DO INFANTS EXPRESS DISCRETE EMOTIONS? ADULT JUDGMENTS OF FACIAL, VOCAL, AND BODY ACTIONS*

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Abstract:
Adult judges were presented with videotape segments showing an infant displaying facial configurations hypothesized to express discomfort/pain, anger, or sadness according to differential emotions theory (Izard, Dougherty, & Hembree, 1983). The segments also included the infant's nonfacial behavior and aspects of the situational context. Judges rated the segments using a set of emotion terms or a set of activity terms. Results showed that judges perceived the discomfort/pain and anger segments as involving one or more negative emotions not predicted by differential emotions theory. The sadness segments were perceived as involving relatively little emotion overall. Body activity accompanying the discomfort/pain and anger configurations was judged to be more jerky and active than body activity accompanying the sadness configurations. The sadness segments were accompanied by relatively little body movement overall. The results thus fail to conform to the predictions of differential emotions theory but provide information that may contribute to the development of a theory of infant expressive behavior.

Article:
Controversy exists as to whether infants experience and express discrete negative emotions. Early views of emotional development (Bridges, 1932; Werner, 1948) posited that infants initially respond similarly to any negative emotion stimulus. This generalized distress response was gradually superseded by more specific negative emotions (e.g., anger, fear) that are differentiated from each other in terms of phenomenology, physiology, situational occurrence, and expressive behaviors.

Although several prominent contemporary theorists (e.g., Sroufe, 1979) continue to espouse a differentiation model, an alternative developmental theory has recently attracted considerable attention. According to differential emotions theory (Izard & Malatesta, 1987), discrete emotions are not preceded by less differentiated affective responses. Instead, the same basic emotions seen in adults emerge during infancy according to a maturational timetable. Emotional development involves the elaboration of these emotions including their association with new eliciting situations, cognitive appraisal processes, instrumental actions, and coping behaviors.

Adherents of differential emotions theory propose an innate concordance between facial expression and emotion such that each infant emotion has a corresponding discrete facial expression. Furthermore, infant facial expressions are automatic manifestations of emotion at least until the age when voluntary control over them begins to be exerted. One important implication of this assertion is that both researchers and nonresearchers may use facial expressions as a free-standing (necessary and sufficient) measure of infant emotions.

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Differential emotion theorists have described specific facial configurations proposed to correspond to the discrete infant emotions. These configurations are specified in Izard's MAX and AFFEX coding systems for the negative emotions of anger, sadness, fear, disgust, and the affective state of physical discomfort/pain. It is important to note, however, that Izard's proposals regarding the specific morphology of infant emotional expressions are theoretically separable from other tenets of the theory, for example, that discrete emotions exist in infants and adults, that emotional development involves emergence and elaboration of discrete emotions rather than differentiation, and that there are discrete facial expressions of some form that correspond to the discrete emotions in infants.

Several propositions of differential emotions theory have recently been questioned by a number of investigators. Regarding emotions in adults, several researchers (e.g., Ortony & Turner, 1990; Russell, 1991; Scherer, 1984; Smith & Ellsworth, 1985) have rejected the notion of qualitatively discrete emotions and have proposed that adult emotions are both experienced and judged in terms of dimensions or components of the affective experience (e.g., pleasantness, arousal, stimulus novelty).

Other researchers believe that discrete emotions are indeed the endpoints of development but disagree with one or more proposals about infant emotions that have been presented by differential emotions theorists. For example, Oster, Hegley, and Nagel (1992) have argued that the AFFEX coding system does not accurately represent discrete negative emotional expressions in infants. In their study, they presented adult judges with still photographs of AFFEX-specified infant emotional expressions and with adult emotional expressions as identified by Ekman and Friesen. Like Izard, Huebner, Risser, McGinnes, and Dougherty (1980), Oster and her colleagues found that judges will indeed choose the theoretically predicted term for the infant expressions if they are required to choose a single term from a list of discrete emotions labels. However, when given the opportunity to select multiple terms or nondiscrete labels, adults will instead judge these expressions to reflect either blends of several negative emotions or "distress." In contrast, when presented with photographs of adult emotional expressions, judges choose the single predicted discrete emotion under both procedures. These findings suggest that discrete emotional expressions for infants have not yet been identified. More generally, Oster (1988) has argued that there is as yet no convincing evidence for differentiated negative emotional expressions in infancy.

Camras reached a similar conclusion based on an extensive critical review of the infant expression literature (Camras, 1991, 1992; Camras, Malatesta, & Izard, 1991). She pointed to several "orphan phenomena" that can not easily be explained by differential emotions theory. First, several expressions specified in Izard's MAX and AFFEX coding systems (Izard, 1979; Izard, Dougherty, & Hembree, 1983) are not typically seen in situations believed to elicit the corresponding emotion (e.g., surprise and fear expressions in object permanence and fear of stranger studies, respectively). Second, other expressions (in particular, the anger configuration) have been reported to occur in such a wide range of negative affect situations that their status as expressions of specific discrete negative emotions is questionable. Third, the AFFEX-specified discrete negative expressions are no more common in some situations than are configurations involving components from several negative emotions (Matias & Cohen, 1991).

In a naturalistic study of her infant daughter's expressive behavior, Camras (1992) also found that three AFFEX-specified negative expressions (discomfort/pain, anger, and sadness) tended to occur together in the same situations and were associated with the waxing and waning of crying episodes. Camras argued that the three facial configurations thus do not meet an important criterion for discrete emotion status specified by Hiatt, Campos, and Emde (1979): situational specificity, i.e., differential occurrence in emotion-appropriate situations. She proposed that the facial configurations instead reflect different variants of distress which, following Bridges (1932), she considered to be a qualitatively less differentiated negative affect.

Differential emotions theorists (Malatesta-Magai & Izard, 1991) have argued that Camras' observations regarding the situational occurrence of the AFFEX-specified discomfort/pain, anger, and sadness configurations merely indicate that infants sometimes experience discrete emotions in non-predicted situations and also (like adults) can experience multiple affects in response to the same situation. However, this argument assumes that the emotion status of these facial configurations has been validated through some other form of evidence. As indicated above, judgment studies of expression photographs have not provided unambiguous evidence to support a discrete emotions interpretation of the AFFEX-specified negative expressions. Thus further research is necessary to clarify their emotion status and, beyond this, to provide a more complete picture of infants' expressive and emotional development.

One important limitation of current research on infant expressive behavior is its almost exclusive focus on facial activity. Yet facial expressions produced in vivo are accompanied by body movements and vocal activity that may provide important information to both researchers and observers attempting to understand the infant's emotional state. For example, possibly the AFFEX-specified facial expressions are accompanied by different forms of nonfacial behavior that might support their interpretation as expressions of discrete negative emotions.

In the present study, we examined facial and nonfacial behavior in an attempt to further our understanding of three AFFEX-specified facial configurations: the discomfort/pain configuration, the anger configuration, and the sadness configuration. In Part 1, we examined emotion ratings obtained from judges who were shown expressive displays that included the AFFEX-specified facial configuration, their accompanying body movements and, in one condition, their accompanying vocalizations. We reasoned that if judges rated these expressive displays in accord with the predictions of differential emotions theory, then one might argue that their component facial expressions indeed reflect their AFFEX-specified emotion irrespective of their situational occurrence or their judgment by raters presented with decontextualized, disembodied facial expressions. In Part 2 of our study, we obtained rater judgments regarding several dynamic characteristics of the infant's body movements (e.g., rhythmicity, coordination). We wished to examine these ratings to determine whether the body activity accompanying the AFFEX-specified facial configurations for discomfort/pain, anger, and sadness seem consistent with theoretically and intuitively based expectations regarding the nonfacial action components of these emotions.

Method

Subjects

The subjects were 32 undergraduate students (16 males, 16 females) who participated to fulfill a course requirement.

Stimulus Materials

The stimuli were 18 segments of videotape each showing an infant displaying the AFFEX-specified facial configurations for discomfort/pain (n = 6), anger (n = 6), or sadness (n = 6). Each segment showed the infant's entire body. The segments were extracted from 167 minutes of videotape taken by the first author of her daughter at 4 to 9 weeks of age during a variety of routine activities and semi-naturalistic experimental interventions. As part of a previous study (Camras, 1992), these tapes had been scored by two coders who achieved .90 reliability in the identification of AFFEX-specified expression configurations.[1]

For the present study, the stimulus episodes were selected by the second author who viewed the tapes in chronological order and identified the first six exemplars of each previously identified target configuration that met the following criteria: (a) 100% agreement between the authors and previous coders that the expression met the AFFEX-specified criteria for identifying the facial configuration, (b) the configuration was displayed for at least 1.33 seconds, (c) the configuration was temporally separated by at least one second from other expressions that preceded or followed it, (d) the mean episode length for each configuration type was approximately equal, (e) at least two freely-moving limbs were shown on camera, and (f) the infant was either in the bath or an infant seat. The bath and infant seat contexts were chosen in order to partially standardize the stimulus situation, because there were many exemplars of these situations on the videotapes and because the infant had maximal freedom of movement in these contexts (see Table 1 for descriptive episode data). The infant's face occupied

6% to 15% of the screen, making her expression clearly discernible but at the same time maximizing the proportion of her body that was also visible to the rater.

TABLE 1

Description of Stimulus Tape Segments for Each AFFEX-specified Expression Type

AFFEX-specified expression type								
Discomfort/pain			Anger			Sadness		
Duration	Context	Age	Duration	Context	Age	Duration	Context	Age
2.8	Bath	7	5.7	Bath	7	5.5	Bath	7
6.9	Bath	7	3.4	Bath	8	1.5	Bath	7
6.4	Bath	8	1.3	Infant Seat	9	2.1	Bath	7
3.6	Bath	8	6.8	Infant Seat	9	2.8	Bath	8
1.3	Infant Seat	9	1.3	Infant Seat	9	3.5	Bath	8
2.1	Infant Seat	9	1.7	Infant Seat	9	1.6	Bath	9

Note. Duration in seconds; age in weeks.

The 18 selected episodes were divided into two sets, each set containing nine episodes (three per target facial configuration). Two videotapes were prepared for each set, each tape showing the nine segments in a different randomly determined order. Each videotape could be presented with or without the audio channel depending upon the stimulus modality condition (video only vs video/audio).

Rating Scales

Two sets of 7-point scales were used by the undergraduate judges. Each term on each scale was given an intensity rating ranging from "1 = not at all" to "7= extremely."

One set of scales consisted of eight emotion terms, seven corresponding to the AFFEX-specified infant affects (i.e., happy, surprised, disgusted, afraid, angry, sad, and pained) and one being distressed, an affect term not included in differential emotions theory. Distress has generally been considered to be less differentiated than emotions such as anger and sadness.

The second set of scales consisted of eight activity terms that potentially could describe types of body activity shown by the infant (i.e., active, uncoordinated, jerky, flexed, extended, rhythmic, coordinated, and still). This set of terms was generated during group discussion by the authors in which previously published lists of affect terms and affect-related terms were inspected. The selected terms do not appear on published lists of affect terms (Dahl & Stengel, 1978; Davitz, 1969; Ortony, Clore, & Foss, 1987; Osgood, Suci, & Tannenbaum, 1958) and would be considered nonmental, physical states by Clore, Ortony, and Foss (1987).

Procedure

Each judge viewed one of the four stimulus videotapes and rated each segment using one of the two sets of rating scales. Each segment was viewed three times before being rated. For each segment, judges were asked to fill out a rating form on which they indicated either how much the infant was experiencing each of the eight emotions or how much the infant was showing each of the eight activity characteristics (i.e., "How (x) is this infant?"). The rating terms were presented in the same randomly selected order to each judge. All segments were viewed either with or without audio accompaniment (video only vs video/audio condition).

Scoring

Each judge's ratings for each scale set term were summed for the three exemplars of each target expression s/he viewed. Thus, 24 scores were generated for each judge (3 target expressions x 8 scale set terms).[2]

Results

Two analyses of variance (ANOVA) were conducted to examine differences in subjects' emotion ratings and activity ratings across the three target expressions. Each ANOVA included two between-subjects factors (rater sex; video vs video/audio presentation) and two within-subjects factors (target expression, $n = 3$; scale set terms, $n = 8$).

Emotion ratings. The emotion ratings analysis yielded significant main effects for target expression, $F(2, 24) = 34.26$, $p < .0001$, and emotion terms, $F(7, 84) = 8.07$, $p < .0001$, and a significant Expression x Emotion Term interaction, $F(14, 68) = 8.65$, $p < .0001$. No significant effects for rater sex or video vs video/audio presentation were obtained.

Simple effects analyses indicated significant differences among emotion term ratings for the discomfort/pain and anger expressions but not for the sadness configuration, $F(7, 84) = 19.17$, $p < .0001$ for discomfort/ pain; $F(7, 84) = 4.74$, $p < .0002$ for anger. Follow-up Tukey tests (using Greenhouse-Geisser adjusted degrees of freedom, alpha level = .05; see Table 2) indicated that for the discomfort/pain expression segments, the ratings of distress were highest and were significantly higher than the ratings for sadness, fear, pain, surprise, and happiness but were not significantly higher than the ratings for anger and disgust. For the anger expression segments, distress was also given the highest rating and was rated significantly higher than pain and happiness but not sadness, fear, anger, disgust, and surprise.

Comparing across the three target expressions, additional simple effects tests indicated significant differences among the expressions for each of the eight scale set terms: distress $F(2, 24) = 39.60$, $p < .0001$; pain $F(2, 24) = 17.43$, $p < .0001$; anger $F(2, 24) = 31.71$, $p < .0001$; sadness $F(2, 24) = 8.72$, $p < .002$; surprise $F(2, 24) = 4.11$, $p < .03$; disgust $F(2, 24) = 13.86$, $p < .0001$; fear $F(2, 24) = 19.58$, $p < .0001$; and happiness $F(2, 24) = 8.43$, $p < .001$. Tukey tests showed that similar patterns of ratings were found for the terms distress, pain, and anger, with the discomfort/pain expressions being rated significantly higher than the anger segments which were rated significantly higher than the sadness segments. Both the discomfort/pain and anger expressions were rated higher on sadness than the sadness expression.

Activity ratings. The activity terms ANOVA yielded a significant Expression x Activity Term interaction, $F(14, 168) = 8.90$, $p < .0001$. No significant effects for rater sex or video vs video/audio presentation were obtained.

TABLE 2

Comparisons Among Emotion Term Ratings for Each AFFEX-specified Expression Type

AFFEX-specified expression type								
Discomfort/pain			Anger			Sadness		
Emotion term	Mean rating	*SD*	Emotion term	Mean rating	*SD*	Emotion term	Mean rating	*SD*
Distress	15.94[a]	3.15	distress	12.88[a]	3.57	happy	8.25[a]	3.64
Anger	14.12[ab]	3.81	sad	11.06[ab]	4.68	distress	8.06[a]	3.12
Disgust	12.81[abc]	4.21	fear	10.94[ab]	4.95	surprise	7.06[a]	2.54
Sad	12.25[bc]	4.55	anger	10.88[ab]	3.59	fear	6.94[a]	3.47
Fear	12.19[bc]	4.94	disgust	9.56[abc]	3.70	disgust	6.75[a]	3.75
Pain	11.94[bc]	5.45	surprise	9.25[abc]	4.20	sad	6.69[a]	3.55
Surprise	9.69[c]	4.58	pain	8.88[bc]	4.36	anger	6.13[a]	3.42
Happy	4.31[d]	2.06	happy	6.81[c]	3.83	pain	4.94[a]	2.14

Note. Means are the total ratings for three segments of each expression type, thus scores could range from 3 to 21. Three sets of comparisons; each set makes comparisons among ratings for one of the expression types. Different superscripts indicate significant Tukey test differences, $p < .05$, comparing among ratings for one of the expression types.

Simple effects analyses indicated significant differences among activity terms ratings for each of the three target expressions: discomfort/pain $F(7, 84) = 3.29$, $p < .004$; anger $F(7, 84) = 3.04$, $p < .007$; and sadness $F(7, 84) = 5.93$, $p < .0001$. Follow-up Tukey tests (see Table 4) indicated that for the discomfort/pain expression segments, the ratings for flexed were significantly higher than the ratings for coordinated, extended, and still. For the anger segments, the ratings for flexed and jerky were significantly higher than the ratings for still. For the sadness segments, the ratings for still were significantly higher than all other ratings.

Additional simple effects analyses indicated differences across the target expressions for several scale set terms: active $F(2, 24) = 11.17$, $p < .0004$; jerky $F(2, 24) = 6.36$, $p < .006$; flexed $F(2, 24) = 5.08$, $p < .02$; and still $F(2, 24) = 20.02$, $p < .0001$. Follow-up Tukey tests (see Table 5) indicated that the discomfort/pain and anger segments were rated significantly higher for active and jerky and significantly lower for still than were the sadness segments. The discomfort/pain segment was also rated significantly higher for flexed than the sadness segment.

TABLE 3

Comparisons Across AFFEX-specified Expression Types for Selected Emotion Term Ratings

	AFFEX-specified expression type					
	Discomfort/pain		Anger		Sadness	
Emotion term	Mean rating	*SD*	Mean rating	*SD*	Mean rating	*SD*
Distress	15.94[a]	3.15	12.88[b]	3.57	8.06[c]	3.12
Anger	14.12[a]	3.81	10.88[b]	3.59	6.13[c]	3.42
Pain	11.94[a]	5.45	8.88[b]	4.36	4.94[c]	2.14
Sad	12.25[a]	4.55	11.06[a]	4.68	6.69[b]	3.55

Note. Means of total ratings for three segments of each expression type. Four sets of comparisons; each set makes comparisons among expressions for one of the emotion terms. Different superscripts indicate significant Tukey test differences, $p < .05$, comparing among expressions for one of the emotion terms.

Discussion

This study found differences in raters' judgments regarding the emotion status and activity characteristics of an infant displaying the AFFEX-specified facial configurations for discomfort/pain, anger, and sadness. However, these differences were not generally consistent with a differential emotions theory interpretation of their affective value.

Subjects who viewed the video segments without hearing the audio component did not differ in their ratings from subjects who both viewed and heard the infant's responses. Thus the infant's vocal behavior did not add information that altered raters' emotion or activity judgments.

Analyses of the emotion-term ratings revealed that subjects failed to rate the three different facial configurations significantly higher for the AFFEX-predicted emotion than for the non-predicted emotions. Of the eight emotion terms, pain ranked sixth for the discomfort-pain configurations, anger ranked fourth for the anger configurations, and sadness ranked sixth for the sadness configurations. Thus comparisons among emotion ratings for each AFFEX-specified expression type failed to support the hypothesis that the facial configurations represented their AFFEX-specified discrete emotions.

Comparisons across the facial configurations for ratings of pain, anger, sadness, and distress similarly failed to conform to the predictions of differ-

TABLE 4

Comparisons Among Activity Term Ratings for Each AFFEX-specified Expression Type

AFFEX-specified expression type								
Discomfort/pain			Anger			Sadness		
Activity term	Mean rating	*SD*	Activity term	Mean rating	*SD*	Activity term	Mean rating	*SD*
Flexed	13.63[a]	2.99	Flexed	12.88[a]	2.39	Still	14.81[a]	3.15
Jerky	12.69[ab]	3.59	Jerky	12.50[a]	2.73	Flexed	11.44[b]	3.14
Active	12.00[ab]	3.34	Active	12.31[ab]	3.36	Rhythmic	11.31[b]	1.99
Rhythmic	11.44[ab]	2.83	Rhythmic	11.44[ab]	3.20	Uncoord.[1]	10.44[b]	3.97
Uncoord.[1]	11.19[ab]	3.12	Uncoord.[1]	11.25[ab]	3.09	Coord.[2]	10.19[b]	2.48
Coord.[2]	10.19[b]	3.54	Coord.[2]	10.81[ab]	3.02	Extended	10.19[b]	2.20
Extended	10.19[b]	2.66	Extended	10.38[ab]	2.96	Jerky	9.63[b]	3.40
Still	10.06[b]	2.95	Still	9.31[b]	3.22	Active	8.56[b]	3.20

Note. Means are the total ratings for three segments of each expression type, thus, scores could range from 3 to 21. Three sets of comparisons; each set makes comparisons among ratings for one of the expression types. Different superscripts indicate significant Tukey test differences, $p < .05$, comparing among terms for the target expression.

[1]uncoordinated

[2]coordinated

ential emotions theory. Identical rating patterns were found for three emotion terms (distress, anger, and pain) with the discomfort/pain configurations rated significantly higher for all three emotion terms than the anger configurations which were rated significantly higher than sadness configurations. For the fourth emotion term, sadness, ratings were significantly higher for both the discomfort/pain and anger configurations than for the sadness configurations. Thus the AFFEX-specified sadness and anger expressions were not rated higher for their predicted emotion than were the distress-pain configurations. In summary, comparisons both within and across expressions suggest that the AFFEX-specified facial configurations do not represent their predicted discrete emotions in infants, at least as judged by naive raters.

Of particular note, for all six negative emotion terms (plus surprise), the discomfort/pain segments were rated higher than the anger segments, which were themselves rated higher than the sadness segments. Only for the term happy was this pattern reversed. This suggests that overall the

TABLE 5

Comparisons Across AFFEX-specified Expression Types for Activity Term Ratings

	AFFEX-specified expression type					
	Discomfort/pain		Anger		Sadness	
Activity term	Mean rating	*SD*	Mean rating	*SD*	Mean rating	*SD*
Flexed	13.62[a]	2.99	12.88[ab]	2.39	11.43[b]	3.14
Active	12.00[a]	3.34	12.31[a]	3.36	8.56[b]	3.20
Jerky	12.69[a]	3.59	12.50[a]	2.73	9.63[b]	3.40
Still	10.06[a]	2.95	9.31[a]	3.22	14.81[b]	3.15

Note. Means of total ratings for three segments of each expression type. Four sets of comparisons; each set makes comparisons among expressions for one of the activity terms. Different superscripts indicate significant Tukey test differences, $p < .05$, comparing among expressions for one of the activity terms.

discomfort/pain segments were seen as more intensely negative than the anger segments, which were themselves seen as more intensely negative than the sadness segments.

For all three expression types, distress was the negative emotion term given the highest rating. However, the ratings for distress were not themselves significantly higher than the ratings for several other emotions. Thus the findings do not support Camras' (1991) hypothesis that the three AFFEX-specified expressions all reflect distress in contrast to the more discrete negative emotions. However, several interpretations of the rating patterns are possible. For example, the pattern of ratings may indicate that observers perceived the infant as experiencing differing blends of negative emotions (including distress) in the different expression episodes. This might occur if raters considered distress to be a discrete emotion on par with the other discrete emotions rather than a less differentiated form of negative affect as it has been conventionally viewed by researchers (e.g., Bridges, 1932; Camras, 1991; Oster et al., 1992). Alternatively, more consistent with Bridges' (1932) differentiation model, judges may have rated segments highly for both distress and for the discrete emotions they predict will supersede it later in development. Lastly, raters may have interpreted distress as a higher order emotion term (i.e., a synonym for negative affect) and provided high ratings for distress when any discrete negative emotion or blend of discrete emotions was judged to be present. Future research should address these several possibilities perhaps by directly querying raters regarding their interpretation of the rating procedure and the emotion term distress.

Turning to the activity term ratings, the data showed that the rank ordering of ratings for the discomfort/pain and anger segments were identical. In both cases, the highest ratings were given for the term flexed while the lowest ratings were given for the term still. In contrast, for the sadness expression segments, the highest rating was given for the term still and significantly lower ratings were given for the other activity terms. Thus the pattern of ratings differed for the sadness segments in comparison to the discomfort/pain and anger expression segments.

Comparisons of activity term ratings across expression segments also revealed similarities between the discomfort/pain and anger segments and differences between these and the sadness segments. In both the discomfort/pain and anger segments, the infant was judged to be significantly more active and jerky and significantly less still than in the sadness expression segments. The pattern of ratings for the term flexed was similar although the differences were not as great. Overall the ratings for body activity suggest that the discomfort/pain and anger expression segments involved active, jerky, and flexed patterns of body activity while the sadness segments involved less body movement overall.

Regarding the emotion interpretation of the activity term ratings, the findings for the AFFEX-specified sadness configurations (i.e., high rating for the term still) seem consistent with theoretically based expectations since sadness is considered to be an emotion associated with depressed activity rather than fight or flight. However, in light of this, it is particularly interesting to note that emotion term ratings for the sadness segments did not suggest that raters judged the infant to be sad. Instead, these ratings suggested that the sadness expression segments were not seen to be highly emotional at all. Judges gave low ratings to the sadness segments for all emotion terms including sadness.

One possible interpretation of these findings is that the infant was indeed sad during the sadness segments as indexed by her low level of body activity but that raters failed to utilize this information to make a correct judgment about the infant's emotion. However, an alternative interpretation might be proposed that is more consistent with researchers' previous use of raters' emotion judgments as a measure of emotion. According to this line of reasoning, our results would indicate that some emotion-related activity differentiation is present in the young infant but that further differentiation must take place before the expressions become associated with discretely different emotions. The findings of our study do not allow for a definitive test of these hypotheses since at present there is no consensus regarding the relative validity of body activity and rater emotion judgment as the measure of emotion. Future research might incorporate additional emotion measures (e.g., the physiological measures proposed by Levenson, Ekman, & Friesen, 1990) to differentiate between the two interpretations. However, with respect to the immediate purpose of the present investigation, it is noteworthy that the emotion term ratings, traditionally offered in support of differential emotions theory, were not the measures that herein supported the discrete emotion interpretation of the sadness segments.

Regarding the discomfort/pain and anger expression segments, the body activity ratings suggested that the nonfacial behaviors accompanying these facial configurations were minimally different with both expressions being accompanied by more jerky activity than the sadness expressions. While these ratings might be viewed as consistent with theoretically based expectations regarding body activity accompanying pain and anger, they would not necessarily be expected to be exclusively associated with these specific discrete negative emotions. For example, jerky activity would be considered equally appropriate for the emotion of fear. While additional distinctions might be expected between the jerky activity associated with fear vs anger vs discomfort/pain (e.g., fight vs flight associated movements), there was no evidence for such distinctions in this study. For example, inspection of the videotapes did not suggest that the anger-associated movements were incipient striking movements and those associated with discomfort were incipient withdrawal or flight movements. Furthermore, the results for the emotion-term ratings also suggested that the activity patterns accompanying the discomfort/pain and anger expressions were not qualitatively different and specifically appropriate to these emotions.

While this study's findings do not confirm the AFFEX predictions for the facial configurations we examined, they do not necessarily indicate that discrete emotions are not present in young infants. Possibly discrete negative emotions indeed exist but are represented by facial configurations other than those specified in the AFFEX coding system. Alternatively, discrete emotions may be present in young infants but are not accompanied by discretely differentiated facial expressions. However, it is also possible that, as proposed by Bridges (1932), infants' responses may initially be qualitatively undifferentiated across episodes that will late evoke discrete emotions such as anger and sadness. According to this last proposal, the findings of this study might be considered to represent an interim point in the differentiation process. That is, at the 7- to 9-week age range studied, infants might produce somewhat different forms of negative response as represented by the different ratings of emotion and activity terms found in this study. Possibly, further differentiations may subsequently take place leading to the discrete negative emotions described for adults.

In conclusion, the results of this study showed that judges perceived the AFFEX-specified discomfort/pain and anger configurations to involve negative emotions not predicted by differential emotions theory and the sadness configurations to involve relatively little emotion overall. These findings did not support differential emotions theory's interpretations of these facial configurations. Similarities were found in the judged body activity accompanying the AFFEX-specified discomfort/pain and anger facial configurations. Thus the body activity ratings failed to provide support for their status as discretely different emotions. In contrast, there were differences between the activity accompanying the discomfort/pain and anger configurations and the activity accompanying the sadness configurations. However, the specific patterns of activity observed did not lead raters to judge the infant's emotion in accord with differential emotions theory. In conjunction with previous research (Camras, 1992) indicating that these expressions are not differentiated in terms of their situational occurrence, the present study suggests that the AFFEX-specified facial configurations of discomfort/pain, anger, and sadness are not expressions of these discrete emotions in young infants. Further research incorporating other indices of emotion may yet clarify the correct emotion interpretation of these facial expressions and indicate whether negative emotions are discrete or undifferentiated in infants.

Notes

1. Although the AFFEX-specified sadness configurations were first reported to emerge at 2 months of age (Izard & Malatesta, 1987), subsequently Izard, Hembree, & Huebner (1987) observed them in younger (2 month old) infants.
2. Although reliability was properly assessed by examining agreement among the coders who identified the AFFEX-specified facial configurations, Cronbach alphas were also computed to examine consistency in the raters' judgments of the emotion and activity content of the exemplars for each category. Alphas ranged from .22 to .82 for the emotion terms ratings (median = .61). Particularly low alphas (< .40) were obtained for the AFFEXspecified distress-pain configurations on ratings of anger; for the AFFEX-specified anger configurations on ratings of anger, sadness, and pain; for the AFFEX-specified sadness configurations on ratings of sadness, disgust, and surprise. Thus judges did not rate the AFFEX-specified anger and sadness configurations consistently for their AFFEX-predicted emotions. For the activity term ratings, alphas ranged from .08 to .76 (median = .50). Low alphas (< .40) were obtained for the AFFEX-specified distress-pain configurations on ratings for the terms flexed and still; for the AFFEX-specified anger configurations on ratings for the terms flexed, still and jerky; for the AFFEX-specified sadness configurations on ratings for the terms flexed, still, rhythmic, coordinated and extended. Deleting one item raised the alpha level substantially (a > .65) only in the case of the ratings for the term still for the anger and sadness configurations. In summary, the exemplars for each expression category sometimes differed in their accompanying body activity and their judged emotion content. While differential emotions theory might accommodate some differences among exemplars in their accompanying body activity, differences in emotion judgments would not be predicted.

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