SPONTANEOUS FACIAL EXPRESSION OF EMOTIONS IN BRAIN-DAMAGED PATIENTS

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In recent years many research studies have checked the hypothesis that there is a critical role played by the right hemisphere in non-verbal communication and emotional behavior (Gainotti, 1972; Galin, 1974; Ross, 1984). Several studies have aimed at identifying a variety of emotionally related behaviors, such as facial emotional expression, effective speech prosody, autonomic responses and comprehension of the emotional value of visual or acoustic stimuli; and right hemisphere involvement has been hypothesized for all of them (see Etcoff, 1986, and Gainotti, 1988, for reviews). Focusing attention on facial expression conceived as an elective and universal channel for the communication of emotions, it has been assumed that the right hemisphere works as a module or as a specialized processor to control facial emotional expressions (Etcoff, 1986).

Indirect support for this statement has been obtained from studies investigating possible asymmetries in facial expression of emotions in normal subjects, the rationale being that if the right hemisphere contains a specialized module for facial emotional expression, then the left half of the face should produce a more intense response to emotional stimuli.

A number of studies have indicated that both deliberate and spontaneous facial expressions are shown more intensely on the left side of the face. This is particularly true for negative emotions (Borod and Caron, 1980; Borod and Koff, 1983; Campbell, 1978; Dopson, Beckwith, Tucker and Bullard-Bates, 1984; Moscovitch and Olds, 1982; Rubin and Rubin, 1980; Sackeim, Gur and Saucy, 1978). In the case of happiness, the findings are more complex with some studies suggesting predominance of the left half face (Borod, Koff and White, 1983), others of the right (Sackeim et al., 1978; Schwarts, Ahern and Brown, 1979), and others no asymmetries (Ekman, Hager and Friesen, 1981). All of these studies are based on the assumption that the control of mimic facial movement is lateralized in a way not dissimilar to that observed for intentional movement of the limbs. However, empirical support for this assumption is scanty (Rinn, 1984). On the contrary, evidence from normal subjects (Hager and Ekman, 1985) has clearly shown that: (a) asymmetries in performing simple and intentional facial actions are not consistent across subjects and can be observed both on the right and on the left side of the face; (b) these asymmetries are not compatible with any of the up-dated models of hemispheric specialization proposed in the area of emotional

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expression. Furthermore, a study of the inability to perform the same facial movements as a consequence of focal brain damage has provided no support for the claim that disruption of specific areas of the cortex may produce a selective impairment of the mimic facial movements (Pizzamiglio, Caltagirone, Mammucari, Ekman and Friesen, 1987). Therefore, inferences drawn from experiments based on the asymmetry of emotional facial expressions in normals must be considered as merely conjectural and in part contradicted by the results.

Alternatively, it may be that the described asymmetries between the two halves of the face can be explained by different factors, such as hemiface size or mobility (Campbell, 1982; Ekman et al., 1981; Koff, Borod and White, 1981).

An apparently more direct approach for evaluating the role of the right hemisphere in affective behavior is to study the facial expressiveness of patients with unilateral brain lesions in different affectively charged situations. However, only inconsistent results have been obtained with this approach. Observing the facial expressions spontaneously produced by unilaterally brain-damaged patients during a neuropsychological examination Kolb and Milner (1981) found no difference between right and left brain-damaged patients, but noted that expressive facial movements were particularly diminished in patients with frontal lobe lesions. Different results have been reported by Buck and Duffy (1980) and by Borod, Koff, Perlman, Nicholas (1985) who studied spontaneous emotional expressions induced by means of emotionally charged slides. The right lesioned patients produced less intense facial emotional responses in both studies. Borod et al. (1985) also found that the poorest results were obtained by patients with right frontal lesions. In sum, the findings from these studies could support both the view of a specialized function of the frontal lobes and the hypothesis of a critical role of the right hemisphere for facial expression of emotions.

In evaluating the above mentioned discrepancies two methodological issues should be considered. The first one concerns the actual procedures used to induce spontaneous emotional responses which are out of the intentional control of the expressor. It seems doubtful, for example, that a clinical test setting (Kolb and Milner, 1981) may be considered as a situation in which the patient necessarily will freely express his emotional states, without introducing some sort of "social control" (Ekman, 1981). Furthermore, Ekman (1980) has questioned whether other studies claiming to have found evidence of right hemispheric control of spontaneous facial expressions actually studied freely expressed emotions. Sackeim, Gur and Saucy (1978) examined photographs of models who had been instructed to deliberately move specific facial muscles into emotional expressions. Borod and Caron (1980), Borod and Koff (1983) and Moscovitch and Olds (1982) examined conversations in which there was no reason to assume that emotion (or at least emotion not subject to social control) had been expressed.

The second methodological problem concerns the scoring of patient's expressiveness. In particular, the subjective scales used in most studies may be of limited reliability and easily biased if they are given to a judge who knows the research hypothesis and the patient's characteristics. Both of these criticism apply to the studies by Kolb and Milner (1981) and Borod et al. (1985).

The partially divergent results obtained studying the emotional expressiveness of brain-damaged patients and the methodological problems discussed above suggested the value of reconsidering this problem under more carefully controlled conditions. All of the brain-damaged patients in the present research were examined in a setting devised to maximize the chance of responding in a natural and spontaneous way. In order to induce the emotion, a set of short movies was shown, most of which had been previously applied in similar studies on normal subjects. Facial expression was recorded by means of an invisible video camera. Furthermore, the technique used to score the patient's facial expressiveness was the Facial Action Coding System (FACS) developed by Ekman and Friesen (1978), which provides analytical and objective scoring of all visible, discriminable facial actions and detects the intensity and the asymmetry of each facial action in a quantitative way.

The aims of our research were the following: (1) to test whether or not the hemispheric side of the lesion produces a differential impairment in the production of spontaneous facial expressions elicited by emotional stimuli as measured by an objective scoring technique (FACS); (2) to study the possible role of the intra-hemispheric localization and size of lesion in the impairment of facial expressions; (3) to compare the evaluations obtained with the FACS score and with the subjective techniques used by Buck and Duffy (1980) and by Borod et al. (1985) of the patient's emotional responses; (4) to see whether results can be influenced by the way in which the material is analyzed.

Material and Methods

Subjects

Two groups of unilateral brain-damaged patients of both sexes, suffering from vascular or tumoral lesions, were selected from the Neurology Department of the Catholic University of Rome. The side of the lesion was determined through standard clinical and neuroradiological examinations. Patients showing signs of multiple lesions were excluded from the sample. No patients included in the research had previous histories of psychiatric disorders or brain lesions and all had sufficient verbal comprehension to understand the task.

The left brain-damaged (LBD) group consisted of 39 patients with the following characteristics: mean age: 56.02 (S.D. = 13.4); years of schooling: mean = 6.52; 23 were aphasics, whereas 16 were not. The right brain-damaged (RBD) group consisted of 23 patients (mean age: 57.32; S.D. = 14.14; years of schooling: mean = 6.81). The control group consisted of 28 subjects without any CNS lesion (mean age: 54.60; S.D. = 11.02; years of schooling: mean = 6.75). The three groups were comparable for sex, age and educational level (all $p > .10$).

Stimuli

Four short movies were used: one was meant to elicit an unpleasant reaction, two pleasant responses, and the fourth was neither pleasant nor unpleasant. Three of these movies had been previously used in other studies (Ekman, Friesen and Ancoli, 1980) and one was added to induce additional pleasant responses. Pilot work, with normal and brain-damaged patients of relatively low educational level, showed that all stimuli were understood by virtually all subjects and that the types of verbally reported emotions were relatively consistent across subjects.

The first stimulus, taken from a commercial movie, showed a short (34″) sequence of a very fat man running after a very skinny one, with amusing interruptions. Happiness is the most usual response. The unpleasant movie (21″) showed a surgical toilette of a man with the face and skull heavily burned. This film usually induces disgust and sadness. The third movie showed sea waves lapping the beach (60″). This stimulus does not usually induce either pleasant or unpleasant emotional reactions and therefore was considered a control stimulus. The last movie (60″) showed a puppy playing with a flower slowly moved by the hand of a person. Happiness is again the usual response to this stimulus.

Procedure

The subject was seated alone in a sound proof room, facing a rear projection screen. The stimuli were projected on the screen from outside the room by a Super 8 movie projector. An invisible video camera recorded the subject's facial expression. The target movies were preceded by four other movies, which were intended to introduce the subject to the situation. The interstimulus interval between movies was 10″. The start of the stimulus presentation and of the videorecording of the subject's face was synchronized by means of a photocell system. The patient was told that he/she was having a special EKG recording under particular visual stimulation. Different autonomic parameters were also recorded and will be the object of a separate paper (Caltagirone et al., in preparation). The patient was requested to relax and watch the screen. After stimulus presentation and recording of facial responses, the subject was asked to briefly describe each movie and to explain the emotion he/she experienced. Only those subjects who proved to have a good overall understanding of the film sequences were included in the experiment.

Scoring

Facial expressions were measured using the FACS (Facial Action Coding System) by Ekman and Friesen (1976, 1978). This technique represents the first and only anatomically-based, comprehensive, objective technique for measuring all observable facial movements. The system requires that a trained scorer "dissect" an observed expression, decomposing it into the elementary facial muscular actions. Videotaped or filmed records are required, not live behavior, to allow repeated viewing. While FACS was designed to provide information about emotion, the scoring is done in descriptive, behavioral terms. The scorer identifies the occurence of particular facial actions, such as brow lowering, brow raising, nose wrinkling, etc., rather than making inferences about underlying emotional states (such as happiness or anger) or utilizing descriptions which mix inference and description (such as smiling, scowling or frowning).

The facial muscular action scores provided by the scorer are converted by a computer dictionary into emotion scores. While the dictionary was originally based on theory, there is now considerable empirical support for the facial action patterns listed in the dictionary of each emotion (Ekman, 1984; Ekman et al., 1980; Ekman et al., 1981).

In addition to the interpretation of facial expressions based on the FACS, the videotaped facial responses of the patients were scored using other methods by other persons who were unaware of the research hypothesis and of the patient's characteristics. Two independent examiners used Buk and Duffy's (1980) 7-point scale of degree of facial and gestural expressiveness. Two different and independent examiners rated the degree of involvement of each patient, on a 4-point scale, basing their judgment on the facial expression produced in response to each movie. This scoring is derived from (but not identical to) the one used by Borod et al. (1985): the rating described in their research was based on facial expression, intonation and speech, i.e. on combined criteria of various channels of emotional expression, not depending only on facial expressiveness.

Score Reliability

The FACS scoring was done by an experienced scorer (A.M.), whose reliability upon administering this technique correlated .80 with external criteria. The correlation between the evaluations of the two raters using Buck and Duffy's technique were different for the four movies, ranging from .51 to .73 (all $p < .001$). For the scoring derived from Borod et al. (1985), the correlation between the two judges was not significant for the evaluation of the "neutral" movie (ocean) and ranged from .43 to .60 for the other three movies (all $p < .01$). Although significant, these correlations are considerably lower than those reported by Borod et al. (1985), which seems to indicate that the reliability of their scoring technique depends in part on the evaluation of the verbal response of the patient.

RESULTS

As indicated several scoring systems were used, from subjectively administered either by naive or experienced judges to more analytical ones. The description of the results will proceed from the former to the latter evaluation of patients responses.

Subjective scales

The results obtained using the 4-point scale of degree of emotional involvement derived from Borod et al. (1985) and the 7-point scale of intensity of emotional expression, described by Buck and Duffy (1980) are shown in Table I. For both scoring techniques, analyses of variance were computed separately for each of the four movies for the three groups. In no case were significant differences found between the performance of controls, LBD or RBD patients (all $Fs < 1.5$).

TABLE I

Means (and S.D.s) of the Responses According to Borod et al. (1985) and Buck and Duffy (1980) Scales for the Three Groups of Subjects and for the Different Movies (Cont. = control subjects; LBD = left brain damaged patients; RBD = right brain damaged patients)

		Puppy	Fat-skinny	Surgery	Ocean
Degree of emotional involvement (Borod et al., 1985)	Cont.	1.20 (.80)	1.24 (.81)	1.26 (.64)	.84 (.64)
	LBD	.85 (.83)	1.07 (.82)	.98 (.77)	.66 (.65)
	RBD	1.04 (.91)	1.34 (.82)	1.11 (.78)	.90 (.73)
	F	1.168	.727	.80	.97
	p	n.s.	n.s.	n.s.	n.s.
Intensity of emotional expression (Buck and Duffy, 1980)	Cont.	2.64 (1.24)	2.80 (1.43)	2.92 (1.42)	2.42 (.93)
	LBD	2.37 (1.17)	2.66 (1.47)	2.51 (1.41)	2.43 (.97)
	RBD	2.70 (1.44)	2.70 (1.32)	2.54 (1.43)	2.47 (1.11)
	F	.515	.066	.685	.023
	p	n.s.	n.s.	n.s.	n.s.

FACS Scoring

Table II summarizes the number of subjects who responded with some kind of

TABLE II

Number of Patients in Each Group Who Produced any Kind of Facial Responses for Each Movie According to FACS

	N	Puppy	Fat-skinny	Surgery	Ocean
Controls	28	15	18	23	18
LBD patients	39	18	23	24	13
RBD patients	23	13	12	11	7
chi-square		.72	.76	6.74	8.16
p		n.s.	n.s.	.03	.01
				Cont.>RBD*	Cont.>LBD*
				Cont.=LBD	Cont.>RBD*
				LBD=RBD	LBD=RBD

*p<.05.

facial activity to the stimuli presented, disregarding what emotion was signaled by the facial activity. While no difference between groups was found for the two positive movies, a larger proportion of controls produced facial activity than both brain damaged groups during the ocean movie (chi-square = 8.16, p =.016). Also there were more controls than right brain damaged patients who showed some facial activity in the negative movie (chi-square=6.74, p<.05).

Further analyses considered the emotional value of the various facial actions. Some of the facial actions which occurred were listed in the dictionary of human facial activity (Ekman and Friesen, 1978) and are interpreted as unambiguous signals of one emotion or a blend of two or more emotions. Some of the facial actions are considered as incomplete but possible expressions of positive or negative emotional responses. Other observed facial actions have no known identifiable emotional meaning (e.g., tilting the head to the right or to the left, opening or closing the mouth etc.).

The first statistical analyses of the FACS scores considered just those facial actions which unambiguously signal a single emotion or a blend of emotions (e.g., happiness and surprise features). A greater number of subjects showed some emotional facial response in response to the two pleasant movies ("puppy" and "fat-skinny") as compared with the unpleasant or the neutral movies. There was no difference in the proportion of controls or brain damaged patients showing these patterns in the two positive movies. Similarly, no difference was observed between left and right brain damaged patients (see Table III).

The majority of the subjects in the control group, but only a minority of the subjects in the brain-damaged groups showed emotional expressions in response to the unpleasant film (chi-square=8.91, p=.01; see Table III). No significant differences were found between the right and left lesion groups. Emotional movements in the neutral movie were too few to make reliable statistical comoften occur when enjoyment is felt, while incomplete smiles (what they called unfelt smiles), occur when smiling is a deliberate act, such as in a polite or agreement smile. Complete smiles were relatively few in all groups for both movies. No differences were found between the three experimental groups for either of the positive movies for either category (see Table IV).

For the negative movie three subcategories were considered. The first (Neg 1) included only complete and clearly identifiable expressions of negative emotions (anger, contempt, disgust or sadness). The second category (Neg 2) added to the previous one also the isolated contraction of the corrugator (AU4) which has been related either with negative affect or with mental effort (Ekman, 1979; Rinn, 1984). The third one (Neg 3) included either complete negative expressions or other action units or combinations which while signalling negative emotion are ambiguous about exactly which of the negative emotions is occuring (e.g., tightening the lip corners, or pulling the lip corners down while pushing the lower lip up, or pressing the lips and tightening the lip corners). It must be observed that the same subject could produce different types of facial activity at different times of the stimulus presentation.

No statistically reliable difference was found among the three groups of patients for the first two negative emotion scores. With the negative emotion score 3, there was a trend ($p=.08$) for more of the controls (61%) to show these expressions than either the left-damaged (36%) or right-damaged (35%) groups. When the two lesion groups were combined in a chi-square comparing the controls and the brain damaged patients, the resulting value was 4.02, $p<.05$.

While scoring the videotaped material and particularly the unpleasant "surgery" film, we realized that, within the variety of facial responses without an explicit reference to any emotional pattern, aversion of the eyes or of the head from the screen recurred with great frequency. Such aversion movements were more frequent in response to the "surgery" film than during the neutral or the pleasant movies. Furthermore, when aversions were observed during the unpleasant movie, almost invariably in the subsequent interview the patients made comments of distress about the presented scene and some of them declared that they felt uncomfortable. The association of these movements in the negative movie with the presence of a clearly defined negative expression was evaluated by calculating separately the separate frequencies of these two behaviors. The proportion of patients showing both behaviors could not be distinguished by the expected proportion based on their individual frequencies (chi-square=.68, n.s.), pointing to the independence of the two behaviors. The number of subjects showing aversion is reported separately for each group and for each stimulus in Table V.

The distribution of aversive eye movements was significantly different among groups only for the "surgery" stimulus (chi-square=5.92, <.05). The number of patients showing aversive eye movements was lower in the RBD patients than in the control group. The difference between right and left brain-injured groups just failed to reach the significance level. On the contrary, no difference was observed between controls and LBD patients. These results indicated that normal controls and LBD patients, when presented with an unpleasant visual scene, often reacted parisons according to the criteria put forward by Siegel (1956).

The intensity of facial expressions based on the FACS scores were compared with the subjective scales previously used. For the pleasant and unpleasant stimuli the correlations between Borod et al. and Buck and Duffy's scores ranged from .49 to .76; between the former and FACS scores ranged from .28 to .59; between the latter and FACS scores correlations ranged from .49 to .68.

Taken together, these results show that, irrespective of the scores used, there were no differences in expressing emotions between the two hemispheric groups. While these results cut across different movies for the two subjective scales, the FACS scores detected some differences between controls and brain damaged patents for the negative movie, showing a greater sensitivity in describing patients' emotional behavior.

Until now we have reported only on the extent of emotional response, no the type of emotional response. For the two positive movies, a distinction was made between "complete" smiles, involving action units in the upper and lower face, and "incomplete" smiles (only lower face action units). Ekman and Friesen (1982) have reported that complete smiles (what they called felt smiles) most

TABLE III

Number of Patients in Each Group Who Produced Emotional Facial Responses for Each Movie According to FACS (Movements for the neutral movie were too few to allow for reliable statistical comparisons)

	N	Puppy	Fat-skinny	Surgery	Ocean
Controls	28	14	11	14	11
LBD patients	39	16	18	7	4
RBD patients	23	7	10	5	0
chi-square		1.9	.31	8.91	
p		n.s.	n.s.	.01 Cont.>RBD* Cont>LBD** RBD=LBD	

*p<.10.'
**p=.01.

TABLE IV

Number of Subjects Showing Full Smiles (both upper and lower face A Us) or Lower Face Smiles in the Two Positive Movies (full smiles were too few for reliable statistical comparisons). For the Negative Movie, the Number of Subjects Falling into the Three Emotional Subcategories is Shown (see text for explanation of the different scores)

		Puppy		Fat-skinny		Surgery		
	N	Full smile	Lower face	Full smile	Lower face	Neg 1	Neg 2	Neg 3
Controls	28	5	8	3	10	9	13	17
LBD patients	39	4	9	6	15	6	11	14
RBD patients	23	5	3	4	7	5	8	8
chi-quare			1.79		.41	2.65	2.37	5.00
p			n.s.		n.s.	n.s	n.s.	.08

TABLE V

Number of Patients in Each Group Who Showed Aversion Movements for Each Movie (Movements in the two positive movies were too few to allow for reliable statistical comparisons).

	N	Puppy	Fat-skinny	Surgery	Ocean
Controls	28	2	2	12	7
LBD patients	39	1	3	14	7
RBD patients	23	3	1	3	4
chi-square		–	–	5.56	.63
p				.06 Cont.>RBD* Cont.=LBD LBD>RBD**	n.s.

*p<.05.
**p=.09.

to this stressful situation by averting their graze from the stimulus, whereas this pattern of behavior was generally not shown by RBD patients.

It should be observed that this category of aversive movements heavily contributed to the total facial activity score. Particularly for the negative stimulus, it seems clear that the lower total activity of the right brain damaged as compared to controls (see Table II) was almost entirely due to the difference between these two groups in the frequencies of averting responses.

The relative importance of the intra-hemispheric locus of lesion was computed separately within each hemisphere for 21 LBD and 13 RBD patients for whom the CT scans were available. All patients with impairment of a particular lobe (e.g. left frontal lobe lesion) were pooled and compared with patients showing no impairment of that lobe (e.g. left lesion without a frontal involvement). Separate comparisons between the opposite groups for presence/absence of an identifiable positive or negative emotional expression were performed. None of the chi-square computed was significant for any of the lobar impairment group; there was only a tendency of the right frontal group to produce a smile less frequently in response to a happy stimulus (chi-square=4.62; p<.10).

Discussion

The main purpose of our research was to check whether or not the right hemisphere can be considered as a specialized processor for the regulation of spontaneous facial expression of emotions. This hypothesis was not supported by our results, since all three scoring methods used to analyze facial emotional expressions produced by pleasant and unpleasant emotional stimuli failed to reveal any substantial difference between right and left brain-damaged patients.

Furthermore, only when the most analytical scoring system (FACS) was used, patients with brain lesions showed significantly lower incidences of emotional facial actions than a group of matched normal controls.

It seems unlikely that the observed lack of a right hemisphere role could be artifactually produced by the methodology used. Most findings suggesting a critical role of the right hemisphere in facial expression of emotion are based upon subjective judgments of the two hemifaces, of composite pictures formed by two left or two right halves of the face or of videotaped material collected on normal or brain damaged patients (see Campbell, 1986). However, when more objective and analytical measures were used (Ekman et al., 1981; Hager and Ekman, 1985) no such difference was found for facial expressions of spontaneous emotions. It could be objected that, in spite of the superficially more analytic and objective evaluation allowed by a scoring technique such as the FACS, an intuitive judgment, based on the gestaltic capacity in perceiving faces, is a more powerful means of evaluating the emotional expressiveness of a face than any sophisticated scoring system. The present data do not support this interpretation, since the only significant difference between brain-damaged patients and normal controls was obtained with the FACS, whereas other subjective scoring procedures drawn from the literature failed to detect even this inter-group difference.

Previous findings were not replicated for several reasons. The first is that Buck and Duffy (1980) and Borod et al. (1985) used a considerably smaller sample of patients (10 and 12 RBD) than the one used in the present study. Secondly, Borod et al. (1985) did not specify whether the two raters were two experimenters or subjects blind with respect to the hypothesis and to the patients' characteristics. In the former case, an obvious bias could have been introduced, since it is quite easy to identify the side of brain lesion by observing the side of face or limb paralysis and the presence of speech disorders. Buck and Duffy (1980) separated the evaluation given by the experimenters and by blind scores: the between groups differences were numerically greater for the experimenters and in no case was a difference observed between RBD patients and controls. The inter-groups differences were, in fact, largely due to the increased expressiveness of the aphasic left brain-damaged patients. The criticism concerning the examiner's bias can also be extended to the study of Kolb and Milner (1981) where the evaluation of facial expressiveness was given by the clinical neuropsychologist during a testing session. It seems, therefore, possible to conclude that with the methodological improvements introduced in the present research (namely, an increase in sample size and a more objective scoring technique) no difference between right and left side lesions for the presence of facial expression of emotions, can be detected.

A second negative result of our research was the lack of a strong relationship between frontal localization of lesion and impairment in spontaneous facial expression of emotions. This finding is at variance with the observation of Kolb and Milner (1981) that during neuropsychological examination frontal lobe patients (regardless of side of damage) were less expressive than patients with any other localization and with the Borod et al.'s finding that right frontal patients were less expressive than any other group of subjects.

Our study did show that both patients with either left or right brain lesions showed less negative emotional responses than did controls. This was significant only when both full expressions, and fragmentary elements were combined, although this same difference was observable as a trend when just full face negative emotional expressions were considered. It would be important in further research to utilize other stimuli to arouse other negative emotions than the ones studied here, to insure that the findings generalize across negative emotions.

The negative findings concerning the lateralization or the intra-hemispheric localization of a hypothetical "neurological module" controlling the facial expression of emotions seems to suggest that the structures involved in the execution of the facial emotional display are subcortically rather than cortically mediated (see Rinn, 1984, and Feyereisen, 1987, for reviews). We would, however, stress the fact that if results of our research do not confirm the hypothesis of right hemisphere lateralization of a specialized processor for facial emotional expression, they do give further support to the hypothesis that the two hemispheres are not equally involved in emotional behavior.

An unexpected finding of our research is, in fact, the observation that right brain-damaged patients rarely showed a pattern of behavior commonly presented by normal controls and left brain-damaged patients when presented with a distressing visual scene. The latter often reacted by averting their gaze from the screen, whereas the former did not avert the eyes from the stressing film. Gaze aversion when the source of emotions is visual can have many meanings. Looking away may signify disinterest or boredom, or it may be part of a disgust display, or it may be a coping response to turn off the source of negative emotions (Ekman and Friesen, 1975). The comments of subjects who showed gaze aversion in the ocean film suggest that they were bored, while the comments of those who gaze averted during the surgery film suggest that they could not tolerate viewing the stressful film any more. The absence of these movements in many of the right brain damaged patients when they viewed the surgery film could be due to an impairment in their ability to cope with negative emotion, or it might signify that their negative emotional experience was less intense. The latter interpretation seems supported by the preliminary results on autonomic responding in these patients which indicated reduced heart rate deceleration and skin conductance responses in right brain damaged patients particularly in the negative movie (Zoccolotti et al., 1986). Further work will be necessary to choose among these interpretations.

Abstract

Spontaneous facial expression of emotion was studied in two groups of right (N = 23) and left (N = 39) brain-damaged patients and in a control group of normal subjects (N = 28). To elicit emotions four short movies, constructed to produce positive, negative or neutral emotional responses, were used. The method used to assess the facial expression of emotions was the Facial Action Coding System.

Brain-damaged patients showed less facial responses to emotional stimuli than normal controls, but no difference was observed between subjects with right and left-sided lesions either with global or disaggregated data analyses, inconsistent with the hypothesis of a specialization of the right hemisphere for facial emotional expressions. An unexpected difference was observed in response to the unpleasant movie. Both normal controls and left brain-damaged patients often averted their gaze from the screen when unpleasant

material was displayed, whereas right brain-damaged patients rarely showed gaze aversion. This finding suggests that the degree of emotional involvement or manner of coping with stressful input may be reduced as a result of right brain damage.

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