FACIAL EXPRESSION IN PAIN: A STUDY OF CANDID PHOTOGRAPHS

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ABSTRACT: A number of investigators have reported that observers can reliably distinguish facial expressions of pain. The purpose of this study was to describe the consistencies which might exist in facial behavior shown during pain. Sixteen candid photographs showing faces of individuals in situations associated with intense, acute pain (e.g., childbirth, various injuries, surgery without anesthesia) were coded using the anatomically-based Facial Action Coding System (FACS) of Ekman and Friesen. A characteristic pain expression—brow lowering with skin drawn in tightly around closed eyes, accompanied by a horizontally-stretched, open mouth, often with deepening of the nasolabial furrow—occurred consistently in this series.

The problems associated with assessing pain solely on the basis of subjective report have been repeatedly stressed (e.g., Chapman, Chen, & Harkins, 1979; Gracely, 1979). The McGill Pain Questionnaire (Melzack, 1975), a standardized tool for verbal report which has recently come into wide use, represents an advance in this area, since such a tool allows for replication of research and comparison among different patient groups. Nevertheless, the McGill Pain Questionnaire carries with it the problems generic to all questionnaire or interview instruments (need for language proficiency, potential cultural bias, etc.) and may not be ideal for assessing all types of pain (Van Buren & Kleinknecht,

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1979). While there is hope that a measure such as brain evoked potentials may eventually provide a physiological index of pain (Chapman et. al., 1979), such procedures require special equipment and are relatively time-consuming and intrusive, making them impractical for use by the office-based general practitioner, dentist or oral surgeon.

A readily accessible source of information which may be of use to the clinician in the assessment of pain is the patient's nonverbal behavior. Yet, despite the potential practical applications of information on the nonverbal behavior of persons in pain, this area has received little systematic study. We do not know whether there are any nonverbal behaviors consistently shown by persons in pain, whether nonverbal behavior varies with type and/or degree of pain, or whether there are cultural and individual differences in the nonverbal expression of pain, as there are in verbal behavior (e.g., Zborowski, 1969) and physiological response (e.g., Tursky & Sternbach, 1967) associated with pain. The purpose of this paper is to investigate one aspect of the first of these questions, specifically, to establish whether there is any pattern of facial behavior which is consistently shown by persons experiencing acute, severe pain.

To date, few systematic descriptions of facial behavior shown by persons in pain have been reported. Leventhal & Sharp (1965) assumed that consistencies exist in facial expressions of "distress" and of "comfort," described the components of these expressions, and went on to study variations in comfort and distress expressions during labor by phase of labor, predispositional anxiety, and previous childbirth experience. However, it is not possible to derive a description of facial behavior during pain from their study for a number of reasons: the basis on which their facial measures of distress were derived was not reported; it is not clear whether the "distress" behavior seen was pain, tension, fear, or some combination of these states; and different parts of the face were observed at intervals separated by as much as 15 minutes, so it is uncertain whether the observed distress behaviors occurred serially, or in some integrated configuration or configurations.

Although the components of facial behavior during pain have not yet been adequately described, a number of pieces of evidence from judgment studies point to the conclusion that there are regular and distinct patterns of behavior which can accompany pain. Boucher (1969) reported significant agreement among judges

as to which of a series of posed photographs, labelled "distress" or "suffering" in previous studies, depicted pain as opposed to sadness or fear. This result was replicated cross-culturally with Brazilian judges as well as with several samples of Americans. In a study of experimentally-induced (cold pressor) pain (Ganchrow, Steiner, Kleiner, & Edelstein, 1976), both depressed and nondepressed subjects were more often judged to be "pained" during the pain induction condition than during the 10-second period just prior to the induction of pain. Unfortunately, although these investigators also had judges indicate the physical conformation of the facial features during these two conditions, interjudge agreement was not high with the pictograph system used to describe facial expressions, and comparisons reported were between the depressed and nondepressed subjects within a condition, rather than between pain and nonpain conditions. Thus, this study presents additional evidence that there may be consistent patterns of facial behavior detectable during pain, but it can only provide vague clues as to what those patterns might be.

Further indirect evidence of reliably detectable facial expressions of pain comes from studies of dissimulation during experimentally-induced (shock) pain carried out by investigators at Dartmouth. Kleck, Vaughn, Cartwright-Smith, Vaughn, Colby, & Lanzetta (1976) found that observers could accurately judge the intensity of anticipated and received shocks from videotapes of the facial expressions of the subject, although subjects were somewhat less facially expressive when they believed they were being observed than when they thought they were alone. Furthermore, subjects, when so instructed, could successfully manipulate their facial expressions to "fake" a more, or a less, intense shock than that actually delivered (Lanzetta, Cartwright-Smith, & Kleck, 1976). In these studies, however, judges saw videotapes beginning prior to the actual delivery of the shock, so it is uncertain whether their judgments were based on the behavior shown during the anticipation of the shock (presumably real or posed fear) or that shown during the shock itself (presumably real or posed pain).

All these investigations provide some evidence that facial behavior during pain shows a consistent pattern or patterns which can be reliably identified by observers. What might these patterns be? In order to answer this question, a reliable tool for measuring facial behavior must be used. The recently developed Facial Action Coding System (FACS) (Ekman & Friesen, 1976; 1978[a]) provides such a tool. This study uses direct facial measurement to

TABLE 1

Subjects and Action in the Pain Slides

Slide No.	Description
1-7	Young adult male, undergoing surgery, without anesthesia, for removal of shrapnel from his leg. (Seven photos of the same person.)
8	Young adult female, bent forward at the waist; her arms are twisted behind her back; each arm is held tightly by a man.
9	Adult male pinned under the dashboard of a crushed automobile.
10	School aged boy having tight metal band (handcuff?) removed from his wrist with bolt cutters.
11	Adult male New Guinea highlander, undergoing either an incision or drainage of an incision made with a bamboo knife in the abdomen.
12-15	Young adult female during labor in childbirth, without anesthesia. (Four photos of the same person.)
16	Adult male soldier with visceral battle injury, receiving transfusion from a medic.

confirm that consistent patterns of facial behavior are shown during pain, and describes these patterns using the anatomically-based FACS system.

METHODS

Slides

Sixteen 35-mm slides of the faces of unanesthetized persons experiencing pain from acute, severe physical trauma served as stimuli for this study. The slides, provided by Paul Ekman, had been produced from black-and-white candid shots clipped from newspapers and magazines. Eight of the photos were taken during surgery, four during childbirth; one showed an abdominal wound, two a crushing, and one a torsion injury. Table 1 contains short descriptions of the subjects and contexts of these pain photos.

The slides were of variable graininess, but major movements of the facial features were readily codable in all of them. All but two of the slides showed at least a three-quarter view of the face.

FACS

The photos were coded using the FACS developed by Ekman & Friesen (1976, 1978[a]). The units of measurement in FACS were derived from intensive study of the functional anatomy of the facial musculature. Forty-four "action units" (AUs) are used singly or in combinations to describe facial movement. Each AU is named with an arbitrary number and denotes the contraction or relaxation of a single muscle, or, more rarely, an independently moving muscle strand or a group of muscles which move as a unit. Together, these AUs can be used to code all the visible movements of the face which can be reliably distinguished by trained observers. In addition to being comprehensive, this system allows for the description of facial behavior without the use of general terms such as "smile" or inferential ones such as "submissive grin." Thus, FACS provides a descriptive base for studies of the association of facial behavior with various physiological or affective states (e.g., Ekman, Friesen, & Ancoli, 1980).

Individual AUs are defined through multiple visual examples and are described verbally in FACS instructional materials. The FACS coding process involves a series of separate coding steps, first for the lower face, then for head and eye positions, and finally for the upper face. Within each of the facial areas, the coding procedure includes compilation of candidate AUs, checks for AUs possibly omitted, and checks for combinations of noncompatible AUs. Decision rules for distinguishing AUs and for coding intensity are built into these steps (Ekman & Friesen, 1978[b]). The convention for reporting the FACS coding of an individual stimulus is to list in numerical order the AUs present, using plus signs between AUs when more than one AU has been coded.

FACS is a self-instructional system, and, on completion, reliability tests are conducted using videotapes of naturally-occurring facial behavior. The author's reliability on this test was .799, comparable with the reliability of others who have learned the system.

FACS was designed for use with motion records or with still photographs where a baseline or "neutral" pose of the face is available. The requirement for a baseline pose when using stills is a precaution against coding as facial movement a feature which is a permanent part of the individual's physiognomy (e.g., downturned lip corners). Because of the sources of the photographs used in this study, no baseline poses were available for the persons shown. However, in the case of nearly every ac-

tion unit in every slide, the movement shown in these photographs was so extreme that the appearance could not reasonably be attributed to a permanent facial feature. In those few cases in which there was some doubt as to whether movement had occurred, no action unit was coded. Thus, coding was conservative; if the results contain errors due to the lack of baseline photos, they are errors of omission, rather than of addition of AUs.

In the two cases where less than a three-quarter view of the face was available (Slides 5 and 16), the action units occurring on the visible side of the face are reported as occurring bilaterally.

All AUs were coded. Head and eye positions were also routinely coded since they influence the scoring of some AUs. However, head and eye positions showed no consistent patterns and are not reported here.

RESULTS

Table 2 shows the coding of each of the 16 photos in FACS action units, along with an everyday language description of the AUs shown. These common language descriptions will be used throughout the remainder of this paper to describe pain behavior. However, the reader should remember that these general verbal descriptors are merely shorthand notations for AUs which are visually defined and highly specific.

It is apparent from Table 2 that some AUs are consistently shown. Brow lowering occurred in 14 of the 15 photos in which the brow was visible; horizontal lip stretching occurred in 14 of the 16 photos, and closed eyes in 12. In addition, 14 of the 16 photos showed some degree of mouth opening: lips parted, jaw dropped, or mouth stretched. All of the slides showed either raised cheeks, tightened eyelids, or a deepened nasolabial furrow. The appearances of these three AUs differ only subtly, although they are caused by different muscles: "cheek raise" occurs due to the action of the outer part of the orbicularis oculi muscle; "lid tightener" is caused by the movement of the inner part of the same muscle; whereas "nasolabial furrow deepener" is based on the action of the zygomatic minor. All three of these AUs lift the infraorbital triangle and/or pull skin toward the eye.

These regularities may be thought of as constituting one prototype of pain expression. The expression is FACS coded as: 4 + (6 or 7 or 11) + 20 + (25 or 26 or 27) + 43, and could be verbally

TABLE 2

Action Units Coded for Pain Faces

	FACS Code and Description																		
Slide No.	Inner Brow Raise	Brow Lower	Cheek Raise	Lids Tight	Nose Wrinkle	Upper Lip Raise	Naso-labial Deepen	Lower Lip Depress	Chin Raise	Lip Stretch	Lip Funnel	Lip Tight	Lip Press	Lips Part	Jaw Drop	Mouth Stretch	Bite	Lids Droop	Eyes Closed
1		4+	6+		9+			16+		20Y[1]+					26+				43
2	1+	4+		7+									24+		26				
3		4+					11+	16+		20Y+					26+			41	
4		4+		7+		10Y+		16+		20Y+					26+				43
5		4+					11+			20X+					26				
6		4+	6+							20Y+				25+					43
7		4+					11+				22+	23+		25+					43
8		4+	6+						17+	20X+		B23[2]+			26+				43
9	1+		6+						17+	20X+				25					
10		4+	6+						17+	20X+				25+					43
11		4+	6+			10Z+		16+		20X+				25+					43
12		4+	6+		9+				17+	20X+				25+					43
13		4+					11+		17+	20X+									43
14		4+	6+						17+	20Y+							32+		43
15		4+					11+			20Y+						27+			43
16	70[3]		6+			10Z+				20Y+				25+					43
Total	2/15	14/15	9	2	2	3	5	4	6	14	1	2	1	7	6	1	1	1	12

[1]Some action units may be coded for intensity. "X" represents the least intense action, "Z" the most, and "Y" moderate.

[2]Some action units may be coded as occurring in only one lip -- "T" (top) or "B" (bottom).

[3]70 indicates that the forehead area is not visible.

described as: brow lowering with skin drawn in tightly around closed eyes, accompanied by a horizontally-stretched, open mouth, sometimes with deepening of the nasolabial furrow.

Variations of this prototypical pain face found in more than one of these slides include the addition of an inner brow raise, a nose wrinkle, or an upper lip raise, of pushing the chin boss up or pulling it down, and/or of tightening the lips.

DISCUSSION

The results presented here indicate a high degree of regularity in the facial movements associated with intense, acute pain. These findings are based on a small number of photographs of few individuals, and should be replicated using a larger, more systematically selected sample. Nevertheless, one may ask whether the highly regular pattern of facial behavior found in this study is unique to pain. Comparing this prototypic pain pattern with patterns hypothesized by Ekman & Friesen (1978[a]) to be operating in the negative emotions of fear, sadness, disgust, and anger, it was found that pain shares no AUs with disgust; and although certain individual AUs found in the pain expression may also occur in various prototypic expressions of fear, sadness, or anger, there is little overlap when the total patterns are considered. For example, the AUs shown in the mouth area in this pain expression are identical to those which occur in some fear prototypes; but the appearance of the brows, eyes, and cheeks are totally different in pain and fear. This pain prototype and some of the sadness prototypes employ the same AUs in the cheek region, but very different ones in the brows and in the mouth area. Brow AUs are similar in the pain and anger prototypes, but the conformations of the eyes and mouth in these expressions are not at all alike. In short, the degree of overlap between the pain expression described here and prototypic expressions of anger, fear, and sadness is small; certainly no greater than the overlap between prototypes of fear and anger, for example. This small degree of overlap suggests that the prototypic pain expression found in these photos is not only distinct from any of the expressions so far identified for fear, anger, sadness, or disgust, but is also unlikely to represent a blend of some combination of these negative emotions.

There is some evidence which indicates that the pain expression described in this study is widely used and recognized as an

expression of pain among humans. Ekman (personal communication) found that preliterate people in New Guinea used the same set of AUs as that reported here when asked to pose pain. They also recognized photographs of faces showing this set of AUs as representing pain expressions. Izard, Huebner, Risser, McGinnes, & Dougherty (1980) reported a similar, possibly identical, pattern for discomfort-pain in infants: "brows down and together, nasal root broadened and bulged, eyes tightly closed, and the mouth angular and squarish" (p. 139). However, they report that these changes are the same as those shown by infants in anger, except that in anger the eyes are open and staring. Adult expressions of anger (Ekman & Friesen, 1978[a]) and pain (this study) clearly differ not only in the eye region but also in the mouth area, with the horizontally stretched mouth being characteristic of pain but not of anger. Because of the different descriptive systems used in these studies and those of Izard, it is difficult to judge whether infant expressions of anger and pain are more similar than those of adults, or whether the apparent similarities of these expressions in infants are a product of Izard's slightly less discriminative descriptive system. This question cannot be answered until the same method of facial measurement is applied to adult and infant expressions.

The finding that acute, severe pain in adults is characterized by a pattern of facial behavior distinct from the patterns shown in disgust, anger, fear or sadness suggests that, although these negative emotions may occur in conjunction with, or as a reaction to pain, the unpleasant emotional component of pain *per se* differs behaviorally from these emotions, and may differ on the experiential and physiological levels as well. Whether or not this proves to be the case, the fact that persons in acute, severe pain show distinct patterns of facial behavior may find practical application in the clinical assessment of pain.

Candid photographs were used in this preliminary study on the assumption that spontaneously occurring pain behavior might be less extreme or less stereotyped than behavior shown during posed pain. However, the use of candid photographs also has limitations. Because the criteria used in picking which particular moment of action to photograph, in selecting which particular photographs to publish, and in choosing which particular published photographs to collect are all unknown, it is uncertain how representative this sample may be of the range of facial behavior associated with pain.

This study used as stimuli photographs of individuals in acute, severe pain. It is, of course, quite possible that there are other prototypes of pain expression. It is not yet clear whether less extreme pain would be shown by less intense or more fleeting forms of the same actions coded in these photos, or by a totally different set of facial actions. It is also possible that facial movements (e.g., blinking, jaw clenching) occur in pain which cannot be coded from still photographs. In an attempt to describe the total range of facial behavior shown during acute pain, observations of experimentally induced pain and of dental pain are currently being conducted. The resulting catalog of behavior will serve as a basis for studies of individual, cultural, diagnostic, and situational variations in the facial expression of pain.

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