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IMPAIRED EMOTIONAL FACIAL EXPRESSION RECOGNITION IS ASSOCIATED WITH INTERPERSONAL PROBLEMS IN ALCOHOLISM

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Abstract — Aims: Emotional facial expression (EFE) recognition has been shown to be impaired in abstinent alcoholics. The present study investigated the relationship between EFE recognition impairments and interpersonal difficulties in recently detoxified alcoholics (RA). **Methods:** Thirty recently detoxified alcoholics were compared to 30 normal controls (NC) matched for age, sex and educational level on an EFE decoding test. This test involves 16 photographs depicting EFE of happiness, anger, disgust and sadness. Subjects were asked to fill in the Inventory of Interpersonal Problems evaluating six dimensions of interpersonal problems (assertiveness, submissiveness, intimacy, reliability, control and sociability). **Results:** RA had EFE recognition deficits and more interpersonal problems, compared to NC. Reported interpersonal difficulties were correlated with EFE decoding problems. **Conclusions:** Interpersonal difficulties serve as a mediator between EFE accuracy problems and alcoholism. Impaired EFE recognition could have a role in the interpersonal difficulties encountered by RA and may therefore constitute a relapse factor.

INTRODUCTION

Alcoholics have impairment in cognitive processing of emotional signals. More specifically, deficits in decoding affective prosody, a non-linguistic aspect of language that conveys emotion and attitude during discourse (Monnot *et al*., 2001) and emotional facial expression (EFE) (Philippot *et al*., 1999; Kornreich *et al*., 2001*a*,*b*) have been described in recently detoxified alcoholics (RA) and mid- to long-term abstinent alcoholics (Kornreich *et al*., 2001*b*).

The ability to interpret non-verbal emotional cues plays an important role in maintaining successful relationships and healthy psychological functioning (Carton *et al*., 1999).

Interpersonal difficulties are common in alcoholics. These are induced at least partly by chronic alcohol consumption: alcohol intoxication leads to conflicts (Zeichner *et al*., 1994) and even violence in interpersonal relationships (Naranjo and Bremner, 1993; Beech and Mercadel, 1998; Brismar and Bergman, 1998). Alcohol focuses the drinker's attention on salient cues in threatening circumstances, increasing the likelihood of aggressive behaviour (Gustafson, 1993; Zeichner *et al*., 1994; Lau *et al*., 1995).

However, alcoholics encounter interpersonal difficulties and social skills deficits even when sober (Nixon *et al*., 1992; Duberstein *et al*., 1993). Both direct evidence (Patterson *et al*., 1988; Nixon *et al*., 1992), using adaptative skills battery tests, and indirect evidence showing that social skills training improves the outcome of alcoholic patients (Intagliata, 1978; Eriksen *et al*., 1986; Miller *et al*., 1998) suggest that social skills deficits are present in alcoholics (Hover and Gaffney, 1991) and that they are partly responsible for alcohol consumption.

A major source of relapse relates to the interpersonal difficulties encountered by alcoholic patients (Marlatt, 1996). We therefore hypothesized in the present work that there is a relationship between deficits in EFE decoding and interpersonal problems in RA, as the former are susceptible to induce misinterpretations and conflicts, which in turn might promote alcohol consumption.

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METHODS AND SUBJECTS

Participants

Thirty in-patients (20 men and 10 women) diagnosed with alcohol dependence according to DSM-IV criteria (American Psychiatric Association, 1994) were recruited either in the psychiatric ward of a large University Hospital in Brussels, Belgium (15 participants) or at an alcohol treatment unit in Braine L'Alleud, Belgium (15 participants). All of them were in their third or fourth week of in-patient stay, that is, at the end of their detoxification process. They were not receiving any psychotropic medication at the time of assessment.

The normal control group (NC) consisted of 30 volunteers (20 men and 10 women) with no psychiatric record nor personal history of alcoholism. Control subjects were recruited among the hospital employees. They were matched for sex, age and level of education with the patients of the alcoholic group. Level of education was coded as follows: level 1 = post-secondary school training; level 2 = completion of secondary school or equivalent; level 3 = completion of the first 3 years of secondary school or equivalent. In each group, there were seven participants who reached level 1; 11 participants level 2; and 12 participants level 3.

Zung Anxiety Scale (Zung, 1971), Zung Depression Scale (Zung, 1965) and the severity of alcohol dependence questionnaire (Sad-q; Stockwell *et al*., 1983) were completed by each subject. The Mini Mental State Exam (MMSE; Folstein *et al*., 1975) was also administered to participants, using a cut-off point of 24/30, to ensure that no demented patients were included.

Historical variables (mean ± SD) were recorded for alcoholic patients. Their daily alcohol consumption was 17.50 ± 11.10 drinks per day, they were hospitalized 2.43 ± 2.28

times for a detoxification stay and they had been alcohol misusers for 12.76 ± 10.01 years. Twelve out of 30 RA participants had a positive family history of alcoholism (mother or/and father with alcoholism antecedents). A description of the samples is shown in Table 1.

As expected, alcoholics showed higher levels of anxiety, depression and alcohol dependency. All participants were provided with full details regarding the aims of the study and the procedure to be followed.

Stimuli

A series of EFE constructed and validated by Hess and Blairy (1995) was used. These authors selected facial expressions of happiness, anger, sadness, disgust and fear performed by two male and two female Caucasian actors from a series of standardized EFE (Matsumoto and Ekman, 1988). Based on the neutral facial expression (0% of emotional intensity level) and the full-blown emotional expression (100% of emotional intensity level) of the same actor, a series of intermediate expressions differing in level of emotional intensity by 10% steps was constructed using the computer program Morph 1.0. From this series, a set of 2 (intensity level: 30% and 70%) ×4 (emotions: happiness, anger, disgust and sadness) ×2 (actors' gender) stimuli constituted the stimulus material. These 16 stimuli (see Fig. 1) were presented in a random order on an Apple Macintosh PowerBook 1400.

Table 1. Characteristics of recently detoxified alcoholics (RA) and normal controls (NC)

Parameter	RA (n = 30)	NC (n = 30)
Age (years)	44.10 ± 10.77	42.07 ± 11.22
MMSE score (/30)	27.62 ± 1.61	28.31 ± 1.65
Alcohol dependence*	27.20 ± 12.86	2.40 ± 4.29
Zung Anxiety Scale*	41.33 ± 8.64	33.00 ± 6.43
Zung Depression Scale*	45.20 ± 8.32	32.70 ± 5.95

Values are means ± SD.
*$P \leq 0.001$.
MMSE, Mini Mental State Examination.

Dependent measures

Facial expression decoding. Each of the 16 examples of expressions were rated by participants on 7-point intensity scales. Eight different emotions were presented as choices (to expand upon the four target emotions). These eight emotions were happiness, sadness, fear, anger, disgust, surprise, shame and contempt. The subject ranked each of the 16 visual examples on each of the eight intensity scales that ranged from 1 = 'not at all' to 7 = 'very intensely'. The image of the face remained on the screen until all scales were completed. After completion of emotion rating of each expression, participants also rated the task's difficulty on a 7-point scale from 1 corresponding to 'very easy' to 7 corresponding to 'very difficult'. This additional measure was used to evaluate the subjects' awareness of eventual deficits in decoding EFE.

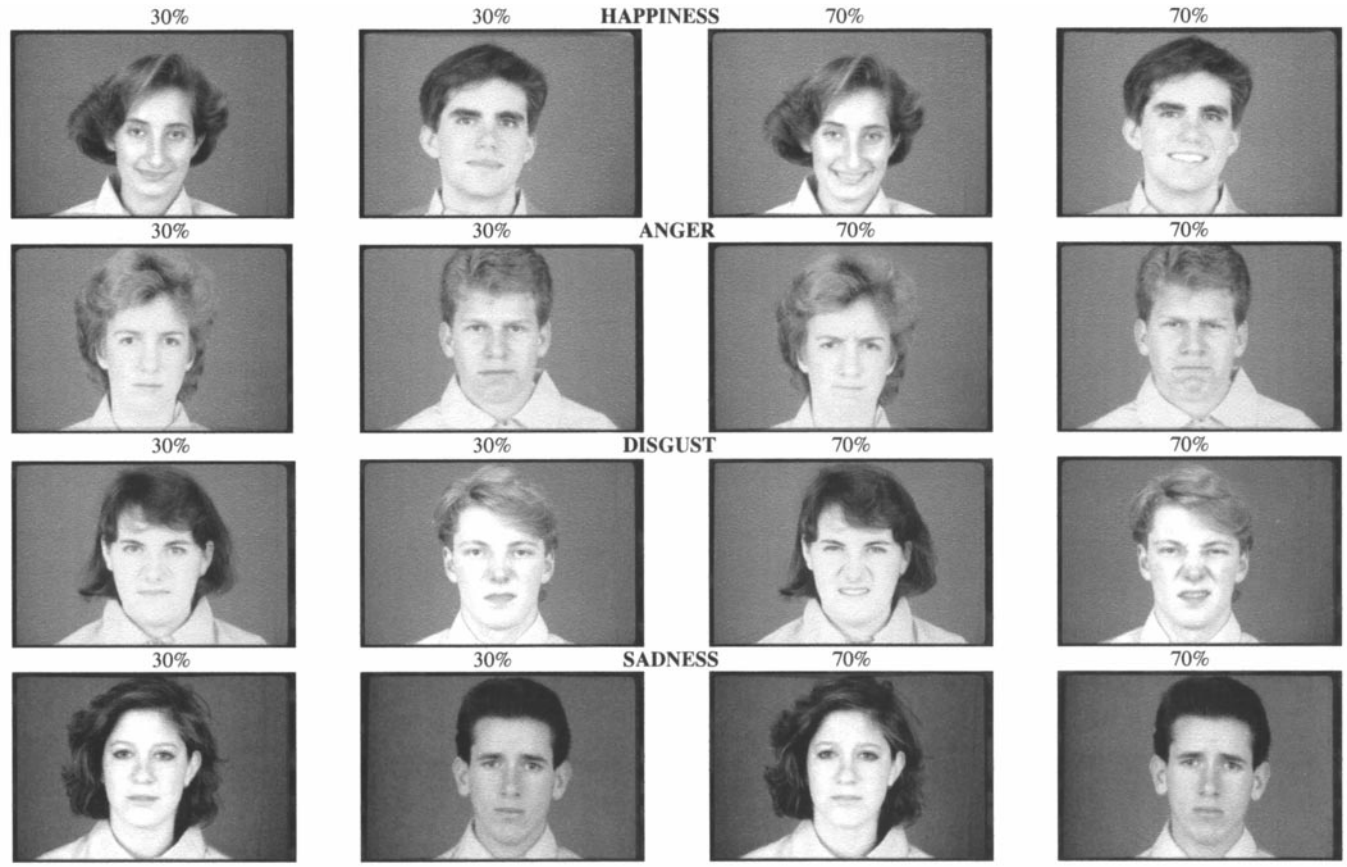

Fig. 1. Stimuli used for the present study. Reproduced by permission of P. Ekman.

Decoding accuracy was defined as the observer's ability to correctly infer the portrayed emotion. An expression was considered as accurately identified when the emotion scale rated with the highest intensity score corresponded to the target emotion. An accurately identified expression received a score of 1 and a misidentified expression received a score of 0.

Evaluation of interpersonal problems. In order to evaluate the difficulties participants may encounter in their interpersonal relations, they were asked to fill in an Inventory of Interpersonal Problems (IIP; Horowitz *et al*., 1988). This 127-item questionnaire describes potential problems encountered by respondents in their relations with others. The participants had to rate the items on 4-point scales from 1, corresponding to 'this problem does not apply to me at all', to 4, corresponding to 'this problem applies totally to me'. The questionnaire is composed of two sections: The first 78 items begin with the sentence 'it is difficult for me to …'. The other 49 items evaluate the behaviours 'that we use too much'. Together, the 127 items assess six different factors: 'to be assertive' (self-confidence), 'to be sociable' (sociability), 'to be submissive' (submissiveness to others), 'to be intimate' (capacity to establish and maintain intimate relations), 'too responsible' (excessive feeling of responsibility). This factor could also be called 'guilt/culpability' and 'too controlling' (excessive self-control). These scales were shown to have a high internal consistency (Horowitz *et al*., 1988).

For each of the six factors, a score was computed by averaging the participants' responses to items relevant for the target factor. A total average score was also computed by averaging the participants' responses to the 127 items. Higher scores correspond to more interpersonal problems.

RESULTS

Correlational analyses by groups (RA and NC) showed no significant correlations between the dependent variables (accuracy score, the six factors and the total average score of the IIP) and the measures of depression, anxiety and MMSE scores. Therefore it was not necessary to control for their effects (e.g. with analysis of covariance).

Univariate analyses of variance (ANOVA), conducted with group as independent factor and (1) accuracy score, (2) total average score of the IIP, (3) each of the six factors of the IIP as dependent variable, revealed neither significant main effects nor interactions involving sex of participant. Consequently, all subsequent analyses were collapsed across this factor.

In the context of the present paper, only main effects or interactions involving group are of interest, and we shall therefore limit our presentation and discussion to these results.

Decoding accuracy

To assess whether RA show a deficit in the ability to decode EFE compared to NC, a repeated measure ANOVA was conducted on the accuracy scores using a multivariate approach with emotion (happiness, anger, sadness and disgust) and intensity level (30% and 70%) as within-subject factors, and group (RA and NC) as between-subjects factor. The analyses revealed that RA showed significantly lower accuracy scores than NC: $F(1,58) = 15\,860$, $P < 0.0001$; $\eta^2 = 0.215$; power = 0.975 (means ± SD: 0.265 ± 0.12 and 0.388 ± 0.11, respectively). EFE means are shown in Figure 2.

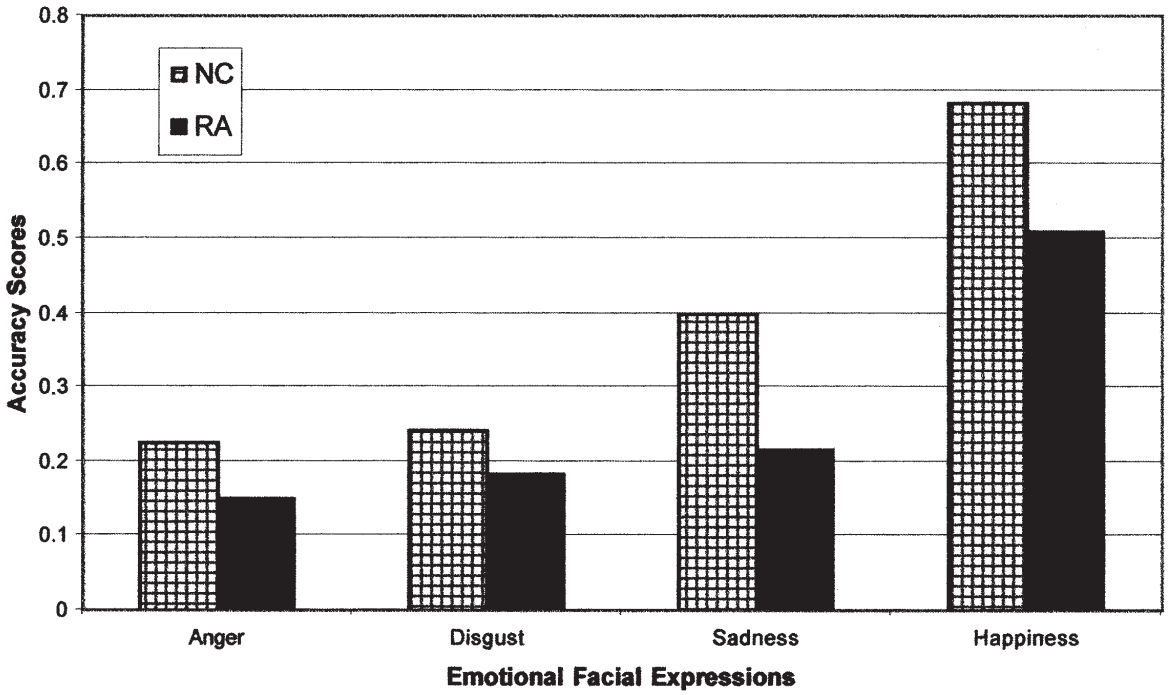

Fig. 2. Accuracy scores for each emotional facial expression (EFE; averaged for 30% and 70% intensity levels) by groups: normal controls (NC) versus recently detoxified alcoholics (RA).

Difficulty ratings

A repeated measure ANOVA using a multivariate approach was conducted on difficulty ratings with emotion (happiness, anger, sadness and disgust) and intensity level (30% and 70%) as within-subjects factors, and group (RA and NC) as between-subjects factor. The results revealed neither significant main effects nor interactions involving group. This means that RA are not aware of their decoding errors.

Interpersonal problems

To assess whether RA report more difficulty in interpersonal problems than NC, a univariate ANOVA was conducted with group as independent factor and the total average score of the IIP as dependent variable. The results revealed a significant main effect of group: $F(1,58) = 20.386$; $P < 0.0001$; $\eta^2 = 0.260$; power = 0.993 (means ± SD: 1.67 ± 0.56 and 1.07 ± 0.46, respectively) with RA reporting more interpersonal problems than NC.

A multivariate ANOVA was conducted with group (RA and NC) as independent factor and scores on the 'assertive', 'sociable', 'submissive', 'intimate', 'too responsible' and 'too controlling' scales as dependent variables. The results revealed a significant main effect of group: $F(6,53) = 5825$; $P < 0.0001$; $\eta^2 = 0.397$; power = 0.995, RA reporting more difficulties on every scale except for the 'too controlling' one.

Table 2 and Figure 3 show means and significant differences for each scale and for the total average score of the IIP for NC versus RA.

Relationship between interpersonal problems and EFE decoding scores

In order to investigate whether interpersonal problems and accuracy scores are linked, a correlational analysis was conducted between accuracy scores and the total average score of the IIP for the whole sample. The analysis revealed a significant correlation [$r(60) = –0.452$; $P < 0.0001$], meaning

Table 2. Comparison of recently detoxified alcoholic (RA) and control (NC) subjects for each scale and for the total average score of the Inventory of Interpersonality Problems

	NC	RA	*F*-ratio; *P*	η^2	Power
Assertive	1.35 ± 0.56	1.76 ± 0.63	$F(1,58) = 7226$ $P < 0.009$	0.111	0.753
Sociable	1.02 ± 0.58	1.77 ± 0.77	$F(1,58) = 17\,841$ $P < 0.0001$	0.235	0.986
Submissive	0.97 ± 0.56	1.65 ± 0.79	$F(1,58) = 14\,674$ $P < 0.0001$	0.202	0.965
Intimate	0.71 ± 0.42	1.67 ± 0.106	$F(1,58) = 21\,103$ $P < 0.0001$	0.267	0.995
Too responsible	1.32 ± 0.78	1.97 ± 0.83	$F(1,58) = 9789$ $P < 0.003$	0.144	0.868
Too controlling	0.98 ± 0.63	1.27 ± 0.58	$F(1,58) = 3406$ $P < 0.070$	0.055	0.442

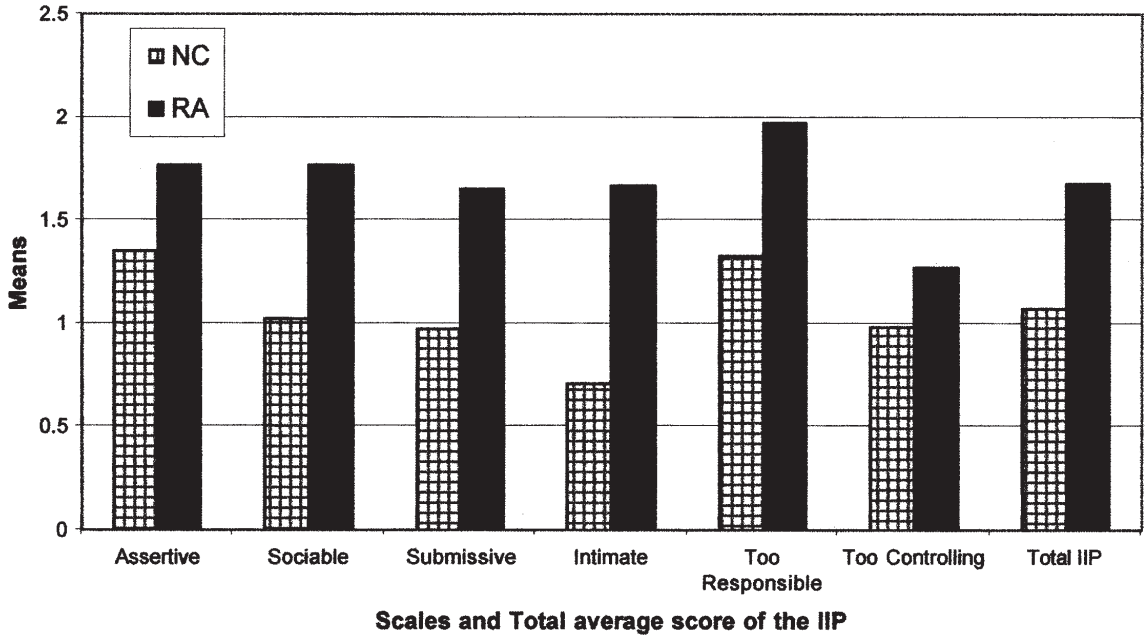

Fig. 3. Means for each scale (and total average score) of the Inventory of Interpersonality Problems (IIP) by groups: normal controls (NC) versus recently detoxified alcoholics (RA).

that less accuracy in the decoding of EFE is associated with more interpersonal problems. These results are illustrated in Fig. 4.

This significant correlation permits an investigation of whether the EFE decoding deficits of alcoholics are still statistically observable after partialling out the variance accounted for by their interpersonal difficulties. Thus, an ANCOVA was conducted with group as between factor, accuracy scores as dependent variable and the total average score of the IIP as covariate. The analyses revealed still a main effect of group [$F(1,57) = 5780$; $P = 0.019$; $\eta^2 = 0.092$; power = 0.657]; without covariate, the main effect of group was: $F(1,58) = 15\,860$; $P < 0.0001$; $\eta^2 = 0.260$; power = 0.993). Thus, interpersonal difficulties seem to mediate an important part (almost two-thirds of the variance) of the relationship between alcoholism and EFE decoding accuracy, as shown by the η^2: the size of the main effect of group is diminished when the total average score of the IIP is introduced as a covariate.

DISCUSSION

Recently detoxified alcoholics (RA) display emotional facial expression (EFE) decoding impairment, making more errors than normal controls (NC). Furthermore, RA do not perceive their EFE decoding problems as reflected by the fact that they judge the test as having the same difficulty level as NC. These results are consistent with our previous studies (Philippot *et al*., 1999; Kornreich *et al*., 2001*a*) as well as others (Monot *et al*., 2001) showing that non-verbal decoding abilities are altered in alcoholics.

RA reported more interpersonal difficulties than NC. They expressed a clear perception of interpersonal problems, contrasting with their non-identification of EFE decoding difficulties.

Reported interpersonal difficulties are correlated with EFE decoding problems. This is consistent with other data showing that the ability to interpret non-verbal emotional cues plays an important role in maintaining successful relationships (Vosk *et al*., 1983; Spence, 1987; Carton *et al*., 1999). The direction of the relationship between interpersonal problems and EFE decoding scores may not be established with our data, even if it appears likely that poor ability to decode emotional expression induces interpersonal problems instead of the other way round.

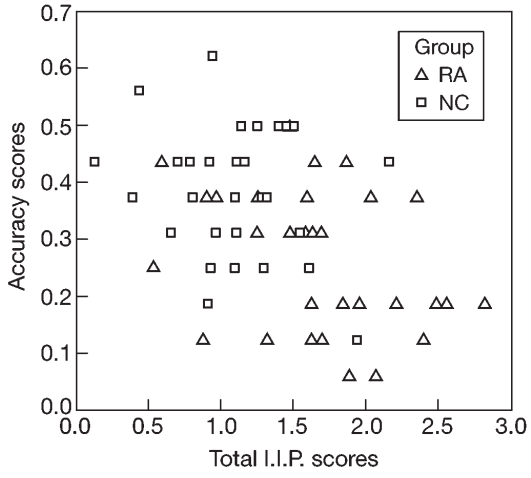

Fig. 4. Relationship between emotional facial expression (EFE) decoding scores (accuracy) and the total average score of the Inventory of Interpersonality Problems (IIP).
NC, normal controls; RA, recently detoxified alcoholics.

Many researchers assume that non-verbal deficits cause relationship difficulties. Alternatively, the relation may be bi-directional, people with high-quality relationships having more opportunities to practise and improve their non-verbal skills (Boyatzis and Satyaprasad, 1994).

The following model could explain the relationship between EFE decoding problems and interpersonal problems in alcoholism: EFE decoding problems would be susceptible to induce interpersonal difficulties in alcoholics while sober, which in turn could represent a relapse factor. Interestingly, alcoholics seem to know theoretically what to do in interpersonal situations, but are unable to implement the strategies they recommend for themselves (Gaffney *et al*., 1998). We suggest that they may not use correctly the environmental cues, such as their partners' non-verbal behaviour, because of EFE decoding difficulties. More specifically, alcoholics could feel less comfortable in close relationships, because of their difficulties in having finely tuned appraisal of their partner's intentions and feelings. This might contribute to depriving them of the affective support linked to intimate relationships, a factor likely to promote relapse. Moreover, social situations might be less controllable, in the context of impaired EFE decoding. This may lead to alcohol consumption in order to relieve socially mediated stress.

Two different, not mutually exclusive, lines of explanations might underlie EFE decoding impairment in RA. Firstly, EFE decoding accuracy problems might precede the onset of alcoholism. This would be consistent with the fact that social skills deficits, of which interpretation of non-verbal behaviour could be part, have been described in populations at risk for alcoholism (Gaffney *et al*., 1998). For instance, children of alcoholics are at increased risk of developing alcoholism (Twentyman *et al*., 1982; Drake and Vaillant, 1988; Jones and Houts, 1992) and are characterized by problems in their relationships with others (Tarter and Edwards, 1988; Woodside, 1988; Jones and Houts, 1992; Noll *et al*., 1992; Black *et al*., 1986; Senchak *et al*., 1996).

Both genetic and environmental factors may be susceptible to induce EFE recognition problems. Regarding environmental factors, some families may be characterized by unreliability between EFE displayed by the parents and the interaction outcome. Confusion could then occur during the child-rearing process regarding the correct interpretation of EFE leading to accuracy errors.

Secondly, chronic alcohol consumption *per se* may have an impact on EFE decoding skills. Alcoholism is associated with severe and multiple cognitive problems, some persisting for long after alcohol cessation (Parsons, 1998). EFE decoding deficit is less severe in alcoholics abstaining for ≥2 months, pointing to some role of chronic alcohol consumption impact on the brain (Kornreich *et al*., 2001*b*). Similar brain regions are altered by chronic alcohol consumption on the one hand and are part of the EFE decoding process on the other. Cerebral structures implicated in the decoding of an EFE follow an

occipito-frontal axis with a right hemisphere advantage (Streit *et al*., 1999). Chronic alcohol consumption has a particular impact on frontal regions (Krill *et al*., 1997; Harper, 1998). Alcohol's negative impact on EFE decoding function could therefore involve right frontal region dysfunction.

Several limitations to our study must be discussed. Our sample is composed of both male and female subjects. Women are generally credited with better non-verbal decoding performances than men (Hall, 1984). However, we did not find a gender effect on accuracy scores with the EFE test we used, neither in this, nor in a previous, study. But, it must be noted that the small samples preclude any firm conclusions regarding the respective susceptibility of male and female RA to have impaired EFE processing. This study examined RA and conclusions reached regarding the potential impact of EFE decoding problems could therefore not be transferable to other stages of the alcoholic disease. Interpersonal difficulties were self-reported through the use of a questionnaire and could prove less reliable than report by 'significant others' or direct observations. Moreover, EFE is only part of non-verbal communication. Prosody and body language were not examined. Finally, the use of an EFE test has less ecological validity, compared to the use of real-life situations, where contextual clues might compensate for the EFE dysfunction observed.

Interpersonal difficulties are known to be a major source of relapse in recently detoxified alcoholics (Marlatt, 1996). Interpersonal difficulties appear to be related to EFE decoding errors in this specific population. It could therefore be of interest to include non-verbal skills training in relapse prevention treatment programmes and to evaluate its potential additional efficacy.

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