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Alcoholics' Deficits in the Decoding of Emotional Facial Expression

Pierre Philippot, Charles Kornreich, Sylvie Blairy, Iseult Baert, Anne Den Dulk, Olivier Le Bon, Emmanuel Streel, Ursula Hess, Isy Pelc, and Paul Verbanck

The present study investigated emotional facial expression decoding in alcoholics. Twenty-five alcoholic patients at the end of the detoxification process were compared with 25 volunteers matched for age, sex, and education. They were presented with facial expressions of neutral, mild, moderate, or strong emotional intensity. Results indicate that alcoholics overestimate the intensity of emotional expressions and make more errors in their decoding with a special bias for anger and contempt. Moreover, this decoding deficit is not perceived by the alcoholic patients. A general model is proposed that links visuospatial deficits, abnormal processing of social information, interpersonal stress, and alcohol abuse.

Key Words: Alcoholism, Emotion, Facial Expression, Nonverbal Behavior.

IN THEIR daily functioning, alcoholics are confronted with severe interpersonal problems (Parsons, 1987; Nixon et al., 1992; Duberstein et al., 1993) that may be linked to a deficit in communication skills. Deficits in communication skills can be present very early and can influence positively alcohol consumption in adolescents (Hover and Gaffney, 1991). Moreover, there are some indications that social skills training helps to prevent relapse (Oei and Jackson, 1982; Eriksen et al., 1986; Rohsenow et al., 1991).

An important facet of social skills is the ability to interpret accurately the internal state of one's interaction partner, specifically in terms of emotion (Patterson, 1999). People's emotional state is a primary source of information, allowing us to understand how they perceive the interaction, to estimate how they react to what we say, and to predict what their likely intend is. In addition, emotion perception has been proposed as a necessary condition for empathy, which in turn leads to a feeling of rapport and understanding in human interactions (Davis, 1994).

How does one come to know an interaction partner's emotional state? Emotions are mostly communicated nonverbally, the face being the primary channel of communication in this respect (Buck, 1984; Hess et al., 1988). Research on the processing of emotional facial expressions has demonstrated that such expressions are recognized at above chance level (Ekman, 1984), and that this ability is progressively learned during childhood and levels off at adolescence (Odom and Lemond, 1972). Thus, the ability to decode facial expressions constitutes an important social skill (Patterson, 1999). Research findings have established the empirical reality of that notion. Specifically, it has been shown that individuals who are less skilled in decoding facial expressions of emotion also demonstrate less social competence and—importantly—are less liked by their peers (Edwards et al., 1984; Feldman et al., 1991; Philippot and Feldman, 1990).

We propose that the chronic deficit in social interaction and communication shown by alcoholics might be partly underpinned by difficulties to interpret accurately the emotional state of others. These difficulties should be reflected in inaccurate perceptions and/or misinterpretations of facial expressions of emotion. In other words, we want to test the hypothesis that alcoholics present a deficit in the accuracy of their perception of emotional facial expression.

To our knowledge, only one study has addressed this issue. Oscar-Berman et al. (1990), compared alcoholic Korsakoff patients, non-Korsakoff alcoholics, and nonalcoholic controls regarding their ability to identify and recognize emotional material, including photographs of facial expressions. Alcoholic Korsakoff patients and non-Korsakoff alcoholics attributed more emotional intensity to facial expressions than controls. Furthermore, the ability to match facial expressions with written labels was determined by an interaction between experimental group and age of the subject. Unfortunately, because their purpose was to relate brain mechanisms to emotional perception and memory functions, they did not specify nor interpret this interaction. In addition, they used prototypical facial expressions, dis-

From the Department of Psychology (P.P.), University of Louvain, Louvain-la-Neuve, Belgium; Department of Medicine (C.K., I.B., A.D.D., O.L.B., E.S., I.P., P.V.), Free University of Brussels, Brugmann Hospital, Brussels, Belgium; Department of Medicine (S.B.), Free University of Brussels, Erasme Hospital, Brussels, Belgium; and the Department of Psychology (U.H.), University of Quebec at Montreal, Montreal, Quebec, Canada.

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Reprint requests: Pierre Philippot, Ph.D., Department of Psychology, Université de Louvain, Place du Cardinal Mercier, 10, B-1348 Louvain-la-Neuve, Belgium; Fax: +32 10 47 48 34; E-mail: Philippot@clis.ucl.ac.be

Table 1. Patients and Controls' Characteristics

	Alcoholics (n = 25)	Controls (n = 25)
Age		
Mean	43.00	43.83
SD	6.44	6.37
Education		
Mean	2.95	2.91
SD	1.04	0.94
Mental efficiency		
Mean	25.20	26.83
SD	4.04	5.58
Alcohol dependency		
Mean	24.33	2.83
SD	12.58	3.54
Anxiety		
Mean	38.50	32.00
SD	9.44	6.27
Depression		
Mean	42.79	31.30
SD	10.83	6.07

playing full-blown emotions. Not only have these extreme stimuli little ecological validity, but they are also easy to decode and the use of such a material is likely to entail ceiling effects (Hess et al., 1997). In conclusion, this study does not bring an answer to the present question.

To examine whether recently detoxified alcoholics show a deficit in the perception accuracy of facial expressions of emotion, we presented a large set of photographs of facial expression to alcoholics and controls who were matched for sex, age, and level of education. To avoid ceiling effects and to use a material reflecting real-life expressions, stimuli varied in the level of emotional intensity of the expression. To increase the sensitivity of our measures, we used a large emotion profile.

METHOD

Participants

Twenty-seven inpatients diagnosed with alcohol dependence according to DSM-III-R criteria were recruited in the psychiatric ward of a large university hospital in Brussels, Belgium. They were in their third week of detoxification process and were not receiving any psychotropic drugs. Participants were provided with the full details regarding the aims of the study and the procedure to be followed. After receiving this information, all but two participants gave their consent. Patients were matched for age (±5 years), sex, and education with 25 volunteers who were free of any psychiatric record and recruited among the experimenters' acquaintances. Each group comprises 18 men and 7 women. Education categories were coded as follows: 1 = completion of primary school; 2 = completion of the 3 first years of secondary school; 3 = completion of secondary school; and 4 = postsecondary school training. Patients and controls were assessed on several control measures: anxiety (Zung, 1965), depression (Zung, 1971), alcohol dependency (Stockwell et al., 1983), and mental efficiency (Folstein et al., 1975). As shown in Table 1, patients and controls were similar in terms of age, sex, education, and mental efficiency; but, as expected, patients showed higher levels of anxiety, depression, and alcohol dependency.

Stimuli

A series of emotional facial expressions constructed and validated by Hess and Blairy (1995) was used. Specifically, Hess and Blairy selected facial expressions of happiness, anger, sadness, disgust, and fear for two male and two female Caucasian actors from a series of standardized emotional facial expressions (Matsumoto and Ekman, 1988). Based on the neutral face (0% of emotional intensity) and the full-blown emotional facial expression (100% of emotional intensity) of the same actor, and using the computer program Morph 1.0, a series of intermediate expressions differing in emotional intensity by 10% steps was constructed. A set of 4 (intensity: 0%, 30%, 70%, and 100%) × 5 (emotions: happiness, anger, sadness, disgust, and fear) × 2 (actors) stimuli constituted the stimulus material. These stimuli were presented in a random order on an Apple Macintosh PowerBook 160.

Dependent Measures

Participants rated each expression on 7-point scales for eight emotions: happiness, sadness, fear, anger, disgust, surprise, shame, and contempt. These scales were presented in a random order on the computer screen, below the facial expression, 3 sec after the face started to be displayed. The face was maintained on the computer screen until all scales were answered. After completion of the emotion scales, participants also rated the task difficulty (i.e., how difficult it had seemed to them to guess the emotion portrayed by that specific facial expression). All scales were anchored by "not at all" at one extremity and "very intensely" at the other. There was an intertrial time of 2 sec between each face.

Decoding accuracy were computed for all stimuli but for the ones of 0% of emotional intensity (neutral faces). Decoding accuracy was defined as the observers' ability to correctly infer the posed emotion. An expression was considered as accurately identified when the emotion scale receiving the highest intensity rating on the emotion profile corresponded to the target emotion. An accurately identified expression received a score of 1 and a misidentified expression received a score of 0.

Procedure

The experimenter explained to the participants that their task was to judge the emotion(s) portrayed by a series of stimulus persons. To familiarize the participants with the procedure and the use of the computer, they were asked to complete two practice trials during which the experimenter answered questions regarding the judgment task. Participants then completed the procedure individually.

After completion of the decoding task, participants were asked to fill-out anxiety, depression, and alcohol dependency questionnaires. Finally, they completed the mental efficiency test administrated by the experimenter.

RESULTS

Data analysis proceeded in four steps. Both groups were compared (1) on decoding accuracy scores; (2) on the emotional intensity attributed to the facial expressions; (3) on the type of decoding errors; and (4) on the task difficulty ratings. Correlational analyses showed that there were no correlations between the dependent variables and the control variables of depression, anxiety, and mental efficiency. Thus, it was not necessary to control for their effects (e.g., with analysis of covariance).

Decoding Accuracy

Preliminary analyses computed on accuracy scores revealed neither significant main effects nor interactions involving sex of participant. Consequently, all subsequent analyses were collapsed across this factor.

To assess whether alcoholics show a deficit in the ability

Table 2. *F*-Values for Profile Analyses on Accuracy Scores

Source	*df*	*F*-values				
		Anger	Happiness	Sadness	Fear	Disgust
Parallelism	2,47	2.26	1.94	0.81	0.98	8.98**
Coincidence	1,48	4.92*	6.95*	6.09*	0.02	

* $p < 0.05$; ** $p < 0.0001$.

to decode emotional facial expressions, a repeated measures analysis of variance using a multivariate approach with Emotion (happy, anger, sadness, disgust, and fear) and Intensity (30%, 70%, and 100%) as within-subject factors, and Group (alcoholics vs. controls) as between-subjects factor was conducted on the accuracy scores. (Analyses of covariance were also performed, with either the scores of depression, anxiety, or cognitive status as covariates. These analyses revealed that the effects observed with the analyses of variance cannot be accounted for by a counfound with these covariates. In the following, only the results of the analyses of variance are reported.) The results showed:

- a significant main effect of Group [$F(1,48) = 17.63$, $p < 0.0001$]
- a significant main effect of Intensity [$F(2,47) = 57.30$, $p < 0.0001$]
- a significant Group × Emotion interaction [$F(4,45) = 5.40$, $p = 0.001$]
- a significant Group × Intensity interaction [$F(2,47) = 3.55$, $p = 0.04$]
- a significant Group × Emotion × Intensity interaction [$F(8,41) = 2.81$, $p = 0.014$].

To understand this pattern of interactions, post-hoc analyses were conducted for each facial expression: profile analyses were performed to assess the tenability of the assumptions that the decoding accuracy profiles of the two groups are (1) parallel (i.e., the shape of the profiles is identical) and (2) coincident (i.e., profiles have the same elevation) across the three levels of intensity (For details regarding this procedure, see Stevens, 1996). The *F*-values of the profile analyses are shown in Table 2 and Fig. 1 display the means of the profiles. For anger, happy, and sad emotional facial expressions, the decoding accuracy profiles are parallel, but alcoholics' accuracy scores are lower than controls' accuracy scores. In other words, the effect of intensity is the same in the two groups, but alcoholics' performances are systematically worse than controls'. For fear expressions, no differences between alcoholics and controls emerged across the three levels of intensity. For disgust expressions, the decoding accuracy profiles are not parallel. Post-hoc analyses indicated that, for 70% and 100% level of intensity, alcoholics' accuracy scores are lower than controls' accuracy scores.

In sum, with the exception of fear stimuli, alcoholics are less accurate when decoding facial expression than are controls. This effect is observed regardless of the intensity of the expression, except for disgust, where the effect is observed only for intense expressions.

Decoding Errors

The preceding analyses revealed that alcoholics make more errors than controls in decoding facial expressions of emotion. The following analyses examined whether alcoholics make the same errors than controls, just more of them, or whether they make errors of a different type than controls. The type of decoding error was specified using the same categorization scheme as the one used for the accuracy scores: for each erroneously decoded facial expression, an emotion category was attributed based on the emotional scale that had received the highest rating by the subject. Then, the number of errors for each emotional scale was computed for each of the five types of facial expressions. In sum, seven error variables (the eight emotion categories proposed to the subjects minus the category corresponding to the accurate decoding) were created for each type of facial expression. Because there were six emotional stimuli (2 actors × 3 intensities—30, 70, and 100%) for each type of facial expression, scores for the error variables vary between 0 and 6.

Analyses of variance, with emotion category as a within-subject factor and group as a between-subjects factor were computed for the five types of facial expressions. The *F*-values are shown in Table 3. (The same analyses of covariance as reported for decoding accuracy were performed. Again, the covariate did not affect the results observed in analyses of variance.) For anger and fear expressions, no significant differences between the two groups emerged. For happy and sad expressions, the results revealed that alcoholics made more errors on each scale than controls. For disgust expressions, post-hoc analyses showed that alcoholics made more errors than controls on the anger and contempt scales [$F(1,48) = 9.60$ $p = 0.003$ and $F(1,48) = 9.51$ $p = 0.003$, respectively]. In sum, the type of decoding error made by alcoholics and controls seems to be similar, with the exception of disgust stimuli for which alcoholics show a systematic bias toward emotions reflecting interpersonal conflict: anger and contempt.

Intensity

A repeated-measure analysis of variance using a multivariate approach with Emotion (happy, anger, sadness, disgust, and fear), Intensity (0%, 30%, 70%, and 100%), and Scales (happiness, sadness, fear, anger, disgust, surprise, shame, and contempt) as within-subject factors, and Group (alcoholics vs. controls) as between-subject factors was conducted on the intensity scores. (The same analyses of covariance as reported for decoding accuracy were per-

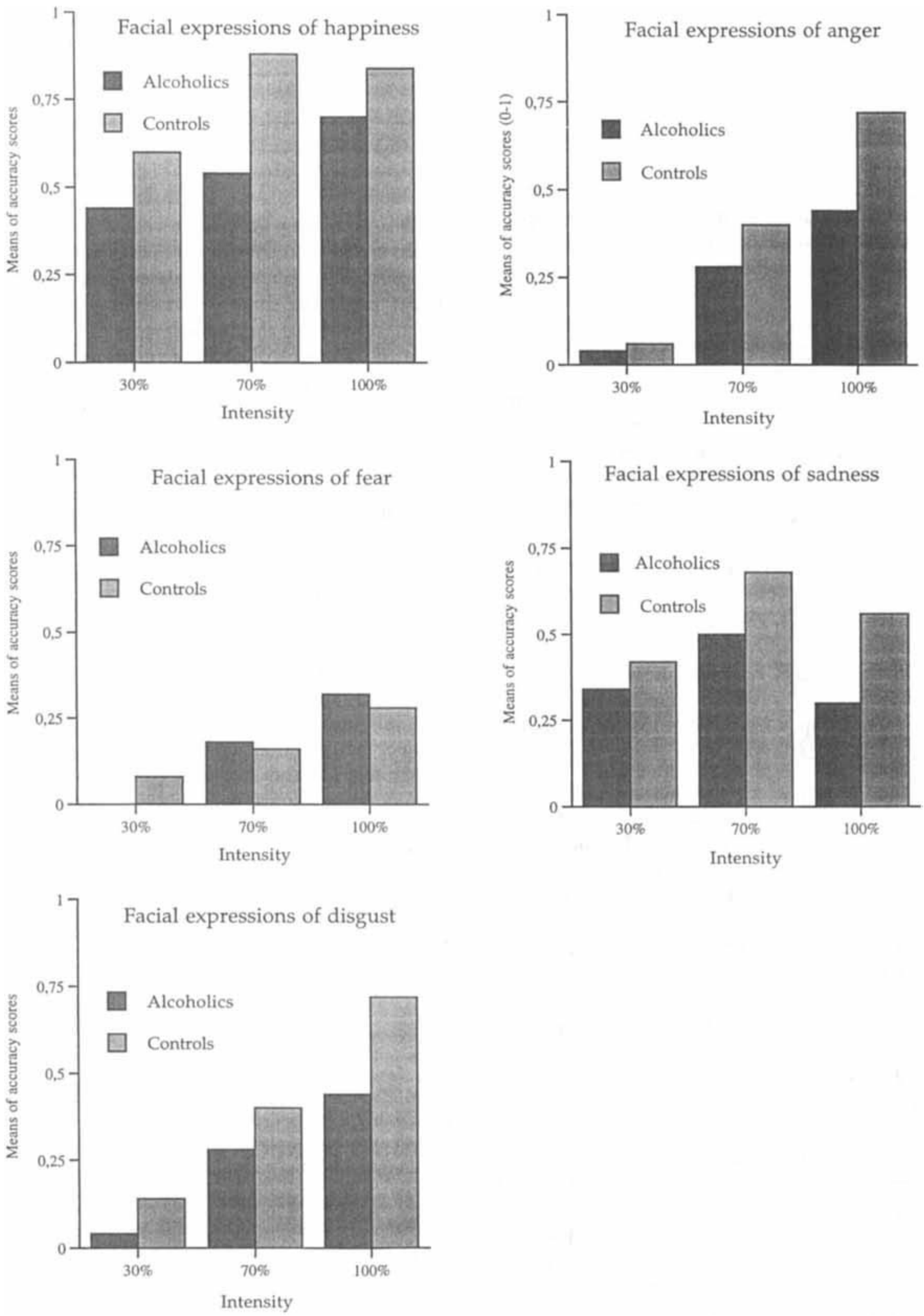

Fig. 1. Decoding accuracy as a function of group, stimulus intensity, and emotion category.

formed. Again, the covariate did not affect the results observed in analyses of variance.) Table 4 displays the results for all effects. However, in the context of the present paper, only effects involving Group are of interest. As regards the main effect of Group, alcoholics (mean: 3.35, SD: 0.86) attributed more emotional intensity to the ex-

Table 3. *F*-Values for MANOVA

Sources	*df*	*F*-values
Group	1,48	19.75**
Emotion	4,45	41.5**
Intensity	3,46	24.29**
Scales	7,42	20.69**
Group × Intensity	3,46	1.85
Group × Scales	7,42	2.35*
Group × Emotion	4,45	7.42**
Emotion × Intensity	12,37	6.28**
Emotion × Scales	28,21	2.46*
Intensity × Scales	21,28	11.92**
Group × Emotion × Scales	28,21	58.92**
Group × Intensity × Scales	21,28	2.24*
Group × Emotion × Intensity	12,37	2.05*
Group × Emotion × Intensity × Scales	20.31,975.06	2.03*

MANOVA, multivariate analysis of variance.
* $p < 0.05$; ** $p < 0.0001$.

pressions than did controls (mean: 2.29, SD: 0.83). However, this effect was modulated by several interactions of various effect sizes. As can be seen in Table 4, the Group × Emotion × Scale interaction explains the largest percentage of variance. Because this effect is the theoretically most relevant, we will limit our presentation and discussion of these results to this interaction.

For each facial expression, a profile analysis was performed to assess the tenability of the parallelism and coincidence assumptions across the eight rating scales. The *F*-values of the profile analyses are shown in Table 5 and Fig. 2 displays the means of the profiles. For anger, happy and sad facial expressions, the emotional profiles are parallel but alcoholics' ratings are systematically higher than controls' ratings. In other words, alcoholics judged these emotional facial expressions as displaying more intense emotions than controls. For fear expressions, post-hoc analyses revealed that alcoholics scored higher than controls on all emotional scales with the exception of the happiness scale. For disgust expressions, post-hoc analyses revealed that alcoholics scored higher than controls on all emotional scales and most notably on anger and contempt scales.

Difficulty

A repeated-measure analysis of variance using a multivariate approach with Emotion (happy, anger, sadness, disgust, and fear), Intensity (0%, 30%, 70%, and 100%) as within-subject factors, and Group (alcoholics vs. controls) as between-subject factor was conducted on difficulty ratings. No significant main effects or interactions involving Group emerged.

DISCUSSION

In line with our hypothesis, the results of the current study demonstrate that alcoholics present a deficit in the interpretation of emotional facial expressions. Several facets characterize this deficit. First, compared with controls, alcoholics overestimate the intensity of the emotion conveyed by facial expressions. A similar observation has been reported by Oscar-Berman et al. (1990), with full-blown expressions. The presentstudy extends this finding to emotional expressions of moderate and weak intensity and even to neutral faces. Thus, it documents that alcoholics tend to perceive more intense emotion than controls in the faces of their interactants, even if no emotion is expressed. Second, alcoholics misinterpret facial expressions more than controls: They are more likely to believe that somebody presenting a happy face is actually in a negative mood. They further tend to misattribute negative expressions (except for fear). For disgust, they present a systematic bias, attributing to their interactants' emotions of anger and contempt, two emotions typical of interpersonal conflict. Finally, despite their poor performance, alcoholics did not report more difficulties with the decoding task than controls. It is thus likely that they do not perceive their deficit in the decoding of emotional facial expression. In sum, the

Table 4. *F*-Values for MANOVA

		F-values				
Source	*df*	Anger	Happiness	Sadness	Fear	Disgust
Group	1,48	17.13**	5.63*	19.97**	19.78**	21.60**
Intensity	3,46	19.71**	4.23*	18.83**	19.22**	9.58**
Scales	7,42	37.56**	67.38**	72.13**	51.88**	75.92**
Group × Intensity	3,46	0.418	0.633	2.11	6.18*	1.99
Group × Scales	7,42	2.07	1.69	2.10	5.91**	4.06*
Intensity × Scales	24,28	16.41**	12.98**	8.14**	11.94**	10.05**
Group × Scales × Intensity	21,28	1.38	0.978	2.30*	0.705	2.94*

* $p < 0.05$; ** $p < 0.0001$.

Table 5. *F*-Values for Profiles Analyses on Accuracy Scores

		Sadness				Disgust			
Source	*df*	Neutral	30%	70%	100%	Neutral	30%	70%	100%
Parallelism	7,42	1.82	1.21	1.70	1.79	1.80	0.789	4.29*	4.46*
Coincidence	1,48	15.75	11.74*	24.58**	16.72**	13.30*	16.12*		

* $p < 0.05$; ** $p < 0.0001$.

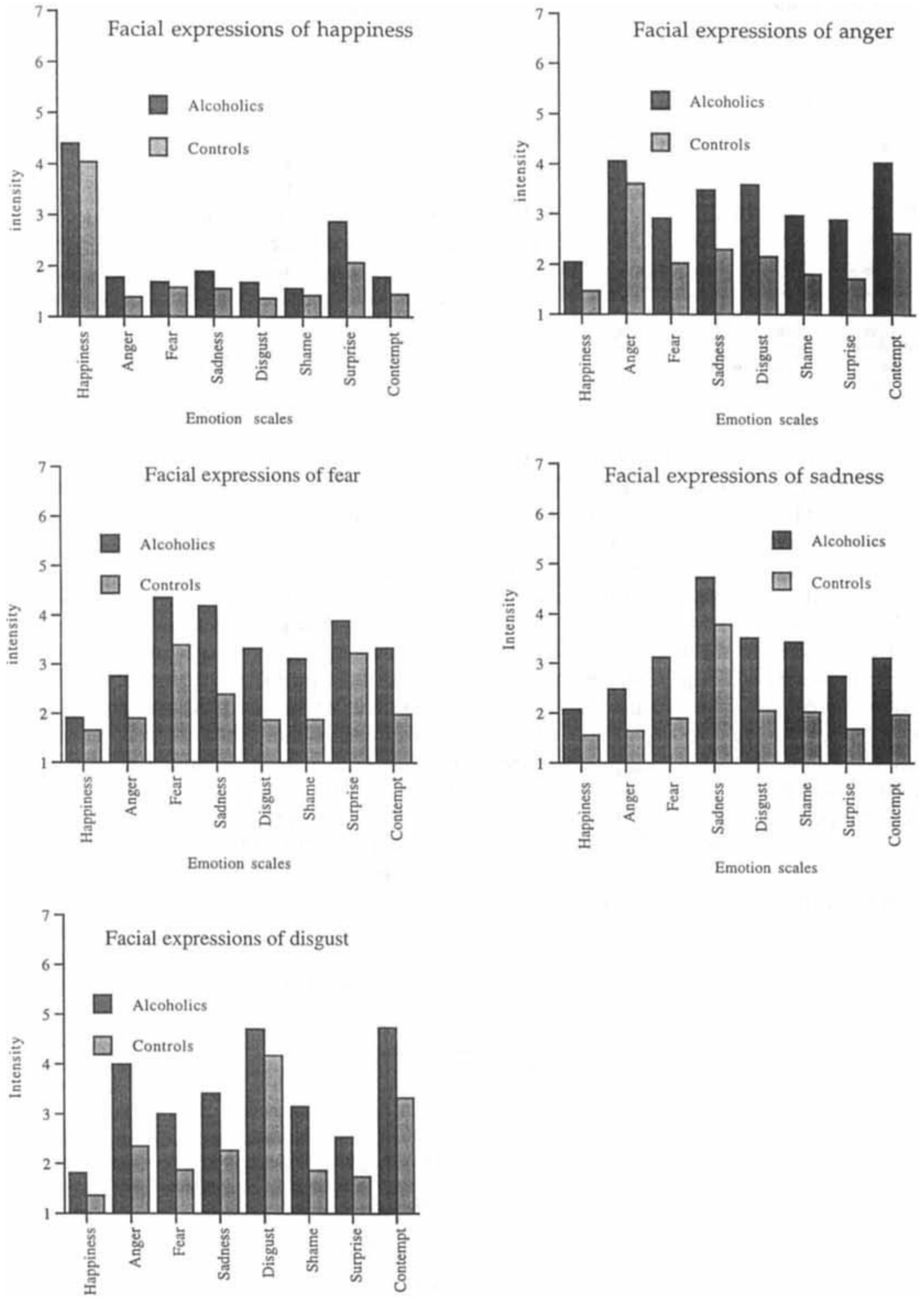

Fig. 2. Emotional intensity attributed to facial stimuli as a function of group, stimulus intensity, and emotion category.

present study portrays alcoholics as living in a world in which they perceive more emotional signals from their interaction partners, emotional signals that they tend to misinterpret, without noticing themselves their deficit in this domain.

The present study had the aim to be descriptive and thus data do not provide an explanation for the alcoholics' deficit in decoding emotional facial expressions. Yet, it is fair to speculate that a specific cognitive deficit accounts for the decoding deficit observed. Indeed, there is recent evidence that alcoholics present a deficit in visuospatial information processing (Schandler et al., 1996; Jonsson et al., 1962; Jones and Parsons, 1972; Cermak and Ryback, 1976;

Butters et al., 1977; Kapers and Butters, 1977). This deficit is present very early in the individual development, preceding the appearance of alcohol dependency. For instance, it has been observed in preschool children from families with a history of alcoholism (Schandler et al., 1995). As visuospatial abilities are required to process facial expressions. the abnormalities shown by the participants in the present study might be the consequence of a visuospatial disturbance or of a visuoperceptual deficit. Further research is needed to investigate the relationship between visuospatial and facial expression deficits. In such further studies, the visuoperceptual and visuospatial status of the participants should be measured.

Whatever its origin, we can foresee at least two consequences of the alcoholics' deficit in the decoding of emotional facial expressions. First, as they overestimate the emotional expressiveness of their interaction partners, they are likely to overreact to displays of mild affect by their interaction partners who in turn are likely to respond to this overreaction—a process that may lead to an emotional escalation and trigger a conflict (Marlatt et al., 1975). Second, as alcoholics are less accurate decoders of others' affect, they are more likely to misinterpret the nature of their interaction partners' affect. This misinterpretation is also likely to result in an inappropriate reaction to others' emotions—another potential source of problems or conflicts in the alcoholics' social life.

From this interpretation emerges a more general model linking visuospatial deficits, abnormal processing of social information, interpersonal stress, and alcohol abuse. We propose that early visuospatial deficits impair the decoding of nonverbal cues, which are essential in the processing of social information. This latter impairment then contributes to misunderstandings and, hence, to problems and conflicts in interpersonal relationships that, in turn, increase social stress. Such chronic social stress increases the probability of alcohol abuse.

A final comment pertains to the generalizebility of our findings. The alcoholic subjects in the present study were inpatients at the end of the detoxification process. We do not know whether they already presented a facial expression decoding deficit before they became dependent on alcohol nor do we know whether the deficit is maintained in long-term abstinent alcoholics. In other words, we need to raise the question whether poor social skills, including poor emotion perception, represent a vulnerability that precipitates the process of alcoholism, or whether they are a consequence of the alcoholic condition? A partial answer to this question could be offered by examining whether the decoding skills of alcoholics who succeeded in their detoxification improve over time. Finally, this latter question would be of particular importance with regard to preventing relapse. If long-term abstinent alcoholic patients can improve their emotion decoding skills—either as part of the recovery process or due to strategic interventions aimed at improving the relevant skills—positive consequences for the re-establishment of satisfactory social relations can be expected.

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