Gergerian, (1978) HANEST*	Hjortsjo (1969)
Disgust	9	25+33	not specified	1+2
	10 (only)	38+59B+63		3
		63+66 (only)		5
				6+7
				8
				9
				10
				16
				17
				18+19
				22+23

NOTE: This table is not to be used to interpret the emotional meanings of facial expression (see text). The key behaviors for identifying each emotion are listed from three emotion classification systems. To determine the muscular basis of units listed, see Appendixes A and B.
* Only Ermiane and Gergerian's "Basic Components" for the five emotions are listed. These authors list other "Auxilliary Components", gaze directions, jaw and head positions.

Scalar measurement

Scalar units are the next step beyond categorization in the quantification of facial actions. The most common scalar units for visually measuring appearances are ordinal and typically supplement specific categorical units. In this case, categorical units describe what activity occurs; scalar units describe how much occurs. For example, in early attempts to measure facial behavior (e.g., Landis, 1924; Thompson, 1941), the involvement of each possible categorical unit was rated on a three point scale, from extreme to no involvement. This approach is improved in later measurement techniques, such as Ekman and Friesen's (1978) FACS with its optional intensity scoring. In FACS the type of behavior is determined prior to and independent of intensity scoring, rather than simultaneous judgments being made of both the category of movement and its intensity. This procedure separates the categorization from the assessment of the extent to which that category occurs. Also, this intensity scoring is guided by explicit rules rather than whatever implicit, preconceived standards the scorer may have, as in the case of Landis's intensity scoring.

Some authors invented ordinal units that were unattached to specific nominal units. For example, Landis (1924) and Fulcher (1942) devised units that expressed the degree of total facial activity, but the units were merely the crude, subjective ratings of observers. In general, such global indexes of facial expressiveness have not proved informative, perhaps because facial activity is controlled by too many different factors.

A higher level of measurement than an ordinal scale can be obtained by measuring physical displacement of particular landmarks. Again, Landis (1924) was among the first to attempt such an approach. He thought that, by highlighting landmarks on subjects' faces with charcoal, he could physically and objectively measure their changes in position. Landis failed because changes in the subject's head orientation between baseline and expression conditions altered apparent facial proportions on the film record and made comparison difficult. Wolff, Smith, and Murray (1934) attempted to trace projections of photographic images and physically measure changes in landmarks, but they found that their procedure was too time consuming to employ. Nevertheless, this approach achieved some degree of success in later applications. Lynn (1940) held the subject's head relatively immobile while eliciting smiles and filming them. By identifying landmarks on a

projection of the image, he was able to measure position changes in millimeters over fractions of seconds and to devise a ratio of these changes to indicate asymmetries between the two sides of the face. Shor (1978) marked subjects' faces with tabs of adhesive tape and photographed them both before and while they posed smiles with their heads held relatively stationary. From the photographs, he measured changes in the positions of the tabs. Measuring movements of landmarks might provide a more precise measure of the intensity of specific muscular actions than a scorer's unaided judgment, if such movement has a linear correspondence to the action, but no research has been done on this issue.

Rubenstein (1969) measured the area of facial profiles as an index of facial activity. A camera rapidly revolving around the head photographed a series of profiles before and while subjects smiled for the camera. The area of each profile was calculated, and the difference between the before- and during-smiling profiles became a measure of "facial displacement." Although facial displacement changed with smiling, the ability of this method to detect and discriminate different facial actions and the method's correspondence with categorical units is unknown.

Lasko (cited by Ekman, 1982) measured curvature of certain facial areas by superimposing a grid over successive frames of film records and recording landmark changes. These changes were entered into mathematical equations that calculated the changes in the curvature of soft tissues with movement. Although both Lasko's and Rubenstein's techniques employ novel units of interval scale or better levels of measurement, the relation of their units to other units is unexplored.

Electromyography (EMG) is a non-visual method of measuring facial activity. Several research groups have measured muscle potential changes using surface electrodes (e.g., see Fridlund & Izard, 1983). The muscular activity detected by surface electrodes is not limited to the muscle over which the electrode is placed, making exact measurement of an active muscle difficult. Needle electrodes can measure the activity of muscle fibers more precisely than surface electrodes, but are not as convenient (Moritani & DeVries, 1978; Sumitsuji, Matsumoto, & Kaneko, 1965). Although EMG measurements are related to the activity of muscles, the relation between EMG and visible appearances is not known precisely. Several authors have critically analyzed the relation between visible measurement and EMG (Fridlund & Izard, 1983; Ekman, 1982; Hager & Ekman, 1983).

I do not attempt in this paper to translate the scalar units described in this section. Comparison of the three to five point scales indicating how much of a nominal unit is present is not very informative. Units of different physical parameters (e.g., distance, speed, electrical potential, area) cannot be translated without empirical studies. For example, a unit of area cannot easily be translated into a unit of electrical potential. It is, however, possible to investigate relationships between measurements made by different techniques. Ekman and Schwartz (Ekman, 1982) showed that EMG measurement of electrical potential generally correlated with FACS visible intensity scoring, but they did not try to calculate how many microvolts equal each FACS intensity score. Their study supports the validity of both measurement methods and highlights the need for a more comprehensive investigation of their correspondence. In general, the weaknesses of scalar measurements have centered around the failure to establish a correspondence between the scales and visible categorical scoring units.

Method of Comparing Visual Categorical Units

Approaches to Comparing Units

In Appendixes A and B, I compare and translate categorical units from 12 different facial measurement techniques. This translation is based on authors' own definitions of their units. Authors convey their definitions in various ways, including use of names, verbal depictions, symbols, drawings, photographs, film, and video. These definitions were compared to determine the theoretical correspondence of units from different techniques. The appendixes compare each author's conceptualization of how to unitize facial behaviors into categories; they do not compare how coders actually assign scores to real behaviors.

Comparing the ways coders assign actual scores would require an empirically based study. For example, reference facial behaviors might be scored independently by the different techniques, and the resulting scores compared. There are

many obstacles to such an empirical comparison. First, different investigators, preferably the respective authors of each technique, should train scorers, because a single investigator might train the coders to score a preconceived correspondence between units (i.e., an experimenter effect). Second, a different scorer for each technique would be necessary to prevent carryover effects. Finding the appropriate coders would be difficult because many of the authors listed in Appendixes A and B are dead or inactive, and poor communication between laboratories might make cooperation difficult. A third problem is the selection of the reference behaviors to score. Should elementary actions, whole face gestalts, or both be selected? Should a limited set of behaviors or a set of behaviors representing each category in each technique be selected? Some techniques were designed for still photos, others for film and video, and others for naturalistic studies in real time; which technique should be used? The fourth problem is how to equate the resulting scores. Techniques might contain no units for the behavior scored, an imperfect match, or a unit that fits the behavior exactly. How should coders' attempts to make inexact matches be accomodated? How should scores be matched when one score represents only part of a configuration and another score for the same behavior represents the whole configuration? If motion records are used, how do researchers deal with different approaches to segmenting the flow of behavior into units? Should scorers be allowed to use stopped and slowed motion or must they score in real time only? These are only some of the problems in designing a good empirical comparison.

Although an empirical comparison of categorical units would be difficult, it might be worth the effort because it answers different questions from those answered by the comparison of definitions presented here. Comparing the definitions of units shows the conceptual correspondence of units, free from the errors and problems introduced by the practical considerations of coding. This comparison can help answer these questions: whether problems or gaps exist in the author's unitization of behavior; whether the units comprehensively cover possible behaviors; and whether the technique measures behaviors that are relevant to an investigator's concepts. An empirical comparison, on the other hand, addresses questions about the convergent validity of different measurement systems and relative accuracy, sensitivity, or reliability of techniques. If the empirical study were able to overcome the obstacles noted above, an empirical comparison also might help to assess how well the conceptual comparison of definitions presented here holds up in practical applications. Other approaches to validating a comparison of definitions are discussed below.

My approach to comparing units based on definitions also faces some difficulties. This comparison relies on the quality of definitions, but quality varies across techniques. Sometimes, little more information than names and shorthand symbols of units are given (e.g., Birdwhistell, 1970; Frois-Wittmann, 1930). Other authors add short verbal descriptions of each unit (e.g., Kendon & Ex, 1969; Landis, 1924; Nystrom, 1974). The units of many techniques, however, are described in detail and illustrated with photographs (e.g., McGrew, 1972), drawings (Blurton-Jones; 1971; Brannigan & Humphries, 1972), and even film (Ekman & Friesen, 1978) or videotape segments (Izard, 1983). In making the translations of units, all the available information, such as written descriptions, pictures, and drawings have been used to determine the equivalence of units. The more information used to define units, the better the basis for comparison and the more accurate the translation.

Comparing categorical units can be difficult also because authors do not agree on what features of behaviors to include in their definitions. A unit of one technique can be a compound of more elementary components that are separate units in another technique. Similarly, some units [such as "medial brow nods" (Birdwhistell, 1970)] would be scored as a sequence of units in another technique [in this case a series of "brow lowering" (Ekman & Friesen, 1978)]. Some units incorporate temporal durations into their definitions [e.g., the "eyebrow flash" (e.g., McGrew, 1972) which is a brief "eyebrows raised" (e.g., Blurton-Jones, 1971)]. The intensity of a unit can be a part of its definition, as in many of Young and Decarie's (1977) units, or intensity can be indexed independently, as in the "optional intensity scoring" of Ekman and Friesen's FACS (1978). When intensity is a part of the definition of units, the number of units spanning the range of intensities of the same behavior may differ among techniques. For example, Blurton-Jones (1971) specified three units for the degree of lip parting, but other authors used only one (e.g., "mouth open").

Units may or may not imply a function for facial activities. For example, the same behavior might be categorized as "intension speak" (Brannigan & Humphries, 1972) that implies a language production function, or as "mouth open" (e.g., Grant, 1969) that does not. Rather than specifying only the activities of the face, units may imply a relationship to environmental objects, as do "kiss," "bite" (McGrew, 1972), "evade" (Grant, 1969), and "chew" (Brannigan & Humphries, 1972). Some units represent changes in appearance referenced either to the head or to some other standard. For example, the up and down direction of gaze may be relative either to the head (Blurton-Jones, 1971; Ekman & Friesen, 1978) or to

the ground (Brannigan & Humphries, 1972; Grant, 1969). Different appearances for the same unit are common. For example, each of Young and Decarie's (1977) whole face units have many equivalent patterns that vary in detail.

Procedure for Comparison

Given the difficulties discussed above, establishing an exact correspondence among all the units of different techniques was impossible. For the translation, one criterion was needed that could be applied to all units to establish those that correspond to each other. The muscular basis for units was chosen as this criterion because it is the only one by which all units can be compared. Using the muscular basis of units as a criterion means that some equated units differ slightly, either in subtle details of the behavior's appearance or in some other qualities of the authors' definitions of their units, such as function or duration.

The muscular basis for units was determined by "scoring" the definitions of units in terms of Ekman and Friesen's FACS. FACS was chosen because it is a commercially available measurement technique, is comprehensive in that virtually all facial muscular actions are represented, and is widely used by investigators in many laboratories. I determined the muscular basis of units from the author's written descriptions of the appearance of the behavioral units and by examining and scoring any visual representations of the units. Authors of units often did not specify the muscular basis, but when an author explicitly specified the muscles involved, my procedure was to verify that the muscular basis was correct and corresponded to FACS's definition. Behavioral units of different techniques were equated when they described the same appearance changes and had the same muscular basis. In rare cases, a genuine disagreement surfaced about what appearance is produced by a muscular action. In such cases, the units were not equated. The most widely known disagreement is Ekman and Friesen (1978) versus Hjortsjo (1969) about the appearances produced by risorius and buccinator.

Each technique was added to the tables one at a time. As a technique was added, the units were cross-checked with the units of the other techniques to verify the correspondence. In rare instances, an author clearly specified the wrong muscular basis for a behavior or stated an incorrect relation between a unit in his system and another's. The translation presented here tried to correct such mistakes.

Validity Issues

The translation of units presented here is valid for comparing units on their muscular basis, not necessarily valid for comparisons based on other aspects of definitions, such as function. There are two major considerations for assessing the validity of this translation. The first is whether I am capable of reliably "scoring" the definitions of units in terms of FACS units. Several reliability studies have consistently shown me to be a reliable FACS scorer[3]. This established expertise supports the accuracy of my translation. A more important consideration for assessing validity is whether the authors and users of these techniques agree on the accuracy of the appendixes. This evidence is difficult to obtain, but it will be easier now that the tables are available to a larger audience that can criticize and suggest further refinements. (Readers' comments will be incorporated into future revisions of the tables, which are available to anyone who sends a request.)

Whether coders actually assign units according to the translation presented here is a separate issue. How coders assign units depends upon many factors, including how well scorers are trained. Ideally, the tables reflect how coders using a particular technique should score behaviors in respect to the other techniques.

3. My FACS Final Test score was 87, indicating high reliability [on the original Ekman and Friesen test]. I have produced reliable FACS-based scores in several empirical studies including Ekman et al. (1982), Ekman, Friesen, & Ancoli (1980), Ekman, Roper, & Hager (1980), and Hager & Ekman (1985).

Selection of Techniques

The techniques that are listed in the appendixes have had the most significant influence on researchers measuring the face. Many were intended for the use of other researchers, are accessible and available for others to use, and represent a broad range of approaches to measuring facial activities.

Not all techniques that used nominal units are translated in Appendixes A and B. Appendix A translates all five anatomically based techniques listed by Ekman (1982). No other anatomical measurement method was added because the actions included or subjects studied were limited in some way, as described below. In addition to these five measurement techniques, Appendix A includes Hjortsjo's (1969) list of muscular actions involved in facial expression. Hjortsjo did not develop a measurement technique, but he studied how the activity of particular muscles was related to certain emotion expressions. His list of muscle actions is important because it helped other researchers, such as Ekman and Friesen (1976) and Ermiane and Gergerian (1978), to formulate their measurement systems. Hjortsjo's list of actions involved in emotion expressions is presented in Table 1.

Appendix B includes six of the other nine techniques compared by Ekman (1982). The method developed by Young and DeCarie (1977) is omitted because their units describe the whole face and have many variations, making it difficult to fit their categories into the table. The method of Ekman, Friesen, and Tomkins (1971) is omitted for similar reasons. Each of their units describes an area of the face (forehead, eyes and eyelids, or lower face) and is defined by pictures. This approach was replaced by FACS. Nystrom's (1974) technique is omitted because he studied only the movements of sleeping neonates. This limitation gave rise to many unique units, such as "sucking on pacifier," "blinking under shut lids," and "vomiting," and relatively fewer units applicable to an older, awake population. Izard et al.'s Affex (1983) is included in parentheses under Izard's column to indicate what MAX units are relevant to Affex units.

There are several reasons for excluding other techniques. Some were not translated because the range of behaviors they measure is too limited. For example, Washburn (1929) and Thompson (1941) measured only the components of laughing, smiling, and crying in infants; Gilmer (1933), like Nystrom (1974), cataloged only appearances of neonates; Jecker, Maccoby, and Breitrose (1965) coded only movements related to the comprehension of a lecture; Leventhal and Sharp (1965) identified only movements indicating comfort or distress. Other techniques have limited availability and/or have been used too infrequently to warrant translation (e.g., Ekman et al., 1971; Kendon & Ex, 1969; Vine, 1971; Young and Decarie, 1977, Seaford, 1976). Finally, techniques not written in English (e.g., Lersch, 1932/1971) were excluded because language barriers are an additional problem for adequate translation.

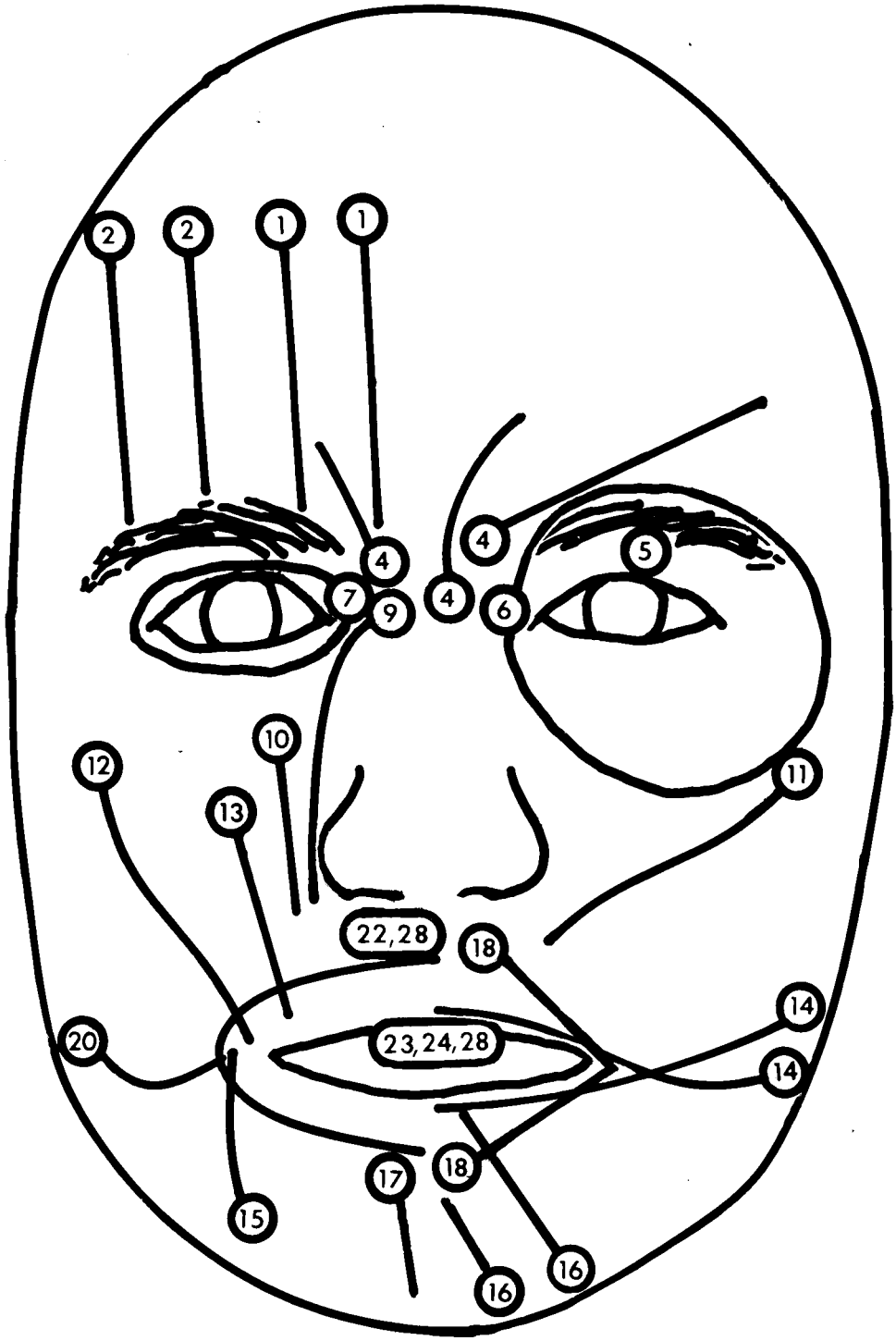
Using the Appendixes

Appendix A translates units of techniques that measure facial expressions with elementary components of behaviors. The anatomical basis for facial behaviors was one important consideration that authors used to construct these techniques. Appendix B translates units of techniques in which function or the theoretical importance of behaviors was given more weight than anatomy in deriving units. The columns of these appendixes list the units of each technique; the rows contain equivalent units.

General

In both appendixes, units are translated into the units of Ekman and Friesen's FACS, which thus serves as a "reference standard." FACS represents units as numbers to minimize scoring biases and to serve as a shorthand. Verbal descriptions of these units in numerical order are found in Appendix A along with the muscular basis. Figure 1 shows the action of most FACS units schematically. To decode the FACS numerical representations in Appendix B, the reader should consult Appendix A and Figure 1.

Figure 1. Schematic portrayal of FACS measurement units. Many Action Units in Ekman and Friesen's Facial Action Coding System (FACS) are depicted schematically. The number in the circle indicates the Action Unit. The circle represents a relatively fixed point towards which the skin is pulled along the radiating line.



Special characters in the tables facilitate comparison of units. An entry of dashes (-----) indicates that there is no unit in the technique that corresponds to the units of other techniques listed in that row. The number of these blank entries in each column can provide a rough index of the comprehensiveness of a technique (i.e., the number of different behaviors that can be scored). For example, in Appendix A, Ekman and Friesen's FACS includes the greatest number of units that describe molar activities of the face and head involving muscles besides facial muscles, such as "cheek suck," "jaw thrust," and "crosseye." Similarly, the number of blank entries in a row indicates how much disagreement among authors there is about including a unit.

A unit that was especially difficult to translate is preceded by a question mark (?) to indicate greater uncertainty that the unit represents the same behaviors as the other units in the row or whether it belongs in a row by itself. Many times, a behavior that is represented by a single unit in one technique is further subdivided or elaborated into several units in another technique.

An ampersand (&) preceding a unit indicates that the unit appears in more than one row (i.e., units in another technique attempt to make finer distinctions than are represented by this unit). By noting how many ampersands each technique has, one can assess how finely the author makes distinctions among behaviors. Sometimes, an author makes fine distinctions for particular types of behaviors that other authors do not. For example, in Appendix B, Birdwhistell's (1970) technique has many units that detail different types of head shakes and nods that other authors distinguish by only one or two units.

Appendix A

The last column in Appendix A lists the muscular basis for units; however, for some muscles, such as the extraocular and pterygoid muscles, only the general basis is indicated. Alternative names for muscles appear in parentheses. By comparing units preceded by an ampersand with the muscular basis of appearances, one can see how each technique distinguished different appearances produced by actions of the same muscle or combined the actions of more than one muscle into a single unit. For example, most techniques in Appendix A combined the actions of procerus, corrugator, and depressor supercilii into one unit representing the brows lowering together, but Hjortsjo (1969) distinguished the appearances produced by each of these different muscles. Ermiane and Gergerian (1978) distinguished the lowering from the drawing together of the brow.

Appendix A shows that different authors devised many of the same units, reflecting a general agreement about the structure of facial muscles and the appearances they produce. Disagreements arise occasionally in regard to the correspondence of fibers to units. For example, Landis (1924) and Frois-Wittmann (1930) divide the effects of orbicularis oculis into upper and lower units, but Ermiane and Gergerian (1978) and Ekman and Friesen (1978) divide the action of this muscle into inner and outer units.

Appendix A does not attempt to list the possible combinations of elementary units listed in the table. Ekman and Friesen (1978) note that combinations of units do not always produce appearances that are simple additions of the appearances of the individual units. Instead, the appearance changes that one muscle fiber produces depends complexly upon what other fibers contract with it, the intensity of these contractions, and other factors. FACS describes in the same detail as individual actions those combinations of actions that produce distinctive appearances, but most of the combinations are not listed in Appendix A. Ekman and Friesen also give explicit rules about how the individual actions can be combined, but other authors have not. Thus, although it is possible to compare individual units in Appendix A and the few combinations that authors made explicit, it is not possible to compare how the units in different techniques might be used to represent other complex patterns of behavior.

Appendix B

For convenience, Appendix B is divided into four sections: gaze direction, the eyes, and eyelids; the brow and forehead; the cheeks and mouth; and the face or head as a whole. Each unit is listed once in Appendix B even though, occassionally, a unit may represent a change in an adjacent area of the face. The units in Appendix B are translated into terms of Ekman and Friesen's FACS. Because FACS has units only for behaviors that are the result of striated muscular action, this trans-

lation was incomplete if a unit included nonmovement activity, such as "blushing" and "tears." FACS also does not include units for some purely descriptive aspects of facial appearances such as the amount of teeth showing. The FACS scoring given is the best representation, but may not be the only one possible.

Many rows of Appendix B have more than one FACS translation because the behavioral units in the row could be produced by alternative muscular actions. Multiple FACS scores in one row indicate the failure of authors to make sharp distinctions about similar appearances that are produced by different muscular actions. For example, Blurton Jones (1971) describes his "lips retracted" unit as a "lateral retraction of the mouth corners without raising the corner" and attributes these changes to various combinations of zygomatic major, risorius, and levator labii superioris. The decision to include different muscular actions in one unit can obscure possible differences in the significance of these actions (Seaford, 1976). Each of these muscular actions are indicative of different emotions (see Table 1).

Because the units in Appendix B (except for FACS) were derived, in part, from a consideration of their apparent importance or value, the appendix shows how consistently a behavior has been identified as meaningful. For example, all techniques have a category for nose wrinkling, but only one has categories for whether the upper or lower teeth show more. Apparently, nose wrinkling has been identified more often as a meaningful sign than has the extent that teeth show. When interpreting such conclusions, however, possible historical biases and the development of new research questions and measurement units should be considered as possible contributors to the relative number of units.

Although a unit in Appendix B may not have an equivalent unit in another technique, it might be possible to combine other units to equal the missing unit. Further study of the units and the rules for combining them, if any, is required to understand the full range of behaviors that can be represented by each technique. For example, Brannigan and Humphries's list (1972) contains two types of smiles that do not appear in other lists, but it is possible that their "compressed smile" could be represented by combining Grant's two categories "tight lips" and "simple smile." This problem of lack of rules for combination of units and the descriptions of appearances they produce is similar to the problem with units in Appendix A.

Example

To illustrate how Appendixes A and B can be used, consider an investigator trying to analyze facial expressions to measure emotion. Table 1 lists the key facial behaviors for identifying six emotions according to four authorities[4]. The term "key behaviors" refers to those units that must be measured to identify a particular emotion. An obvious use for the appendixes is to translate the units in Table 1 into their muscular basis or one common system of units. With this approach, the differences and agreements about key behaviors that each authority associates with a particular emotion can be assessed. Doing this, one sees many apparent differences about the key units for particular emotions, as well as considerable overlap. For example, three of the four authorities agree that action of the inner and outer frontalis plus corrugator is a key behavior for identifying fear. Ermiane and Gergerian (1978) agree about inner frontalis and corrugator but relegate action of the outer frontalis to an "auxiliary component." There is further disagreement about key behaviors in the mouth area for identifying fear. Friesen and Ekman agree with Izard that the action of risorius stretching lip corners laterally is a key. The other two authorities omit this action and add others not considered essential by the first two, indicating, instead that lateral stretching is not a key in fear.

One question our hypothetical investigator might ask is why one investigator considers a behavior as a key to emotion when it is not so identified by other authorities. Of course, there are many possible reasons for such disagreements, including different definitions of the emotion, but one possibility can be assessed by examining Appendixes A and B. Could it be that differences in determining key behaviors arise because the behaviors are not identified as scoring units by some authorities? Indeed, Izard's MAX omits several scoring units found elsewhere in Table 1 (e.g., zygomatic minor, compressor naris). The other techniques omit a few units found elsewhere (e.g., depressor septi is a separate unit only in

4. Table 1 is not to be used to interpret emotion from facial behaviors. None of the complexities and rules for identifying emotions are included in this table. Specifically, this table does not include all emotions, all combinations of units that predict emotion, the effects of intensity on predictions, blends of emotion, and felt versus simulated or controlled versus uncontrolled distinctions.

Ermiane and Gergerian's HANEST and is one of their keys for anger) or construe muscular actions differently (e.g., only HANEST scores the preseptalis, a key unit in fear for these authorities, as a separate unit). We conclude that missing scoring units for behaviors can be a contributor to disagreements over key emotion behaviors, at least for some units.

This approach of comparing the scoring units which appear in different techniques can be extended beyond Table 1 to help us understand the results of previous studies. For example, Landis (1924) elicited emotions with several different and inventive situations, but he concluded that no facial expression was typical of any one situation and that expressions could not distinguish emotions. There are many reasons why Landis could not distinguish situations by facial expression, including the possibility that more than one emotion was elicited by the same situation (see Ekman et al., 1982), but omissions of emotionally relevant scoring units is a possibility that can be checked with the appendixes. Table 1 confirms the importance of Ekman's (1979) distinctions for detecting fear, sadness, and surprise (discussed earlier) by studying the raising the inner versus outer brow in combination with drawing together and pulling down . Landis did not have separate scoring units for the inner and outer brow raises. This omission and others might have contributed to his failure to distinguish emotions.

Translating units can help to interpret previously published research. Suppose, for example, that our investigator wants to know the emotional significance of the behaviors catalogued by the ethologists in Appendix B [i.e., Blurton-Jones (1971), Brannigan and Humphries (1972), Grant (1969), McGrew (1972)]. The investigator can look up these units in Appendix B, note the FACS equivalents, and find the emotional meanings in the EMFACS dictionary (of which Table 1 is a skeleton).

Summary

The discussion of visual units for measuring facial behaviors and the translation presented here provide a necessary beginning for understanding the relationships between units of different techniques. Knowing more about the relation of coders' typical use of units to the conceptual relations specified here would provide answers to additional questions, but the necessary empirical studies are difficult. The present translation is useful for comparing the varied ways that authors of techniques conceptualize behaviors, for facilitating communications between investigators, for exploring the meanings of units of one technique in terms of others, for interpreting previous research, and for providing a basis for further refinement and clarification of this translation. Ultimately, this effort may result in a more standard and comprehensive approach to facial measurement.

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Appendix A: Elementary Components of Facial Behaviors

					Reference	
Landis (1924)	**Frois-Wittmann (1930)**	**Fulcher (1942)**	**Hjortsjo (1969)**	**Ermiane & Gergerian (1978)**	**Ekman & Friesen (1978)***	**muscular basis ****
frontalis	brow raised	frontalis	1+2 frontal muscle	-----	1+2 brow raise	frontalis
-----	-----	-----	1 medial part frontalis	1 frontalis	1 inner brow raise	" pars medialis
-----	-----	-----	2 lateral part frontalis	2 external frontalis	2 outer brow raise	" pars lateralis (pars externalis)
&corrugators	&brow frowning	-----	3 glabella depressor	&4 depressor supercilii	&4 brow lowerer	procerus (pyramidalis nasi)
&corrugators	&brow frowning	-----	5 eyebrow depressor	&4 depressor supercilii	&4 brow lowerer	depressor supercilii
&corrugators	&brow frowning	corrugator	4 eyebrow wrinkler	3 corrugator supercilii	&4 brow lowerer	corrugator supercilii
-----	-----	-----	-----	5 auricularis posterior	-----	auricularis posterior
eyes wide	upper lid raised	eyes widened	-----	6 levator palpebrae superioris	5 upper lid raise	levator palpebrae superioris
-----	-----	orbicularis oculi	6+7 sphincter muscle of the eye	-----	6 or 6+7	orbicularis oculi (O.O.)
-----	-----	-----	6 orbital part	10 orbitalis	6 cheek raise	O.O. pars orbitalis
-----	-----	-----	7 eyelid part	&9 palpebralis inferioris: winking	7 lids tight	O.O. pars palprebralis
upper orbicularis oculis	upper lid depressed	-----	-----	8 palpebralis superioris	-----	O.O. pars superioris
&lower orbicularis oculis	&lower lid wrinkled	-----	-----	&9 palpebralis inferioris: winking	-----	O.O. pars inferioris
&lower orbicu laris oculi	&lower lid wrinkled	-----	-----	11 preseptalis	-----	preseptalis
&lower orbicularis oculi	&lower lid wrinkled	-----	-----	7 pretarsalis	-----	pretarsalis
-----	-----	-----	-----	-----	8 lips toward	orbicularis oris
&quadratus labii superioris	nose wrinkled	&quadratus labii superioris	9 upper lip and nasal wing levator	15 levator labii superioris, alaque nasi	9 nose wrinkle	levator labii superioris, alaque nasi
&quadratus labii superioris	upper lip raised	&quadratus labii superioris	10 upper lip levator	16 levator labii superioris	10 upper lip raise	levator labii superioris
-----	? upper lip depressed	-----	-----	14 depressor septi	-----	depressor septi

Appendix A: Elementary Components of Facial Behaviors

					Reference	
Landis (1924)	**Frois-Wittmann (1930)**	**Fulcher (1942)**	**Hjortsjo (1969)**	**Ermiane & Gergerian (1978)**	**Ekman & Friesen (1978)***	**muscular basis ****
&zygomaticus	&corners raised	&zygomaticus	11 lesser zygomatic muscle	17 zygomaticus minor	11 nasolabial deepen	zygomatic minor
&zygomaticus	&corners raised	&zygomaticus (or lips smiling)	12 greater zygomatic muscle	18 zygomaticus major	12 lip corner pull	zygomatic major
-----	-----	-----	13 levator of the angle of the mouth	22 caninus	13 cheek puff	caninus (levator anguli oris)
-----	-----	-----	14 smiling muscle	-----	-----	risorius
-----	-----	-----	-----	19 buccinator	14 dimpler	buccinator
triangularis	corners depressed	triangularis	15 depressor of the angle of the mouth	23 triangularis	15 lip corner depress	triangularis (depressor anguli oris)
-----	lower lip depressed	-----	16 lower lip depressor	26 quadratus	16 lower lip depress	depressor (quadratus) labii inferioris
-----	lower lip raised	-----	-----	-----	-----	orbicularis oris or mentalis
mentalis	chin raised	-----	17 chin muscle	27 mentalis	17 chin raise	mentalis
-----	-----	-----	18+19 incisive muscles of the upper and lower lip	24 incisivus	18 lip pucker	incisivi labii
-----	-----	-----	-----	-----	19 tongue show	not specific***
-----	-----	-----	20+21 cheek muscle	-----	-----	buccinator
risorius	corners contracted	risorius	-----	20 risorius	20 lip stretch	risorius
-----	-----	-----	-----	21 platysma	21 neck tighten	platysma
&lips pursed or compressed	-----	lips pursed	22+23 sphincter of the mouth	25 orbicularis oris	-----	orbicularis oris
-----	upper lip protruding	-----	&22 lip part	-----	t22 lip funnel	orbicularis oris
-----	lower lip protruding	-----	&22 lip part	-----	b22 lip funnel	orbicularis oris
-----	-----	-----	23 marginal part	-----	23 lip tight	orbicularis oris
&lips pursed or compressed	-----	lips compressed	-----	-----	24 lip press	orbicularis oris
&lips open	lips open	lips just parted	-----	-----	25 lips part	not specific***

Appendix A: Elementary Components of Facial Behaviors

					Reference	
Landis (1924)	**Frois-Wittmann (1930)**	**Fulcher (1942)**	**Hjortsjo (1969)**	**Ermiane & Gergerian (1978)**	**Ekman & Friesen (1978)***	**muscular basis ** **
&lips open	-----	&jaw dropped	-----	&II-1 depression of mandible	26 jaw drop	lateral pterygoids
-----	-----	lips wide open	-----	-----	-----	not specific***
-----	-----	lips rounded	-----	-----	-----	not specific***
&lips open	-----	&jaw dropped	-----	&II-1 depression of mandible	27 mouth stretch	lateral pterygoids
-----	-----	-----	-----	II-2 elevation of the mandible	-----	masseter, medial pterygoids
-----	lips closed	-----	-----	-----	-----	not specific***
-----	teeth open	-----	-----	-----	-----	not specific***
-----	teeth closed	-----	-----	-----	-----	not specific***
-----	upper teeth exposed	-----	-----	-----	-----	not specific***
-----	lower teeth exposed	-----	-----	-----	-----	not specific***
-----	lips retracted	-----	-----	-----	28 lip suck	not specific***
-----	-----	-----	-----	II-3 protrusion of the mandible	29 jaw thrust	pterygoids
-----	-----	-----	-----	II-4 retraction of the mandible	-----	pterygoids
-----	-----	-----	-----	II-5 lateral movements of the mandible	30 jaw to sideways	pterygoids
-----	-----	jaw clenched	-----	-----	31 jaw clench	masseter
-----	-----	-----	-----	-----	32 bite	not specific***
-----	-----	-----	-----	-----	33 blow	not specific***
-----	-----	-----	-----	-----	34 puff	not specific***
-----	-----	-----	-----	-----	35 cheek suck	not specific***
-----	-----	-----	-----	-----	36 tongue bulge	tongue
-----	-----	-----	-----	-----	37 lip wipe	tongue
nasalis	nose dilated	-----	-----	12 dilator naris	38 nose dilate	dilator naris (nasalis, alar part)

Appendix A: Elementary Components of Facial Behaviors

						Reference
Landis (1924)	**Frois-Wittmann (1930)**	**Fulcher (1942)**	**Hjortsjo (1969)**	**Ermiane & Gergerian (1978)**	**Ekman & Friesen (1978)***	**muscular basis ******
-----	nose pinched	-----	8 nasal muscle	13 compressor naris	39 nostril compress	compressor naris (nasalis, transverse part) or depressor septi
-----	-----	-----	-----	-----	41 lid droop	levator palpebrae superioris
&eyes closed	-----	-----	-----	-----	42 slit	orbicularis oculi
&eyes closed	-----	-----	-----	-----	43 closed	orbicularis oculi
&eyes closed	-----	-----	-----	-----	44 squint	orbicularis oculi
-----	-----	-----	-----	-----	45 blink	orbicularis oculi
-----	-----	-----	-----	-----	46 wink	orbicularis oculi
&head movements	-----	-----	-----	&III-5 rotation	51 turn left	not specific***
&head movements	-----	-----	-----	&III-5 rotation	52 turn right	not specific***
&head movements	-----	-----	-----	III-4 backward extension	53 head up	not specific***
&head movements	-----	head down	-----	III-2 forward flexion	54 head down	not specific***
&head movements	-----	&head to the side	-----	&III-3 lateral flexion	55 tilt left	not specific***
&head movements	-----	&head to the side	-----	&III-3 lateral flexion	56 tilt right	not specific***
&head movements	-----	-----	-----	III-6 propulsion	57 forward	not specific***
&head movements	head back	-----	-----	&III-7 retropulsion	&58 back	not specific***
chin back	-----	-----	-----	&III-7 retropulsion	&58 back	not specific***
-----	&glance side	-----	-----	****	61 eye position left	extraocular
-----	&glance side	-----	-----	****	62 eye position right	extraocular
eyes up	-----	-----	-----	****	63 eye position up	extraocular
-----	glance down	eyes lowered	-----	****	64 eye position down	extraocular

Appendix A: Elementary Components of Facial Behaviors

					Reference	
Landis (1924)	**Frois-Wittmann (1930)**	**Fulcher (1942)**	**Hjortsjo (1969)**	**Ermiane & Gergerian (1978)**	**Ekman & Friesen (1978)***	**muscular basis ****
-----	-----	-----	-----	-----	walleye	extraocular
-----	-----	-----	-----	-----	crosseye	extraocular

Key to Symbols:

----- no equivalent unit

? unit may not be equivalent to others on the same line

& unit appears on more than one line

Notes

* FACS scores consist of an alphabetic prefix indicating asymmetry (G or H) and laterality (R or L), the number of the action unit, and an alphabetic suffix indicating intensity of the action. The X suffix indicates low intensity; the Y suffix, moderate intensity; the Z suffix, high intensity. The R prefix indicates actions only on the right side of the face; the L prefix, actions only on the left. In later scoring additions, the prefixes G and H indicated right and left asymmetry.

** Alternative names of muscles are given in parenthesis.

*** Various muscles and behaviors can produce the appearances indicated by this unit.

**** Ermiane and Gergerian provide a long, complex list of gaze directions, planes, and orientations.

Appendix B: Empirically Derived Units for Facial Behavior

Birdwhistell (1970)	Grant (1969)	Blurton-Jones (1971)	McGrew (1972)	Brannigan & Humphries (1971)	Izard MAX (1983)* (Affex)	-- Reference -- Ekman & Friesen FACS (1978)
			Part 1: Units for gaze, eye, and eyelids			
? focus on auditor	1. look at	-----	&look	look at	-----	head and eye positions**
-----	2. look away	-----	&look	look away	36 gaze aversion (SH)	head and eye positions**
-----	3. look directly away	-----	&look	-----	-----	head and eye positions**
-----	-----	-----	-----	-----	39 gaze cast downward with head tilt back or cocked (CS)	head and eye positions**
-----	4. look down	-----	&look	-----	-----	head and eye positions**
-----	-----	eye direction downwards	-----	-----	-----	64
-----	-----	-----	-----	look down (at self)	-----	head and eye positions**
-----	5. look up	-----	&look	look up	-----	head and eye positions**
eyes upward	-----	eye direction upwards	-----	-----	-----	63
? shifty eyes	6. look around	-----	&look	look around	-----	head and eye positions**
sideways look	-----	eye direction sideways	-----	-----	-----	61 or 62
rolled eyes	-----	-----	-----	-----	-----	61+62+63+64, etc
stare	7. stare	-----	-----	-----	-----	5 + head and eye positions**
-----	-----	-----	gaze fixate	-----	-----	head and eye positions**
-----	-----	-----	glance	-----	-----	head and eye positions**
-----	-----	face direction	-----	-----	-----	head and eye positions**
shut eyes: A-2 count B>5 count	8. eyes closed	-----	eyes closed	shut	-----	43 or 7+43
-----	-----	-----	-----	-----	37 tight closing of the eyes (DP)	6+43 or 6+7+43

Appendix B: Empirically Derived Units for Facial Behavior

Birdwhistell (1970)	Grant (1969)	Blurton-Jones (1971)	McGrew (1972)	Brannigan & Humphries (1971)	Izard MAX (1983)* (Affex)	-- Reference -- Ekman & Friesen FACS (1978)
blink	9. blink	-----	blink	blink (a series)	-----	45
wink	11. wink	-----	-----	wink	-----	46
? slitted eyes	10. narrow eyes	-----	narrow eyes	narrow eyes	&33 eyes are squinted or narrowed (IE, SD, AR, DR, CS)	7 or 6+7
full squint	-----	&contraction around the eye	-----	-----	&33	6 or 44
lateral squint	-----	&contraction around the eye	-----	-----	38 cheek raised (IE, EJ, SD, AR, DR, DP)	6
inferior lateral orbit contraction	-----	-----	-----	-----	-----	6 or 7
-----	-----	-----	-----	-----	30 eyes have a widened and roundish appearance (IE, SS)	1+2
wide eyed	12. eyes open	eye openness: wide	-----	stare	&31 eyes are widened and more white shows than normal (FT)	5Y or 5Z***
-----	-----	" " bit wide	-----	-----	& 31	5Y or 5X***
-----	-----	" " normal	-----	open	-----	-----
-----	-----	" " bit narrow	-----	-----	-----	41
-----	-----	" " very narrow	-----	-----	-----	42
-----	-----	upper lid down	-----	droop	-----	41
-----	-----	-----	-----	widen	-----	5 (rapid)
-----	13. pouch	-----	-----	pouch	-----	-----
-----	14. tears	-----	weep	tears	-----	-----
-----	61. twitch	-----	-----	twitch	-----	6 (rapid)
Part 2: Units in the Forehead and Brow Area						
raised brows	16. eyebrows raised	raised brows	-----	raise	20 brows are raised in normal shape (IE, SS)	1+2
single raised brow	-----	-----	-----	-----	21 one brow raised higher than the other (CS)	R1 or R2 or R1+R2 or L1, L2 or L1+L2****
-----	15. flash	-----	eyebrow flash	flash	-----	1+2 (rapid)

Appendix B: Empirically Derived Units for Facial Behavior

Birdwhistell (1970)	Grant (1969)	Blurton-Jones (1971)	McGrew (1972)	Brannigan & Humphries (1971)	Izard MAX (1983)* (Affex)	-- Reference -- Ekman & Friesen FACS (1978)
-----	-----	-----	wide eyes	-----	-----	1+2+5
lowered brow	-----	-----	-----	-----	-----	R4 or L4****
medial brow nods	-----	-----	-----	-----	-----	4 (a series)
-----	17. aggressive frown	strong frown	&low frown	angry frown	25 eyebrows lowered and drawn together (AR, DR, DP)	4Y or 4Z***
? medial brow contraction	18. puzzled frown	weak frown	&low frown	-----	24 eyebrows are drawn together (IE)	4X***
-----	-----	-----	-----	-----	22 brows raised part way but not maximally, and they are drawn together (FT)	1+2+4
-----	19. sad frown	&oblique brows	-----	sad frown	23 inner corners of the eyebrow are raised and pulled medially (SD)	1+4 or 1+4+6
-----	-----	&oblique brows	-----	sad raise	-----	1 or 1+4
-----	-----	general frowns	-----	-----	-----	other combinations of AU4
-----	-----	-----	pucker face	-----	-----	1+4+(6 or 44) or 1+4+9+44; may include 25, 26, 43
-----	-----	-----	-----	low frown	-----	4
glare	-----	-----	-----	-----	-----	4+5
		Part 3: Units in the Lower Face, Mouth, and Cheeks				
mouth in repose	-----	-----	-----	basic mouth	-----	-----
nose wrinkle	51. wrinkle	wrinkling the nose	nose wrinkle	screw face	42 nasal bridge is furrowed (DR)	9 or 9+25
-----	-----	-----	-----	lip up	-----	10 or R10 or L10
right sneer	40. &sneer	-----	-----	&sneer	&61 upper lip raised on one side (CS)	R9 or R10**** may include 25, 26

Appendix B: Empirically Derived Units for Facial Behavior

Birdwhistell (1970)	Grant (1969)	Blurton-Jones (1971)	McGrew (1972)	Brannigan & Humphries (1971)	Izard MAX (1983)* (Affex)	-- Reference -- Ekman & Friesen FACS (1978)
left sneer	40. &sneer	-----	-----	&sneer	&61	L9 or L10**** may include 25, 26
-----	-----	squared upper lip	-----	-----	-----	(9 or 10)+25 or 9+10+25
-----	-----	squared lower lip	bared teeth	-----	-----	16+(25 or 26) or 15+16+(25 or 26) may include 31
-----	-----	-----	-----	-----	63 lower lip is lowered and slightly forward (DR)	16+25
-----	39. intension bite	-----	-----	intension bite	-----	16+25+29
-----	-----	-----	-----	-----	54 angular, squarish mouth (AR, DP)	9+16+(25 or 26) may include 20
-----	-----	-----	-----	-----	59B opened, tense, angular mouth with tongue forward (DR)	9+16+19+26
? retreating lips	-----	-----	-----	squared mouth	-----	10+16+(25 or 26)
smile tight-loose o	20. simple smile	&mouth corners raised	&smile	&simple smile	&52 corners or angle of mouth pulled back and up (EJ)	12X or 12Y*** may include 7
-----	21. wide smile	&mouth corners raised	&smile	&simple smile	&52	12Y or 12Z*** may include 6, 7
-----	22. grin	-----	&smile	grin	-----	R12 or L12****
? toothy smile	23. upper smile	&mouth corners raised	&smile	upper smile	&52	12+(25 or 26) may include 6, 7
-----	24. lip in smile	&mouth corners raised	&smile	lip-in smile	-----	12+26+B28 or 12+26+B32****
? square smile	25. broad smile	&mouth corners raised	&smile	broad smile	&52	(6 or 7)+12+16+(25 or 26)
-----	-----	&mouth corners raised	play face	play face	-----	8+12+(26 or 27) or 12+(26 or 27)

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-----	26. open grin	-----	&smile	open grin (may be bilateral)	-----	R12+(25 or 26) L12+(25 or 26)****
-----	27. oblong smile	&mouth corners raised	&smile	oblong smile	-----	12+25+29
-----	-----	-----	-----	wry smile	-----	R12+L15 or L12+R15****
-----	-----	-----	-----	compressed smile	-----	12X+23 or 12X+24***
-----	28. mouth corners back	&lips retracted	-----	mouth corners back	-----	20 or 12+15 may be 12 or 14
-----	29. oblong mouth	&lips retracted	grin face	mouth corners out	53 slightly opened mouth with corners retracted straight back (FT)	20+(25, 26, or 27) may include 10, 16
-----	-----	-----	-----	oblong mouth	-----	20+25+29 may include 10, 16
-----	-----	-----	-----	mouth corners tremble	-----	15 or 20 or 15+20
? droopy mouth	32. mouth corners down	mouth corners lowered	-----	mouth corners down	56 corners of mouth drawn downward and outward (SD)	15 or 17 or 15+17
pout	33. lower lip out	lower lip pout	&pout	lower lip out	-----	17
-----	-----	-----	-----	scowl	-----	15+17
-----	34. lower lip tremble	-----	-----	lower lip trem-ble	-----	17 or alternating 17 and 16
-----	-----	-----	-----	-----	55 mouth open, stretched tense (AR, DP)	27 may include 9, 10, 16, or 20
-----	36. lips forward	two lip pout	&pout	lips forward	-----	17 or 22 or 17+22 or 22+25 or 17+22+25
-----	-----	-----	-----	point	-----	22
pursed lips	42. purse	contraction of orbicularis oris	-----	purse	-----	18 or 18+(23 or 24)
-----	37. small mouth	-----	-----	small mouth	65 pursed lips (IE)	18 may include 24 or 25
-----	38. tight lips	lips pressed together	-----	tight lips	-----	23 or 24

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-----	41. twist mouth	-----	-----	twist mouth	-----	G18 or H18 may include 20, 23, 24****
-----	-----	lengthening the upper lip	-----	-----	-----	8 or 22
-----	-----	lips touching	-----	-----	-----	-----
? lax mouth	-----	lips slightly apart	&mouth open	-----	-----	25
&open mouth	&44. open mouth	lips clearly apart	&mouth open	&open mouth	51 open, relaxed mouth (IE)	26
-----	-----	-----	-----	-----	50 open, round-ish or oval mouth (SS)	26 or 27 or 18+(26 or 27)
&open mouth	&44. open mouth	lips wide apart	&mouth open	&open mouth	-----	26 or 27
dropped jaw	-----	-----	-----	-----	-----	26 or 27
-----	35. lips in	lips rolled in	-----	lips in	64 lower lip (or both) rolled inward (SH)	28
&lip biting	&43. bite lip	upper lip bitten	&chew lips	&bite lip	-----	t32
&lip biting	&43. bite lip	lower lip bitten	&chew lips	&bite lip	-----	b32
slow lick-lips	&30. lick lips	-----	&lick	-----	-----	37
quick lick-lips	&30. lick lips	-----	&lick	lick	-----	37
moistening lips	-----	-----	&lick	-----	-----	37
-----	-----	tongue invisi-ble	-----	-----	-----	-----
-----	&45. tongue	tongue visible	-----	-----	-----	-----
-----	&45. tongue	tongue pushed forward	&tongue out	tongue between lips	66 tongue for-ward	19+26
-----	-----	-----	-----	-----	59A open, relaxed mouth with tongue forward (IE)	19+26
-----	46. tongue out	tongue out of mouth	&tongue out	tongue out	-----	19+(26 or 27)
tongue in cheek	-----	-----	-----	-----	-----	36
-----	-----	no teeth show	-----	-----	-----	-----
-----	-----	upper teeth show	-----	-----	-----	-----
-----	-----	lower teeth show	-----	-----	-----	-----

Appendix B: Empirically Derived Units for Facial Behavior

Birdwhistell (1970)	Grant (1969)	Blurton-Jones (1971)	McGrew (1972)	Brannigan & Humphries (1971)	Izard MAX (1983)* (Affex)	-- Reference -- Ekman & Friesen FACS (1978)
-----	-----	both show equally	-----	-----	-----	-----
-----	-----	upper teeth show more	-----	-----	-----	-----
-----	-----	lower teeth show more	-----	-----	-----	-----
-----	-----	toothgrinding	grind teeth	-----	-----	-----
clenched teeth	-----	clenched molars	-----	-----	-----	31
chin protruding	-----	clenched incisors	-----	-----	-----	29
set jaw	-----	-----	-----	-----	-----	-----
-----	-----	jaw moved sideways	-----	-----	-----	30
pinched nostrils	-----	-----	-----	-----	-----	39
bunny nose	-----	-----	-----	-----	-----	-----
curled nostril	-----	-----	-----	-----	-----	R38 or L38****
flaring nostrils	-----	-----	-----	flare	-----	38
-----	-----	indented cheeks	-----	-----	-----	35
-----	-----	puffed cheeks	-----	-----	-----	34
? blank faced	-----	-----	normal face	normal face	0	0
chewing	-----	-----	-----	chew	-----	-----
-----	31. swallow	-----	swallow	-----	-----	-----
peck	-----	-----	&kiss	&kiss	-----	-----
smack	-----	-----	&kiss	&kiss	-----	-----
whistle	-----	-----	-----	-----	-----	-----
-----	-----	-----	spit	spit	-----	-----
-----	-----	-----	-----	intension speak	-----	-----
out of the side of the mouth (left)	-----	-----	-----	-----	-----	-----
out of the side of the mouth (right)	-----	-----	-----	-----	-----	-----
-----	-----	-----	verbalize	-----	-----	-----
-----	-----	-----	vocalize	-----	-----	-----
-----	-----	-----	mouth	-----	-----	-----
-----	-----	-----	laugh	-----	-----	-----
-----	-----	-----	bite	-----	-----	-----
-----	-----	-----	blow	-----	-----	-----

Appendix B: Empirically Derived Units for Facial Behavior

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-----	47. yawn	-----	yawn	yawn	-----	27
-----	-----	-----	-----	grimace	-----	6+9+15+25 may include 43
-----	48. head forward	-----	-----	head forward	-----	57
-----	49. threat	-----	-----	threat	-----	57
-----	50. chin out	-----	-----	chin out	-----	53
-----	-----	-----	face thrust	-----	-----	53+57
-----	53. chin in	-----	chin in	chin in	-----	58
			Part 4: Units of the Whole Face and Head			
-----	52. evade	-----	-----	evade	-----	-----
cocked head (six varieties)	56. head to side	head on side	head tilt	head to side	-----	55 or 56
-----	58. jerk	-----	-----	jerk	-----	head positions**
-----	57. bob	-----	-----	bob	-----	53
-----	-----	-----	-----	hang	-----	54
-----	-----	-----	-----	level	-----	-----
-----	60. head rock	-----	-----	head rock	-----	-----
full nod up and down or down and up (six varieties)	&54. nod	-----	&head nod	&nod	-----	head positions**
half nod either up or down (six varieties)	&54. nod	-----	&head nod	&nod	-----	head positions**
small bounce at end of head nod (six varieties)	&54. nod	-----	&head nod	&nod	-----	head positions**
tense medial multiple nod (two varieties)	&54. nod	-----	&head nod	&nod	-----	head positions**
full side and back sweep (six varieties)	&55. shake	&head shake	&head shake	&shake	-----	head positions**
half sweep (six varieties)	&55. shake	&head shake	&head shake	&shake	-----	head positions**
small bounce at end of sweep (six varieties)	&55. shake	&head shake	&head shake	&shake	-----	head positions**
tense medial multiple sweep (two varieties)	&55. shake	&head shake	&head shake	&shake	-----	head positions**

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Birdwhistell (1970)	Grant (1969)	Blurton-Jones (1971)	McGrew (1972)	Brannigan & Humphries (1971)	Izard MAX (1983)* (Affex)	-- Reference -- Ekman & Friesen FACS (1978)
-----	59. head movement	-----	-----	head movement	-----	head positions**
ear wiggle	-----	-----	-----	-----	-----	-----
total scalp movement	-----	-----	-----	-----	-----	-----
temples tightened	-----	-----	-----	-----	-----	-----
-----	62. smooth face	-----	-----	smooth face	-----	-----
-----	116. blush	-----	red face	facial reddening	-----	-----
-----	117. blanch	-----	-----	blanch	-----	-----
-----	118. sweat	-----	-----	sweat	-----	-----
-----	-----	bilateral asymmetry	-----	-----	-----	R or L**** G or H

Key to Symbols:

----- no equivalent unit
? unit may not be equivalent to others on the same line
& unit appears on more than one line

Notes

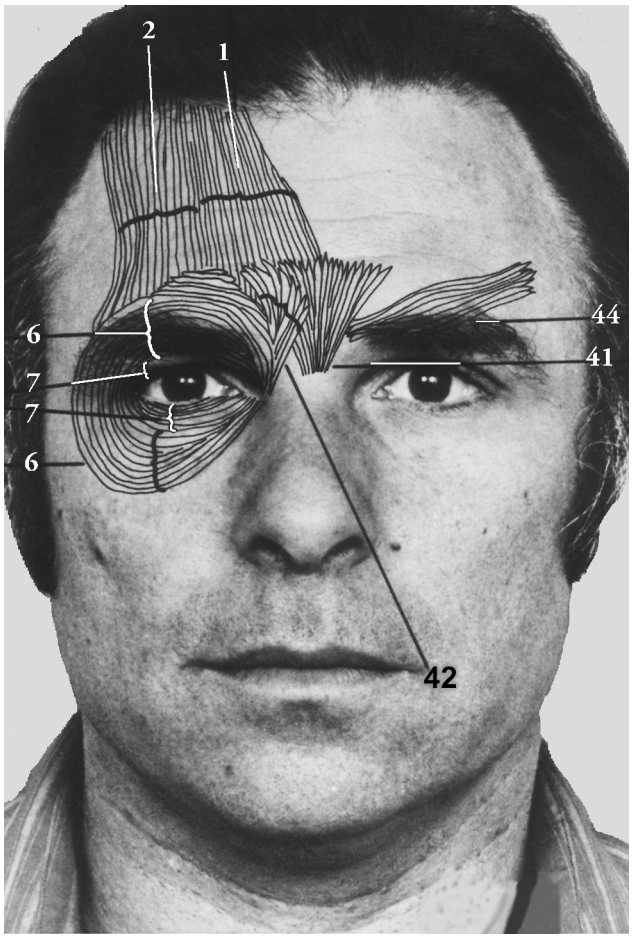
* Each unit in Izard's MAX is followed in parentheses by the affect units in his Affex technique which could be coded when these appearance changes are observed. See the text for a discussion. IE = interest; EJ = joy; SS = surprise; SD = sadness; AR = anger; DR = disgust; CS = contempt; FT = fear; SH = shame-guilt-shyness; DP = discomfort-pain.

** Head positions (units 50-59) and eye positions (units 60- 69) allow scoring many head and eye movements.

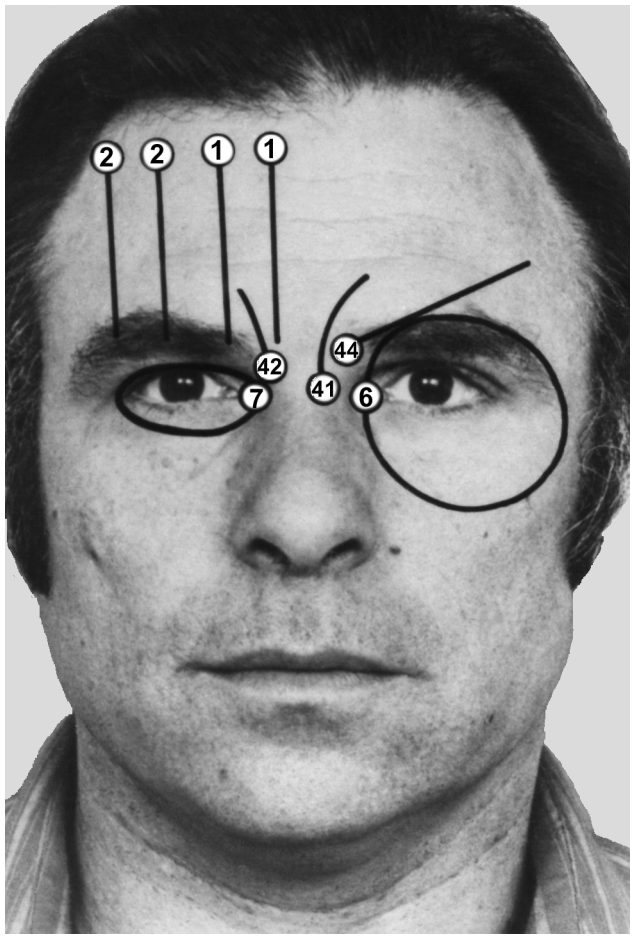
*** The X suffix indicates low intensity; the Y suffix, moderate intensity; the Z suffix, high intensity. Intensity distinctions are made in the table when relevant to definitions.

**** The R prefix indicates actions only on the right side of the face; the L prefix, actions only on the left. In later scoring additions, the prefixes G and H indicated right and left asymmetry, but asymmetry scoring is an additional step (e.g., see Hager & Ekman, 1985). B prefix indicates bottom of lip; T, top.

Chapter 11: *Scoring the Separate Strands of AU 4: AUs 41, 42, and 44*



Muscular Anatomy



Muscular Action

The FACS Manual describes the muscular basis of AU 4 as consisting of the action of three anatomically distinct muscles. AU 4 is scored when any combination of these muscle strands fires. The standard version of FACS does not make many distinctions between these separate muscles because they often fire together and are difficult to identify independently. Others have made more distinctions based on the separate actions of these muscles. Hjorstjo separately indentifies the three strands as 3 (procerus), 4 (corrugator), and 5 (depressor supercilli). Harriet Oster distinguishes action of the corrugator from procerus, which she claims is a useful distinction for infants. In this chapter, we present a tentative FACS distinction among these AUS: 41 (procerus), 42 (depressor supercilli), and 44 (corrugator).

We could not agree among ourselves about how to separate these different strands as separate AUs for inclusion in the FACS Manual, nor whether it was valuable to do so. We examined the possibility of separating actions of procerus from corrugator, depressor supercilii from corrugator, and all three strands from each other. We thought about making a distinction between drawing together of the brows with or without lowering verses brow lowering alone, without any drawing together. In fact, however, we think that each of these strands firing alone has at least a small capacity to both lower and draw the brows together. It is only by examining the most minute details of the appearance changes and the balance of drawing together versus lowering and where it occurs that distinctions can be made. The difficulties in obtaining reliability for such AUs, obtaining good reference examples of the behaviors, and the continuity with previous definitions worried us. No matter what we decided about individual AUs, the implications and rules for scoring AU combinations such as 6+41, 41+44, 9+42, etc. were daunting.

We eventually decided to retain AU 4 in the new version of FACS much as in the previous version and move the issues for separating out the strands to this ***Investigator's Guide***. We reserved the three AU numbers, 41, 42, and 44 for the three separate strands, and provide initial descriptions of the AUs, similar to those in the ***Manual***. This chapter provides the basis for FACS scoring of the separate strands of AU 4 for investigators who have an interest in doing so. We leave to these investigators the task of refining the descriptions, obtaining reliability for the scores, and establishing the connections to interesting psychological constructs. This effort illustrates the difficulties involved in establishing distinctions for many of the other AUs in FACS. The investigator who wishes to differentiate these actions will also need the best quality of video that reveals the necessary details in the mid-brow area. Without good resolution of motion cues, it would be difficult indeed to distinguish these actions.

This chapter contains descriptions for scoring each of the separate strands of AU 4. Figure 11-1 shows the separately labeled strands: AU 41 (procerus), the Glabella Lowerer; AU 42 (depressor supercilli), the Inner Eyebrow Lowerer; and AU 44 (corrugator), the Eyebrow Gatherer. Study these diagrams to understand their anatomically close relationship to each other and to other AUs.

Action Unit 41 – Glabella Lowerer

Figure 11-1 shows the muscle strand that underlies this action. AU 41pulls the skin in the glabella region down. Looking at the Muscular Anatomy illustration of Figure 11-1, you will see that the shape of this muscle is like a fan with its narrow part at the root of the nose and its unfolded part in the medial brow area above the inner parts of the eyebrows and underlying the glabella. Keep this shape in mind to better visualize the appearance changes it produces and how they differ from AUs 42 and 44.

A. Appearance Changes due to AU 41

1. Lowers skin in the glabellar region, pulling the skin of the glabella towards the root of the nose.
2. Lowers the inner corners of the eyebrows.
3. May slightly pull the inner corners of the eyebrows closer together.
4. May produce one or more horizontal wrinkles at the root of the nose, just below the glabella.
5. May produce pouching or muscle bulging in the glabellar area between the brows.

B. How to do AU 41

AU 41 is very difficult for adults to produce without adding other actions. You are a rare facial gymnast if you can pull down your glabella towards the root of your nose without doing some other action, most likely AU 44, pulling the eyebrows together and down. Contraction of the muscle underlying AU 41 can easily be recruited by AUs 4, 6, 9 and possibly 7. Try to wrinkle your nose (AU 9), gradually increasing the intensity until you see the skin of your glabella being lowered and horizontal wrinkles forming at the root of your nose. These changes indicate AU 41. You will probably also see the skin just medial to the eyebrow corners being lowered by AU 42. Try increasing the lowering of the glabella without increasing the nose wrinkling. Then try do more of the glabella lowering and less of the nose wrinkling. Alternatively, try bringing your eyebrows together only (AU 44), then lowering them by adding 41.

C. Intensity Scoring for AU 41

AU 41A

The Appearance Changes for AU 41are sufficiently present to indicate AU 41, but are insufficient to score AU 41B (e.g., a *trace* of glabella lowering).

AU 41B

1. The skin of the glabella is lowered *slightly*; if you do not see the movement, you must see pouching or muscle bulging in the glabellar region. If a puckering or muscle bulge is permanent in the neutral face, it must increase *slightly.* and
2. Slight horizontal wrinkling at the root of the nose. If a wrinkle is permanent in the neutral face, it must increase *slightly.*

AU 41C

The glabella lowering and horizontal wrinkling criteria for 41B are present and at least *marked*, but the evidence is less than that required for 3D.

AU 41D

The glabella lowering and wrinkling criteria are at least *severe*, but less than the criteria for the E level.

AU 41E

Glabella lowering is maximum and horizontal wrinkling at the root of the nose is at least *extreme*.

Action Unit 42 – Inner Eyebrow Lowerer

The Muscular Action part of Figure 11-1 shows the muscle of AU 42, which pulls the skin at the inner corners of the eyebrows down. This muscle rarely acts alone, without AU 41, 44, 6, or 9. Look at the Muscular Anatomy illustration of Figure 11-1 and you will see this muscle in the medial brow at the inner corners of the eyebrows You can also see from this illustration that the fibers of AU 42 are somewhat intermingled with those of AU 6. The fibers of AU 42 also are closely associated with the muscles of AU 9. This mingling accounts for frequent recruitment of AU 42 when AUs 6 or 9 fire. AU 42 lies over parts of the strands of AU 41 and affects some of the same skin in a similar way.

A. Appearance Changes due to AU 42

1. Lowers the inner corners of the eyebrows.
2. Lowers the skin medial to the inner corners of the eyebrows.
3. May slightly pull the inner corners of the eyebrows closer together.
4. May produce one or more horizontal or vertical wrinkles at the root of the nose, just below the glabella.
5. May lower skin in the lower part of the glabella area.
6. Flattens skin below the inner corners of the eyebrow and lateral to the root of the nose, making the root of the nose broader and flatter.
7. May produce depressions and/or muscle bulging between the eyebrows and just above the nasal root.

B. How to do AU 42

AU 42 is very difficult for adults to produce without adding other actions. You are a rare facial gymnast if you can lower the inner corners of your eyebrows without doing some other action, most likely AU 44, pulling the eyebrows together and down. Contraction of the muscle underlying AU 42 can easily be recruited by AUs 44, 6, or 9. To see AU 42, try to do AU 6 without affecting the inner parts of our eyes, then try to recruit AU 42 by very slightly wrinkling your nose. You may see the inner corners of your eyebrows and skin medial to them being lowered, flattening of skin lateral to the root of the nose. These changes indicate AU 42. Try to avoid any pulling together of the eyebrows, due to AU 44. Try producing AU 42 without the AU 6 and nose wrinkling.

C. Intensity Scoring for AU 42

AU 42A

The Appearance Changes for AU 42 are sufficiently present to indicate AU 42, but are insufficient to score AU 42B (e.g., a *trace* of lowering of the inner corners of the eyebrows and flattening of the skin below and lateral to the nasal root).

AU 42B

1. The inner corners of the eyebrows and skin at and below the inner corners is lowered *slightly*;
   and
2. *Slight* flattening of the skin below the inner corners of the eyebrows and lateral to the root of the nose. This flattening appears to broaden the root of the nose *slightly.*

AU 42C

The eyebrow corner lowering and flattening of skin lateral to the root of the nose criteria for 3B are present and at least *marked*, but the evidence is less than that required for 3D.

AU 42D

The eyebrow corner lowering and flattening of skin lateral to the root of the nose criteria are at least *severe*, but less than the criteria for the E level.

AU 42E

The eyebrow corner lowering and flattening of skin lateral to the root of the nose criteria are both at least *extreme*.

Action Unit 44 – Eyebrow Gatherer

Figure 11-1 shows the muscle strand that underlies this action.It emerges from the lateral part of the root of the nose under the glabella and runs up and laterally to attach in the forehead above the center of the eyebrow. By studying the position of this muscle, you can see how its contraction pulls the brows together and lowers the eyebrow by pulling the center of each brow towards the root of the nose. Typically this strand acts together with AUs 41 and 42, although there may be more of one strand than the other involved in any given action. Unlike AUs 41 and 42, which primarily lower the eyebrows and, in doing so, may draw them together, AU 44 (at least at lower intensities) can draw the eyebrows together without noticeably lowering them.

A. Appearance Changes due to AU 44

1. Pulls the eyebrows medially, the inner corners of the eyebrow are closer, often squeezed closer by skin in the middle of the eyebrow and above it being pulled medially.
2. May lower the eyebrow. It may be only the inner portion of the brow that is lowered or it may be both inner and central portions that are lowered, or it may be the entire brow that is lowered.
3. Can push the eye cover fold downwards and may narrow the eye opening.
4. Produces vertical wrinkles between the eyebrows, which may be deep. In some people the wrinkles between the eyebrows may not be vertical but at a 45 degree angle, or both angled and vertical. If these wrinkles are permanently etched, they will deepen.
5. May produce an oblique wrinkle or muscle bulge running from the middle of the forehead above the middle of the eyebrow down to the inner corner of the brow, or a series of these bulges like waves or ripples above the eyebrow.
6. May produce muscle bulges and pouches above the eyebrows.

The characteristic action of AU 44 is drawing the eyebrows and the skin above them medially and lowering the eyebrows from their centers, but whether appearance changes (1) and (2) or appearance changes (3) and (4) predominate may change with each instance and the person observed.

B. How to do AU 44

This movement is only slightly easier to perform independently of AU 41 and 42 than the converse. Pull your eyebrows together. This pulling together of the eyebrows may also lower them, but do not try to lower them as lowering likely involves AUs 41 and/or 42. The lowering of each eyebrow by 44 is led from its center medially. Try not to lower the skin between the eyebrows, the glabella region, which is the action of AU 41 or 42. Try not to wrinkle your nose (if your nose is wrinkling, you are doing AU 9 and probably recruiting AU 41 too). Avoid using AU 1 to hold the eyebrows up, just concentrate on slowly bringing the inner corners of the eyebrows together to form vertical wrinkles.

C. Intensity Scoring for AU 44

AU 44A

The Appearance Changes for AU 44 are sufficiently present to indicate AU 44, but are insufficient to score AU 44B (e.g., a *trace* of pulling together).

AU 44B

Eyebrows pulled together *slightly*; if you do not see the movement, you must see a wrinkle or muscle bulge between the eyebrows. If a wrinkle or muscle bulge is permanent (in the neutral face), it must increase *slightly.*
or

Central portion of eyebrow lowered *slightly,* pushing down or reducing visibility of medial portion of eyecover fold.

AU 44C

Both the eyebrows pulling together and the lowering from their centers criteria for 4B are present and at least one is *marked*, but the evidence is less than that required for 4D.

AU 44D

Both the eyebrows pulling together and the lowering from their centers criteria for 4B are present and both are at least *severe*, but less than the criteria for the E level.

AU 44E

Eyebrows pulling together and the lowering from their centers are both *maximum*.

Subtle Differences for AUs 41, 42, and 43

41 vs. 44	AUs 41 and 44 often occur together and present two main difficulties for distinguishing their action. Both can lower the inner parts of the eyebrows, but: AU 44 lowers them by pulling each brow, from its center to the inner corner, medially and downwards and can lower the lateral parts of the eyebrow as well; while AU 41 lowers them by pulling the skin of the glabella down and dragging the inner corners of the eyebrows with it, having little effect on lateral eyebrow parts. Both AUs can also move the inner corners of the eyebrows closer together, but: AU 44 squeezes the corners together by drawing the skin in from the center of the eyebrows medially; while AU 41 can bring the inner corners closer together as it pulls the skin of the glabella down, gathering it at the nasal root. The capacity of AU 41 to bring the eyebrows closer together is much less than that of AU 44. The main appearance changes of AU 44 are the drawing together of the eyebrows and skin above them and lowering them by pulling the skin down from above the eyebrows's centers to their inner corners, forming vertical wrinkles and bulges in and above the eyebrow, the inner eyebrow corners, and the glabella. The main appearance changes of AU 41 are the pulling down of the skin in the glabella towards the root of the nose and forming horizontal wrinkles at the root of the nose and bulges along the border between the glabella and the nasal root. AU 44 does not generally lower the skin of the glabella; although some skin under the inner eyebrow corners might be lowered by AU 44, it does not lower skin in the "third eye" area of the glabella. If you see the skin lowered there, score AU 41. AU 41 generally does not pull the entire eyebrows together; although the inner corners might be moved slightly closer by the skin of the glabella being gathered at the nasal root by AU 41, it does not pull the eyebrow from the center to the inner corners towards the midline to produce the vertical wrinkles described above for AU 44. If you see this pulling and vertical wrinkling, score AU 44. The wrinkling produced by AU 41 is largely horizontal, but the wrinkling produced by AU 44 is vertical.
41 vs. 42	AUs 41 and 42 often occur together and present two main difficulties for distinguishing their action. Both can lower the inner parts of the eyebrows, but: AU 41 lowers them by pulling the skin of the glabella down and dragging the inner corners of the eyebrows with it; while AU 42 lowers them by pulling skin at the inner eyebrow corners almost straight down, not affecting the skin in the center of the forehead (the “third eye” area). Both can bring the inner corners of the eyebrows closer together, but only a small amount, and this

42 vs. 44	AUs 42 and 44 often occur together and present two main difficulties for distinguishing their action. Both can lower the inner parts of the eyebrows, but: AU 44 lowers them by pulling each brow, from its center to the inner corner, medially and downwards and can lower the lateral parts of the eyebrow as well; while AU 42 lowers them by pulling skin at the inner eyebrow corners almost straight down, affecting the inner eyebrow corners and skin medial to them only, not the more lateral aspects of the eyebrow. Both can pull the eyebrows together, but: AU 44 squeezes the corners together by drawing the skin in from the center of the eyebrows medially; while AU 42 primarily pulls only the inner corners almost straight down, barely affecting the distance between the eyebrows, if at all. The main appearance changes of AU 44 are the drawing together of the eyebrows and skin above them and lowering them by pulling the skin down from above the eyebrows's centers to their inner corners, forming vertical wrinkles and bulges in and above the eyebrow, the inner eyebrow corners, and the glabella. The main appearance changes of AU 42 are the pulling down of the eyebrows's inner corners and the flattening of skin lateral to the nasal root. AU 44 produces primarily vertical wrinkles, but AU 42 may produce a deeper horizontal furrow at the root of the nose.

Video Examples for AUs 41, 42, and 44

		
none available	**none available**	
41	42	44

Chapter 12: *Suggestions About Using FACS*

This chapter briefly discusses issues we expect will arise when an investigator begins to use FACS.

1. Translating AU Scores Into Emotion Terms

Some of those using FACS will be interested in converting the AU descriptive scores into emotions. Table 10-1 lists some of the AU combinations which are associated with emotion. We consider these AU combinations to be either prototypic or major variants. We believe these are the central or most common actions for each emotion. They are the ones for which there is currently the best evidence of universality.

Excluded from Table 10-1 are dozens of minor variants for each of the emotions, AU combinations for variations in the intensity of each emotion, and AU combinations for blends of two or more emotions.

Cautions:

There are many reasons for being cautious in the use of this table.

A. Evidence

Ideally there should be various sources of evidence to demonstrate that an AU combination is a sign of an emotion. This would include cross-cultural and developmental data which showed how the occurrence of the AU combination was related to environmental circumstance, subjective experience, psychophysiological changes, other motor behavior, vocalizations, speech, and the behavior of other interactants who observe the AUs. No such complete evidence exists for any of the entries in Table 10-1. There is evidence for each entry, but it is partial. The weakest evidence is for the distinction between surprise and fear, and for the Lower Face AUs in sadness.

B. Emblems

In what we have called an emblem about an emotion (Ekman, 1973: 179-185), a person refers to an emotion by use of an AU or AU combination but does not necessarily experience the emotion any more than he would if he used a word to refer to an emotion. Some of the major variants listed in Table 10-1 may occur for such symbolic references to an emotion. We expect that the timing of the AUs is different for emblems about emotion than for actual emotional expressions, and that the prototypes are less likely than the major variants to be employed as emblems about emotion, but there is no quantitative evidence about this.

Table 10-1: Emotion predictions

EMOTION	PROTOTYPES	MAJOR VARIANTS
Surprise	1+2+5B+26 1+2+5B+27	1+2+5B 1+2+26 1+2+27 5B+26 5B+27
Fear	1 +2+4+5*+20*+25, 26, or 27 1+2+4+5*+25, 26, or 27	1+2+4+5*+L or R20*+25, 26, or 27 1+2+4+5* 1+2+5Z, with or without 25, 26, 27 5*+20* with or without 25, 26, 27
Happy	6+12* 12C/D	
Sadness	1+4+11+15B with or without 54+64 1+4+15* with or without 54+64 6+15* with or without 54+64	1+4+11 with or without 54+64 1+4+15B with or without 54+64 1+4+15B+17 with or without 54+64 11+15B with or without 54+64 11+17
	25 or 26 may occur with all prototypes or major variants	
Disgust	9 9+16+15, 26 9+17 10* 10*+16+25, 26 10+17	
Anger	4+5*+7+10*+22+23+25,26 4+5*+7+l0*+23+25,26 4+5*+7+23+25, 26 4+5*+7+17+23 4+5*+7+17+24 4+5*+7+23 4+5*+7+24	Any of the prototypes without any one of the following AUs: 4, 5, 7, or 10.

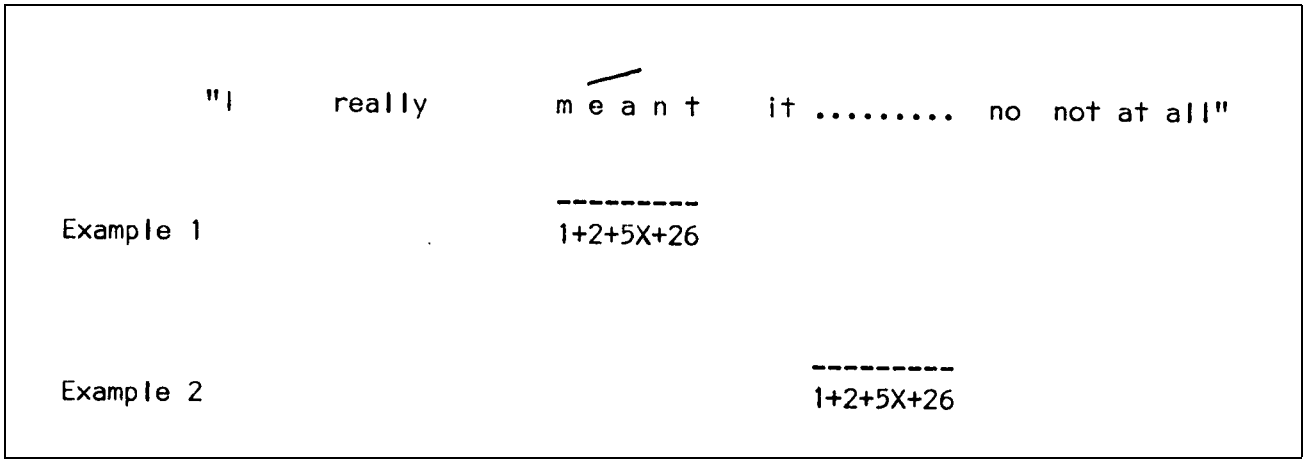
Table note: * means in this combination the AU may be at any level of intensity.

C. Conversational Signals

Certain AUs and AU combinations are used as conversational signals directly tied to speech rhythm or content and may be confused with emotional expressions. The combination 1+2 (sometimes with 5) and AU 4 are the most frequent conversational signals we have observed, functioning as emphasis marks, question marks, exclamations, inquiries, requests for clarifications, signs that a reply is being sought, etc. Additionally, almost any AU or AU combination (including others listed in Table 10-1) may be used as such a conversational signal by a particular person.

Figure 10-1 shows two examples of AU combinations which might be either emotional expressions or conversational signals. In Example 1 the combination 1+2+5B+26 coincides with the word "meant," which is the word within that clause which receives the primary voice stress. Because of the coincidence of facial action with vocal emphasis, it is likely that this AU combination is serving an emphasis function rather than indicating the occurrence of surprise. It would be more clear-cut if the action was just a 1+2 or just a 5 rather than the combination. In Example 2, it is more likely that this is a surprise reaction, since it occurred in a pause. This interpretation would be strengthened if the other interactant did something unexpected immediately before the occurrence of the 1+2+5B+26.

Figure 10-1



Also, relevant to the determination of whether an action is a conversational signal or an emotional expression is the timing of the action (onset, how long held and offset) and the sequence of actions within the combinations. We are currently studying these issues; preliminary findings are discussed in Ekman (1978)

D. Disagreements About What is an Emotion

There is disagreement among theorists about whether the information conveyed by certain AUs or AU combinations has to do with emotion. Examples are: AU 14 (unilateral or bilateral) and an unilateral AU 10 are both signs of contempt; AU combination 1+2+10+15+17+41 is a sign of disbelief or skepticism.

E. Masks

The most common mask, an AU used to conceal an emotional expression, is AU 12. we have hypothesized (Ekman & Friesen, 1975, Ch. 12) how masks and other deceptive facial actions differ from actual emotional expressions, but so far the only evidence we have is based on qualitative observations.

2. Options in Scoring Location of an AU in Time

The Manual teaches description – how to determine which AUs were responsible for a particular facial movement. It does not describe the options for locating the movement in time and measuring various aspects of the timing of any movement. Let us define a few terms which refer to different phases in the appearance of an AU:

Onset: the first frame (film) or field (video) when the AU was at all visible.

Offset: the last frame/field when the AU was at all visible.

Apex: the period during which the movement was held at the highest intensity that it reached.

The following time measures could be obtained by locating the AU in the stream of behavior:

a. Onset point.

b. Onset duration – from onset to start of apex.

c. Acceleration or slope of change in onset period.

d. Apex duration.

e. Offset duration – from end of apex to offset.

f. Deceleration or slope of change in offset period.

g. Offset point.

To measure all of these features would be very time consuming. We will consider four options, starting with gross location of the AU in time, ending with an option which considers most of the features just listed.

Option A is the simplest scoring shown in Figure 10-2. The investigator roughly locates the period during which the AU occurred. He does not bother to determine the precise onset nor the precise offset of the AU. Option A may be employed when the investigator only wants to know if an AU coincided with another event, or if one type of AU occurred more than another, or if there was a change in the frequency of certain AUs in two different samples. Examples of research questions for which option A might be appropriate are:

- Does the person show evidence of disgust (AUs listed in Table 10-1) whenever talking about sexual experience? The precise onset, duration and offset is not required, only location within periods of speech where sexuality is discussed.
- Did the type A person show more digust AUs than the type B person?

For option A in Figure 10-2, we have employed a single dash to indicate the rough location of the AU, preceded and followed by a question mark to note that the precise onset, offset, and apex are not known.

The precise onset and offset of the AU is determined in the scoring shown in option B. Duration of the AU is now available, which is not obtained in option A. Also, option B allows much more precise determination of whether an AU coincides with another event. For example, with option B, it is possible to determine whether an AU coincides with a particular word, or part of a word, or momentary change in loudness, etc. Also, the sequence or occurrence and coordination of multiple AUs can be more readily studied.

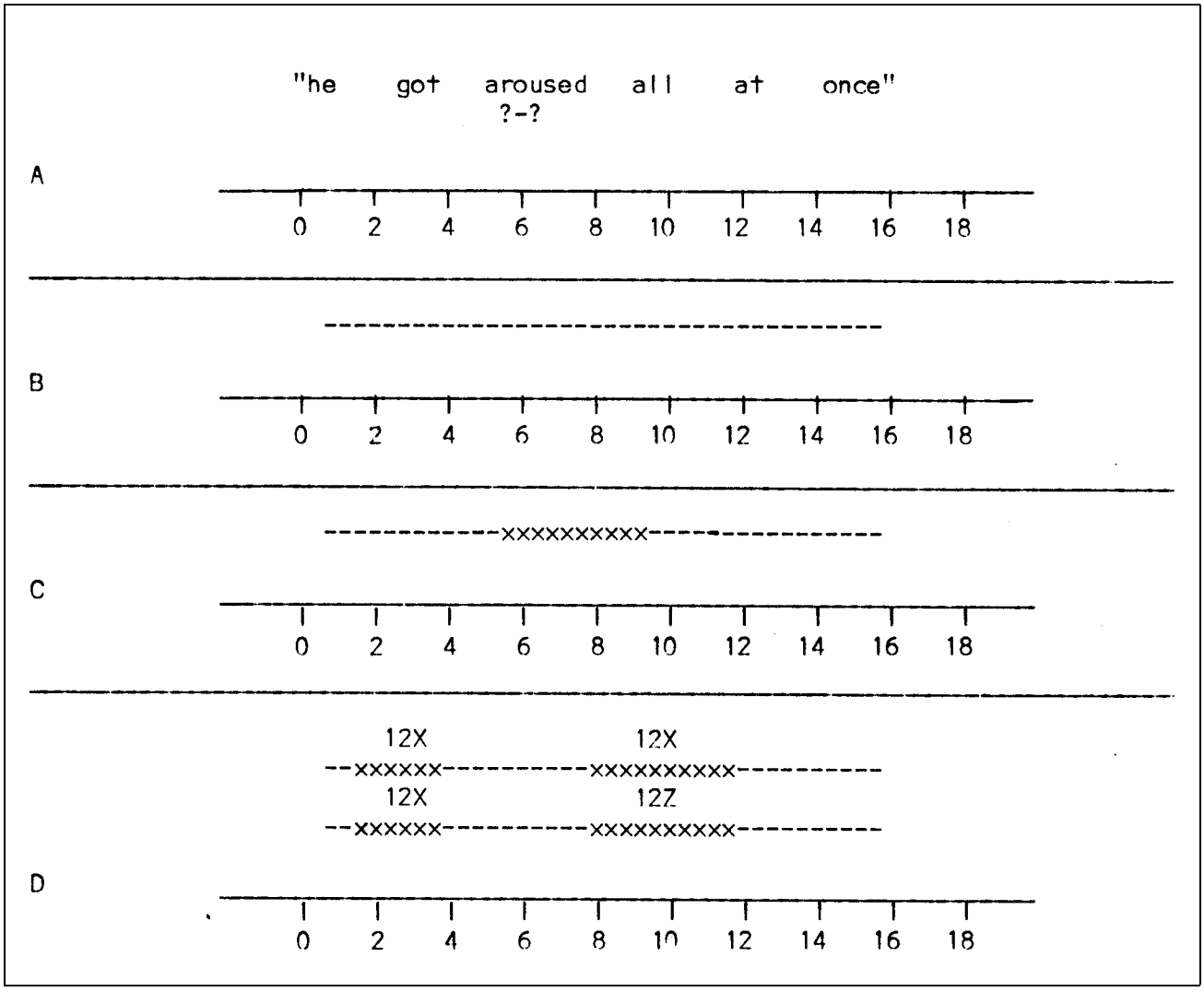
We have defined the precise onset point as the first film frame or videofield where the action can be seen to begin, i.e., the first trace of an AU. The procedure followed in scoring onset is to work back in time from a point where the AU clearly is present until one reaches the point where there is no longer any trace of the AU. Going back and forth in slowed motion and real time is usually necessary to confirm the onset point. A similar routine is followed for locating the offset point. It is the last frame at which there is any visible trace of the AU.

Option C adds a further piece of information about location by differentiating the apex. The duration of an apex may vary considerably, from as little as 1/60th of a second to several seconds. This depends, in part, on the AU or combination that occurs, and also is a function of the meaning or usage of the AU in context.

We believe that the precise measurement of a movement's apex will prove to be useful methodologically and relevant to some substantive questions. We expect to find better reliability for the determination of the apex than for the onset and offset. In relating an AU to another event (such as hand movement, voice change, other interactants' behavior), the apex may be just as relevant as the onset.

An investigator may also choose to perform apex scoring because he needs to do so in order to focus on onset time (how long it takes a movement to reach apex) or offset time (how long it takes for a movement to decay). For example, we have hypothesized that false smiles will differ from genuine smiles in the length of the time from onset to apex of AU 12.

Figure 10-2



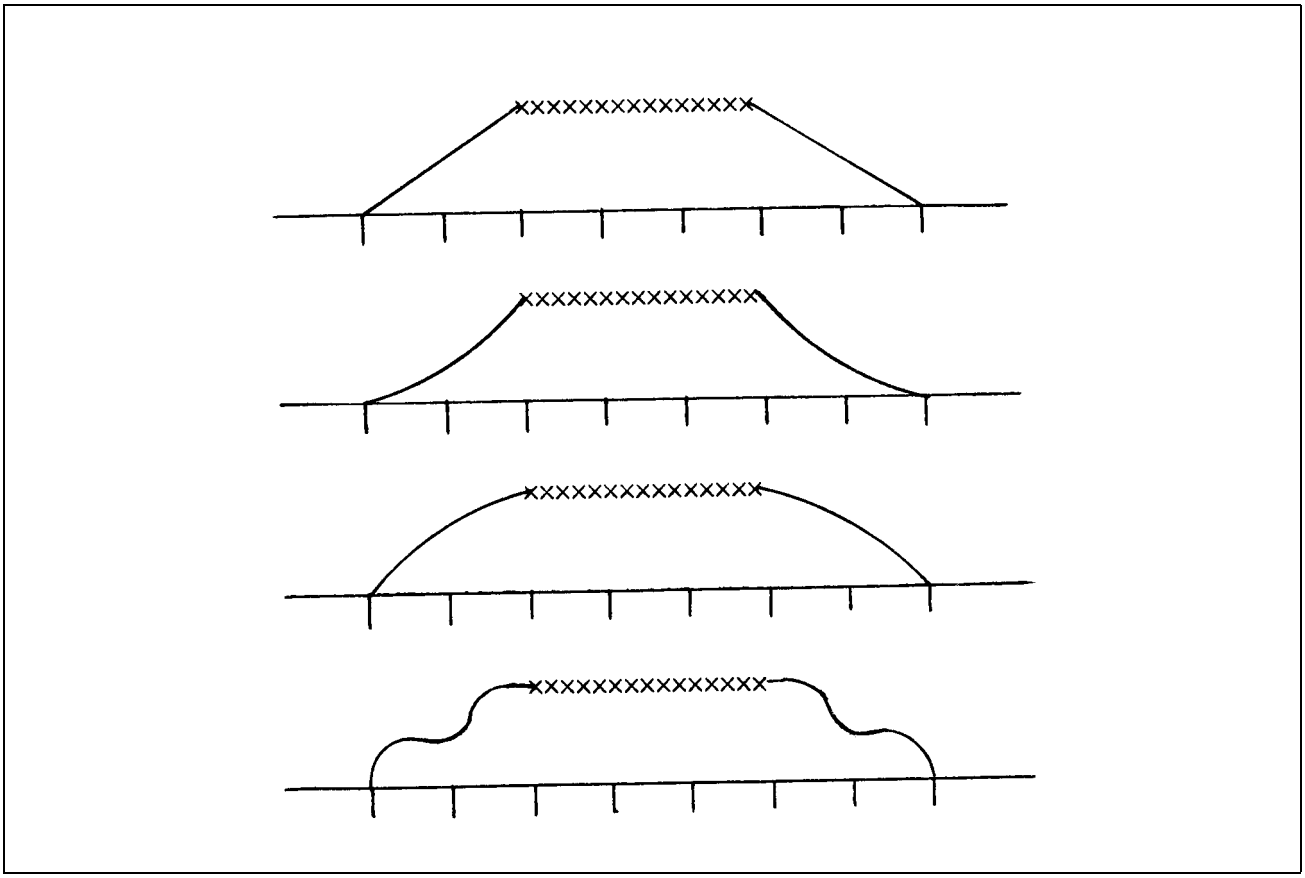
A complication may arise when there is more than one apex for an AU. Example 1 of option D shows an action which had two apexes with an intermediate period when the AU did not totally vanish, although it may have dropped below the B intensity level. Note that in this example we have indicated that each apex was at the same intensity level. In D2 the first apex is at a lower level of intensity than the second apex.

If option D is followed, the investigator may need to score intensity for all of the AUs. As an alternative to scoring each apex within an action, the investigator may choose instead to simply note that during a particular AU the apex included variations in intensity. We have added the prefix P to an AU to note that the apex pulsated and was not held constant.

We have been trying option D scoring and do not have either empirical evidence nor any hunches about whether it is worth the effort. In the samples of conversation between adults we have been scoring, we have noted that pulsating (multiple apex) occurs for only some AUs, and is shown frequently by only some people.

Even option D location scoring ignores measurable information. We have represented the onset time in Figure 10-2 by a broken line because there is no information about the slope or acceleration of the action from the onset point to the point where apex begins. The same is true for the offset time. Such measurement might be important for certain questions but we have not yet attempted to do such work. Figure 10-3 illustrates some of the variations in onset time which we have observed.

Figure 10-3



3. Delineating Events[1]

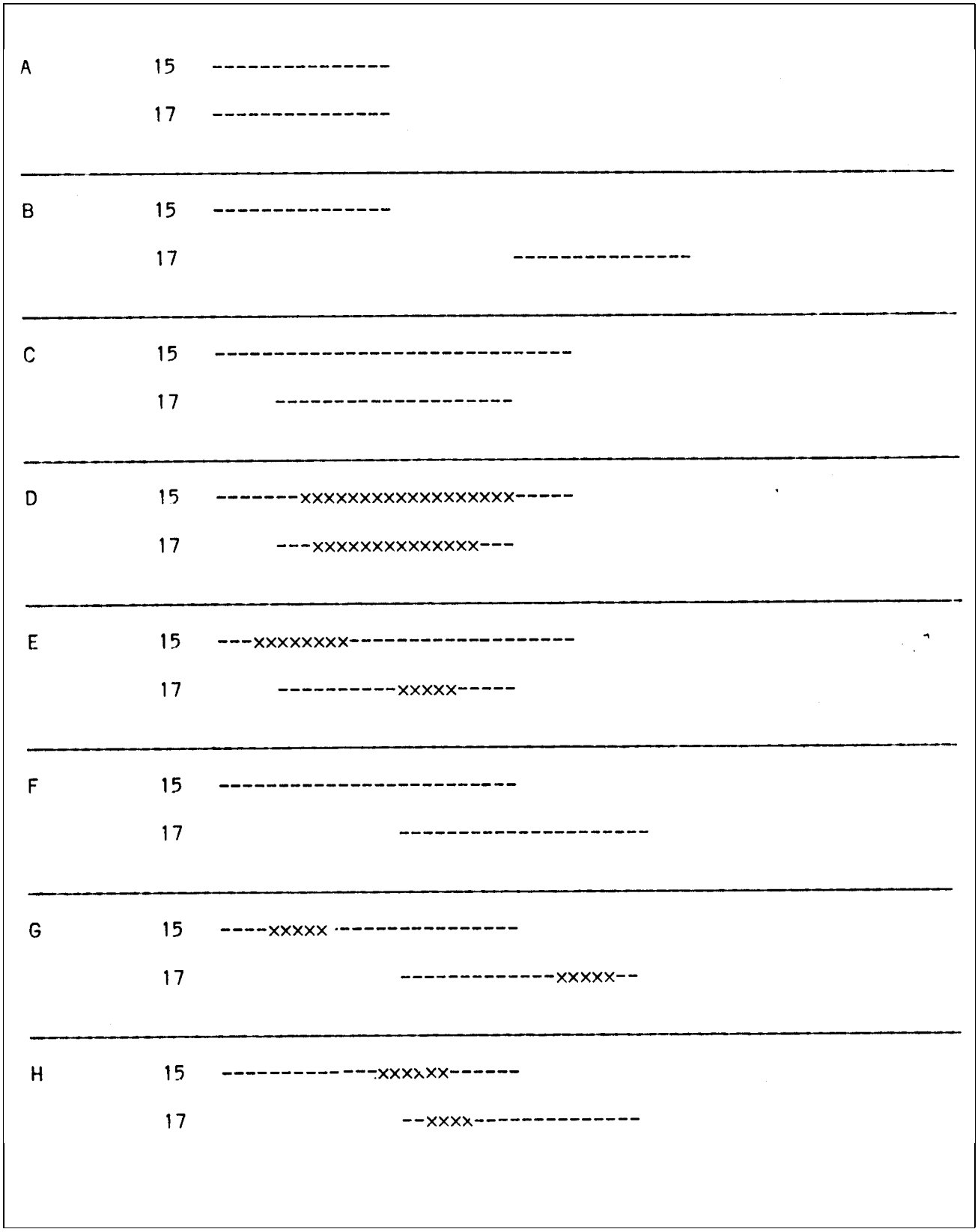
Let us define an event as a potentially meaningful unit of facial action. This can be a single AU, but it is more often a complex movement involving a number of AUs acting together within a certain period of time. While it is possible that AUs that co-occur are unrelated, each activated by different systems or mechanisms, this seems unlikely, at least when their co-occurrence is shown to be nonrandom. Thus, the investigator may want to determine the frequency with which certain AUs co-occur, and whether these combinations have systematic relationships to other phenomena. Those interested in converting AU scores into emotion scores will also need to delineate events, since many of the entries in Table 10-1 deal with AU combinations.

In the practice movie clips the AUs usually acted simultaneously, neatly forming events. This does not always happen in nature. It was common in the practice movie clips because the persons shown had learned FACS and were following instructions given in advance to perform certain AUs. There were some clips where the AUs did not start at the same time; for example:

- Practice 202: AU 15 started after AUs 1+4 had reached apex.
- Practice 225: AU 16 started after AU 12 had reached apex.
- Practice 232: AUs 1+4 start after 10+23 has reached apex.

1. Event scoring is covered more fully from the coder's perspective in Chapter 11 of the ***Manual***.

Figure 10-4


A 15 ----------
17 ----------
B 15 ----------
17 ----------
C 15 ----------
17 ----------
D 15 -------xxxxxxxxxxxxxxxxx-----
17 ---xxxxxxxxxxxxxx---
E 15 ---xxxxxxxx----------
17 ----------xxxxx-----
F 15 ----------
17 ----------
G 15 ----xxxxx ----------
17 ----------xxxxx--
H 15 ----------xxxxxx------
17 --xxxx----------

Let us consider the bases for delineating whether or not two AUs form an event.

The first two examples in Figure 10-4 show instances in which the decision about whether to consider two AUs as a single event is straightforward. In Example A, the onset and offset are precisely the same, and therefore it would be considered a single 15+17 event rather than two events, 15 and 17. In Example B, since there was no overlap in time between the occurrence of the two AUs, they are not treated as a single event, but as two separate events, 15 and 17.

Example C is more ambiguous. The two AUs, 15 and 17, do not begin and end at the same moment. One might argue that because one AU is contained within the other they should be considered as one event. Here is an instance where locating the apexes of the two AUs may be particularly relevant. When the apexes overlap (Example D), it seems more sensible to consider the two AUs as one event. When the apexes of the two AUs do not coincide (Example E), but instead as one AU decreases the other begins, it seems more sensible to regard the two actions as separate events.

In Example F, there is little overlap between the two AUs, and the apexes have not been determined. In this case it might be sensible to consider the actions as separate events. Example G shows how apex location could strengthen that decision, while Example H shows how apex location might suggest that even when there is little overlap in total duration, some overlap in apex night suggest treating the two AUs as one event.

These examples show the logic we are currently using in our own research. Certainly many other rules-of-thumb can be devised. For example, the proportion of overlap time might be relevant in deciding whether to treat two AUs as a single event. There is no empirical basis for any of these ideas, but with time the evidence should emerge from various studies.

One of the bases for lumping AUs into events is frequency of co-occurrence. While we do not have what could be properly called norms, we do suggest that the AU combinations listed in Table 10-2 are common ones, and when those AUs overlap it may be sensible at least to explore the possibility of considering the AUs as an event. Another basis for lumping overlapping AUs into a single event would be that the AUs are ones commonly associated with an emotion. Table 10-1 gives some examples of these.

Table 10-2: Commonly Occurring AU Combinations

1+2	5+7	9+17	10+17
1+2+5	6+12	9+16+25	12+15
1+4	6+43	10+15+17	12+17
4+5	7+43	10+16+25	20+26

4. Scoring Head and Eye Movements

The ***Manual*** provides a procedure for scoring held positions of the head or eyes, but does not provide a procedure for scoring head or eye movements. Certain movements are sufficiently discrete, easy to recognize and common that they could easily be scored:

- Head nod: quick up and down movements.
- Head shake: quick lateral movements from one side to another.
- Head cock: a quick, abrupt tilt upwards.
- Chin up: a quick raise of the head so chin appears to go upwards.
- Eyes up: looking upwards, often occurs during a word search.
- Lateral glance: eyes dart over to one side and back.
- Eyes down: look down and back up to baseline.

There are, of course, many other head and eye movements. Some are variations on those just described; others are different, complex and subtle actions. The head/eye position descriptors given in the ***Manual*** could be adapted for scoring all head/eye movements. We have just begun to evaluate when it might be necessary to describe head/eye movements at this level and when a direct identification of specific actions should be used.

5. Scoring Movements in Relation to Speech[2]

Certain Lower Face AUs may be involved in the process of speech: 10, l4, 16, 17, 18, 20, 22, 23, 24, 25, 26, and 28. For almost all of these AUs the amount of action required by talking is below what has been set as the criteria for the B intensity in the C sections of the Manual. (Note our observations are for American speakers of English.) At one time, we followed the convention of not scoring AUs 17, 18, 22, 23, 24, 25, or 26 if they coincide exactly with speech and instead scoring an Action Descriptor 50 to indicate that the person is talking. We have found since that all these actions can be scored and now only omit 25 and 26 when 50 is scored. During speech, of course, there are pauses, sometimes of just part of a second, and if one of these AUs is shown during the pause we score the AU, not 50.

6. Short Cuts in Measuring Facial Movement

FACS is a time consuming procedure for measuring facial movement. Many of the distinctions between AUs or the full description and timing of complex combinations may be irrelevant to certain questions. Hopefully, empirical data in coming years will provide the basis for determining which distinctions can be collapsed and when time consuming locational procedures are unnecessary.

Some investigators may not want to utilize FACS in its entirety but may wish instead to make some short cuts. For example, they may only want to score the occurrence of the presumed emotion signals (Table 10-1). A very gross scoring could be obtained by training coders to recognize those particular combinations of AUs and having them simply indicate whether or not they observed any of the combinations in a given time sample.

7. A Final Note

Write us if you are using FACS in your research. Once a year we will circulate a newsletter among FACS users, letting them know who is doing research with FACS so they can be in touch with each other. We will also report on new methodological developments. And, we will enlist your aid in suggesting revisions, simplifications and elaborations for updating FACS.

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Ekman, P. & Friesen, W.V. ***Unmasking the Face: A Guide to Recognizing Emotions From Facial Clues***. New Jersey: Prentice—Hall, 1975.

2. The coder's perspective on scoring during speech is discussed in Chapter 11 of the ***Manual***.

Ekman, P. & Friesen, W.V. Analyzing Facial Action. Book in preparation. New York: Plenum.

Chapter 13: *Assessing Proficiency: The FACS Final Test*

The FACS Final Test[1] is an important milestone in the training of a FACS coder. Every new coder is encouraged to take the Final Test after finishing the training prescribed in the FACS Manual and diligently scoring and reviewing all the practice items. This test provides the trainee with an opportunity to evaluate reliability against expert scoring with material collected from actual interactions. The behaviors in these records are more difficult to score than the FACS practice items and provide a realistic measure of progress in learning to score with FACS. The scores on this test afford a comparison to the skill level of other coders who have taken the test. Passing the Final Test is an achievement that every FACS coder recognizes as proof of membership in a group of people trained to observe the behavior of the face. A passing level of scoring agreement on the Final Test is a certification that allows a claim of reliability against standard materials that should be cited in research publications. It is an essential indication that the new FACS coder is scoring behavior the same way as others who use FACS. Passing the test has certain privileges in accessing FACS-related information, and your name is added to the list of certified FACS coders, to whom notices about FACS are sent.

Every person who intends to score research materials should take the Final Test. An an in-house program for establishing reliability among coders is good research practice, but not a substitute for the Final Test, as it is possible to be reliable but not accurate, and the test provides a standard of FACS compliance. Trainees who have consistently produced an agreement index below.75 on the FACS practice items probably are not proficient enough to pass the Final Test. If the trainee has not carefully studied all of the FACS materials and scored the practice items successfully, he or she is not likely to pass the test. In these cases, remedial work and repetition of practice scoring can elevate skill levels sufficiently to pass the test, especially as difficulties often center on a few AUs. If someone does not perform satisfactorily on the test, he or she will receive some feedback about remedial action to take before a retest is advised. Of course, learning to apply FACS to facial behaviors is an ongoing process, so regardless of one's score on the test, there are always new things to learn as experience broadens.

The test consists of 34 short videotaped excepts from conversations. The behaviors in the recording are diverse, and the people talk and move their heads, making identification of AUs even harder. These conditions are typical of actual research recordings, except that the excerpts circumscribe the behaviors to be scored, as in the practice video. The test is recorded on standard VHS video tape and comes with specific instructions on how to score the material and its individual items. To obtain the test, contact Paul Ekman's Human Interaction Laboratory.[2]

After taking the test, return the scores for each item as described in the test materials. These scores are then analyzed, and listings of scores with the correct answers and norms on how other learners have performed on the final test are returned. This feedback provides a basis for evaluating your own proficiency, and the authors have established a minimum level of the agreement index as passing. If you made any systematic errors we will advise you about how to correct them. Further instructions come with the test.

1. The FACS Final Test was originally developed from recordings made in Ekman and Friesen's lab, but it had various technical problems that added to the difficulty of the items. The material was changed in 1989 to a better quality recording developed at the University of Zurich by Eva Baenninger-Huber, Bernadette Schenker, and Bruno Thomann.
2. Write: 401 Parnassus Ave. Box HIL, San Francisco, CA 94143-0984. A more efficient method of providing the Final Test is currently being devised, and will be announced when available.

Facial Action Coding System

Investigator's Guide

Ekman

Friesen

Hager

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