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Brief report

The "Reading the Mind in the Eyes" test as a new way to explore complex emotions decoding in alcohol dependence

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ABSTRACT

It has been repeatedly shown that alcohol dependence is associated with emotional impairments, particularly for emotional facial expression decoding. Nevertheless, most earlier studies focused on basic emotions and did not explore more subtle affective states. In order to obtain a more accurate evaluation, and in view of earlier results showing impaired performance for this task among high-risk children of alcohol-dependent participants, the "Reading the Mind in the Eyes" test was used here to explore emotional recognition in alcohol dependence. We showed that the deficit described earlier for basic negative emotions is (1) generalizable to complex and positive emotions; and (2) specific for emotional features. This strengthens the proposition of a general face recognition impairment in alcohol dependence.

1. Introduction

Alcohol dependence is associated with many behavioral alterations, notably at the emotional level. Marked affective impairments have been identified in alcohol dependence, particularly for the recognition of emotional facial expressions (EFE, see Uekermann and Daum, 2008, for a review). It has been hypothesized (e.g. Plutchik, 2003) that this EFE recognition impairment could be implicated in the maintenance of alcohol dependence: indeed, the EFE decoding deficit could worsen interpersonal problems in alcohol dependence and lead to social isolation, which may in turn increase the use of alcohol as a coping strategy to face the stress induced by social problems, thus creating a vicious circle (Kornreich et al., 2002). Earlier studies showed negative EFE decoding deficit (e.g. Philippot et al., 1999; Frigerio et al., 2002; Clark et al., 2007), but most of them focused on classical basic emotions (e.g. anger, disgust, happiness) and thus present several shortcomings:

(1) *Weak variety of emotions*: with the notable exception of a study conducted among children with a positive family history of alcohol dependence (Hill et al., 2007), earlier studies only proposed narrow and artificial EFE stimulations as compared to real life situations, where EFE consist of highly diversified displays. The recognition of subtle emotions and affective mental states (e.g., interest, and worry; see Harkness et al., 2005, for a review), which are the most frequent in everyday life, has never been explored among recently detoxified alcohol-dependent participants;

(2) *Imbalance between positive and negative emotions*: most of these studies only used one positive emotion (i.e. happiness) but several negative ones (see Uekermann and Daum, 2008, for a review). The dissociation they observed between preserved positive and impaired negative EFE processing could thus be an experimental artefact due to an imbalance between emotional valences rather than to a specific impairment for negative emotions;

(3) *Lack of valid control task*: while earlier studies did compare alcohol-dependent participants with healthy controls, most of them (e.g. Philippot et al., 1999; Frigerio et al., 2002; Kornreich et al., 2002; Townshend and Duka, 2003) did not use any control (i.e. non-emotional) task to check whether the emotional processing deficit was specific for emotions and not just part of a general non-emotional face processing impairment. Recent studies (e.g. Foisy et al., 2007b; Hill et al., 2007; Maurage et al., 2008) gave some insights concerning this question by using control tasks, but the emotional specificity of the deficit in alcohol dependence is still to be confirmed.

In order to overcome these limits, the present study will use the "Reading the Mind in the Eyes" test (RMET, Baron-Cohen et al., 2001), as this task: (1) explores subtle EFE decoding, beyond basic emotions; (2) uses different categories of positive emotions; and (3) uses a non-emotional control task offering a valid comparison with the emotional task. Initially used as a mindreading task (e.g. Richell et al., 2003), the RMET explores the ability to infer others' emotional states expressed by the eyes and proposes a wide variety of positive, negative and neutral stimuli. It has thus recently been used as a complex emotion

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recognition test in healthy and psychopathological populations, and now constitutes an original and reliable evaluation of subtle EFE decoding (e.g. Shamay-Tsoory et al., 2009; Guastella et al., 2010; Harrison et al., 2010). Moreover, it has recently been shown that RMET performance is impaired among high-risk individuals (i.e. non-dependent young adults with a positive family history of alcohol dependence, Hill et al., 2007), and the present work notably aimed at extending these previous results to alcohol-dependent individuals. Finally, as compared to classical emotion decoding tasks, the RMET involves both easy and difficult items (thus avoiding ceiling effects, e.g. Domes et al., 2007) and does not imply cognitive abilities known to be impaired in alcohol dependence (e.g. memory load). In view of these characteristics, the RMET thus constituted an ideal way to test our main hypotheses, namely that the EFE decoding deficit in alcohol dependence, up to now observed for basic emotions, is also present for subtle affective states (particularly for positive emotions) and is emotion-specific (i.e. absent for neutral stimuli).

2. Methods

2.1. Participants

Twenty-four inpatients (9 females; mean age: 48.63 ± 8.76 years), diagnosed with alcohol dependence according to DSM-IV criteria, were recruited during their third week in a detoxification center. They had all abstained from alcohol for at least 10 days (mean = 14.29, SD = 3.66), were free of any other psychiatric diagnosis as assessed by an exhaustive psychiatric examination based on a structured interview [i.e. the Mini International Neuropsychiatric Interview, MINI (Sheehan et al., 1998) performed by a trained psychiatrist] and were all right-handed. Their mean alcohol consumption just before detoxification was 21.38 alcohol units per day (SD = 9.73, a unit corresponding to 10 g of pure ethanol), the mean number of previous detoxification treatments was 2.38 (SD = 2.51) and the mean total duration of alcohol dependence was 11.79 years (SD = 9.64). Patients were matched for age, gender and education with a control group of 24 volunteers who were free of any history of psychiatric disorder (also assessed using the MINI) or drug/substance abuse. The mean alcohol consumption in the control group was 3.9 U per week (SD = 2.3), and control participants abstained from any alcohol consumption for 3 days before testing. Exclusion criteria for both groups included major medical problems, neurological disease and polysubstance abuse. Each participant had a normal-to-corrected vision. All control participants were free of any medication, but 13 alcohol-dependent individuals still received benzodiazepines (mean = 33.96 mg/day, SD = 39.42). Participants were provided with full details regarding the aims of the study and the procedure and gave their informed consent. The study was approved by the Ethical Committee of the Medical School.

2.2. Task and procedure

2.2.1. Psychosocial measures

Every participant was assessed to validate self-completion questionnaires (mentioned in brackets) to evaluate the presence of sub-clinical psychopathologies: anxiety (State and Trait Anxiety Inventory, forms A and B; Spielberger et al., 1983), depression (Beck Depression Inventory; Beck and Steer, 1987), interpersonal problems (Inventory of Interpersonal Problems, IIP; Horowitz et al., 1988) and alexithymia (20-item Toronto Alexithymia Scale; Bagby et al., 1994). Indeed, as alexithymia (i.e. the difficulty to feel and identify one's own emotions) is associated with impaired emotion decoding (e.g. Parker et al., 1993; Pedrosa Gil et al., 2008) and is frequent in alcohol dependence (e.g. Taieb et al., 2002; Uzun et al., 2003), it appeared crucial to control the potential moderating effect of alexithymia on emotion recognition among alcohol-dependent participants. Moreover, as the results of the experimental task may be influenced by the general vocabulary level, the Vocabulary subtest of the Wechsler Adult Intelligence Scale, Third Edition (WAIS-III; Wechsler, 1997) was used to verify that the groups did not differ for vocabulary abilities.

2.2.2. Experimental task

A computerized version of the RMET (Baron-Cohen et al., 2001; Havet-Thomassin et al., 2006, Morissette et al., submitted for the French translation) was used, consisting of 36 photographs (18 males) of eyes expressing a complex mental state. Photographs were presented one by one together with four adjectives (a target and three foils) displayed around the face. For each item, a participant had to decide which one best described what the person in the photograph was feeling (by clicking on this adjective with the mouse). While most distractors had roughly the same emotional valence as the target word, distractors and target did not systematically share the same valence. Participants had unlimited time to decide, but were asked to answer as fast as possible (reaction times were recorded). In line with previous studies, a glossary presenting a brief definition of each word presented was available if needed. A first item was used as an example and then the 36 experimental items appeared successively. Global performance (percentage of correct answers) was calculated, as well as subscales scores (following a validated RMET item valence classification; Harkness et al., 2005) for positive [8 items; i.e. playful, fantasizing (2×), thoughtful, friendly, interested, flirtatious, confident], negative (12 items, i.e. upset, worried, regretful, accusing, doubtful, preoccupied, defiant, hostile, cautious, distrustful, nervous, suspicious) and neutral (16 items, i.e. desire, insisting, uneasy, despondent, preoccupied, cautious, skeptical, anticipating, contemplative, decisive, tentative, pensive, interested, reflective, serious, concerned) valence.

3. Results

3.1. Psychosocial measures

One-way analyses of variance (ANOVAs) showed no significant group differences for age [$F(1,46) = 3.28$, $p = 0.076$], education [$F(1,46) = 0.67$, $p = 0.415$], vocabulary [$F(1,46) = 2.59$, $p = 0.114$] and state anxiety [$F(1,46) = 3.41$, $p = 0.071$]. Alcohol-dependent participants obtained higher scores than controls for depression [$F(1,46) = 7.51$, $p = 0.009$], trait anxiety [$F(1,46) = 7.11$, $p = 0.011$], interpersonal problems [$F(1,46) = 13.91$, $p = 0.001$] and alexithymia [$F(1,46) = 5.54$, $p = 0.023$].

3.2. Experimental measures

As shown in Fig. 1, alcohol-dependent participants presented lower performance than controls for the global RMET score [$F(1,46) = 5.61$, $p = 0.022$] as well as for the positive [$F(1,46) = 9.28$, $p = 0.004$] and negative [$F(1,46) = 6.85$, $p = 0.012$] items subscales. No significant group difference were found for the neutral items subscale [$F(1,46) = 0.05$, $p = 0.821$] and reaction times in any RMET subscale [$F(1,46) < 1.52$, $p > 0.22$].

3.3. Complementary analyses

As differences in psychosocial measures could influence the experimental results, Pearson's correlations were computed between control measures and RMET results. The only significant correlation was between the positive items subscale score and the IIP score among alcohol-dependent participants [$\rho = -0.366$, $p = 0.011$]. Moreover, all the psychosocial measures were included as covariates in our ANOVAs. There was no significant influence of psychosocial measures on any experimental results [$F < 2.52$; $p > 0.10$].

4. Discussion

Following a previous study among high-risk individuals (Hill et al., 2007), the RMET task was used here to explore the ability of alcohol-dependent participants to decode a wide range of complex emotional facial expressions. Indeed, the RMET offered a precise evaluation of EFE decoding deficits among alcohol-dependent adults, and led to the following main results.

First, results showed that the EFE decoding deficit in alcohol dependence can be generalized to more complex emotional states. Indeed, this deficit is not only present for prototypical and basic stimuli, as it had been described in many earlier studies (e.g. Philippot et al., 1999; Frigerio et al., 2002; Townshend and Duka, 2003; Foisy et al., 2007a; 2007b), but also when using more ecological stimulations. This reinforces the proposition of a general facial emotion processing deficit in alcohol dependence (e.g. Uekermann and Daum, 2008; Maurage et al., 2009). The present results are also in line with those obtained for the same task among high-risk individuals (Hill et al., 2007), suggesting that this deficit could be present before the appearance of alcohol dependence. As the present results do not allow us to propose causal inferences, further studies are thus needed to explore the causal link between the facial emotion recognition deficit and alcohol dependence.

Second, this deficit is also present for positive emotions when a variety of positive emotional states are used. Alcohol-dependent participants were impaired for negative items but also for positive ones, which contradicts earlier studies showing a preserved ability to

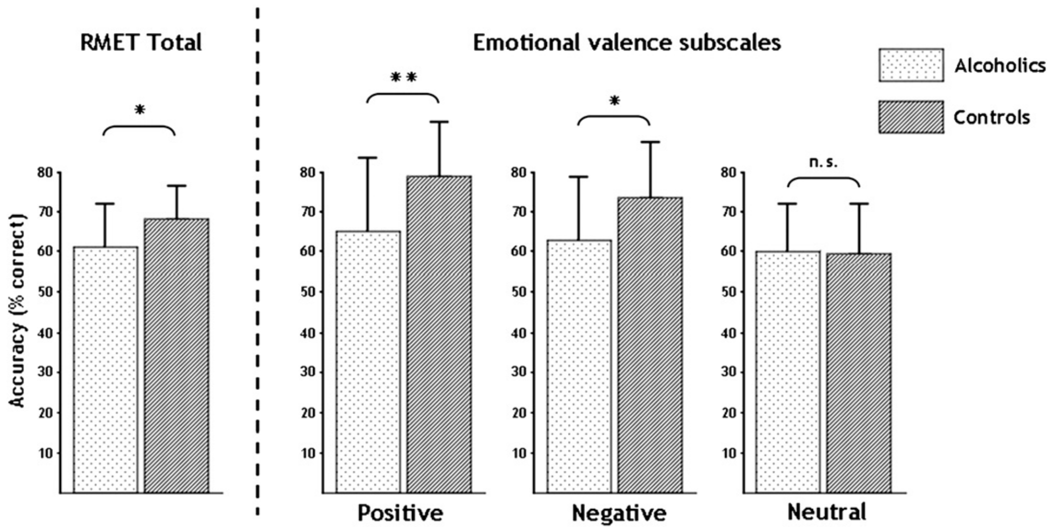

Fig. 1. Alcoholic and control participants' mean accuracy scores for RMET global score and each subscale score. This figure illustrates the *specific deficit for emotional recognition*: while no significant group differences are observed for non-emotional stimuli (neutral subscale), alcoholism leads to reduced RMET global score and emotional subscales scores (positive and negative items). N.S. = non significant; * = $p<0.05$; ** = $p<0.01$.

decode positive facial emotions (e.g. Philippot et al., 1999; Frigerio et al., 2002; Clark et al., 2007). The specific deficit for negative facial emotions described earlier could thus be an experimental artefact due to the imbalance between multiple negative stimuli and a unique positive one: in the classical EFE tasks, happiness faces appeared suddenly in a stream of negative ones and were thus easier to identify. Moreover, this discrepancy between our results and those obtained in earlier studies do not appear to be explainable by major differences in alcohol-dependent individuals' characteristics, as our sample is very close (concerning sociodemographic or psychosocial variables as well as alcohol consumption aspects) to those described in earlier studies (e.g. Philippot et al., 1999; Frigerio et al., 2002; Clark et al., 2007; Foisy et al., 2007b).

Finally, the EFE decoding impairment in alcohol dependence is specific for the emotional features of faces, as no deficit was found for neutral RMET task items. Interestingly, this preservation of non-emotional item decoding cannot be explained by a complexity difference with emotional ones as the difficulty is comparable for emotional and non-emotional valence subscales (Harkness et al., 2005). As it had already been suggested earlier (Foisy et al., 2007b; Hill et al., 2007; Maurage et al., 2008), alcohol dependence is thus not associated with a general impairment for facial features but rather with a particular problem for facial emotions recognition.

It should also be noted that the data obtained can neither be explained by psychopathological comorbidities (no correlations were found between psychosocial and experimental measures), nor by speed–accuracy trade-off (groups did not differ for reaction times) or vocabulary (groups did not differ for vocabulary) differences. Finally, the significant negative correlation between positive subscale and IIP scores strengthens the proposition (e.g. Kornreich et al., 2002) of a link between facial emotion recognition and interpersonal impairments in alcohol dependence: impaired sensitivity to subtle facial emotional cues could play a role in social disturbances observed among alcohol-dependent individuals.

The present results have several potential implications. At the experimental level, they call for developing more ecological and diversified tools to evaluate the EFE decoding deficit in alcohol dependence, as classical tasks are insufficient to correctly evaluate this deficit. At the clinical level, the present results add further to the many recent reports showing emotional deficits in alcoholism (see Cheetham et al., 2010, or Uekermann and Daum, 2008, for recent reviews). The present results do not allow infer a causal link between the deficit in facial emotion recognition and alcohol dependence, but they highlight the need to consider these emotional impairments during the evaluation and therapy of alcohol-related impairments. Indeed, while emotional deficits are now considered as a central therapeutic concern in several psychiatric states, leading to the growth of emotion-focused treatments (e.g. Suveg et al., 2006; Trosper et al., 2009), such treatment approaches are lacking for alcohol-dependent patients. In conclusion, this study using the RMET to explore the EFE decoding deficit in alcohol dependence (and particularly the differential deficit according to stimulus valence) is an important step towards a more realistic evaluation of emotional abilities.

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