Alexithymia in Relation to Alcohol Use, Emotion Recognition and Empathy: The Role of Externally Oriented Thinking

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Abstract

Both alcohol misuse and the externally oriented thinking (EOT) facet of alexithymia are associated with deficits in facial emotion recognition and emotional empathy. The aim of the present study was to investigate whether EOT mediates the association of drinking with these deficits, and to test the hypothesis that impaired facial emotion recognition mediates the relationship between EOT and low emotional empathy, in a non-clinical sample. The sample was comprised of 161 men and women who completed an online survey which included the Alcohol Use Disorders Identification Test (AUDIT), Depression Anxiety Stress Scales, Interpersonal Reactivity Index (IRI), Reading the Mind in the Eyes Test (RMET), and Toronto Alexithymia Scale (TAS-20). In addition to replicating associations between TAS-20 and other measures, EOT was found to mediate relationships between potential alcohol misuse (as indexed by AUDIT) and facial emotion recognition (as indexed by RMET) as well as emotional empathy (as indexed by the corresponding subscale of the IRI) after controlling for mood and demographic variables. The negative relationship between EOT and emotional empathy was mediated by impaired facial emotion recognition. Present findings point to a likely role of the EOT trait in the reported associations of alcohol misuse with both poor emotion recognition and low emotional empathy, and a mediating role of poor emotion recognition in the relationship of EOT to the latter.

Alexithymia, a personality trait involving difficulties in identifying and describing one's own emotional feelings and an externally oriented or concrete thinking style (Taylor, Bagby & Parker, 1997), has been reported to be strongly associated with alcohol misuse as well as interpersonal difficulties (e.g., Thorberg, Young, Sullivan & Lyvers, 2009; Thorberg et al., 2011; Vanheule, Desmet, Meganck, & Bogaerts, 2006). Research supports the existence of three distinct facets or dimensions of alexithymia as reflected in the subscales of the Toronto Alexithymia Scale (TAS-20; Bagby, Parker, & Taylor, 1994): difficulty identifying feelings (DIF), difficulty describing feelings (DDF) and externally oriented thinking (EOT). Of the three facets, EOT has specifically been linked to deficits in recognizing external cues of emotion (Demers & Koven, 2015; Grynberg et al., 2013; Lyvers, Kohlsdorf, Edwards & Thorberg, in press), which may contribute to the social difficulties reported by those with high levels of alexithymia (e.g., Qualter, Quinton, Wagner & Brown, 2009).

The concrete thinking or EOT facet of alexithymia has been found to predict deficits of facial emotion recognition and emotional empathy (Demers & Koven, 2015; Lyvers et al., in press), both of which have also been linked to alcohol use disorders (Maurage et al., 2011; Onuoha, Quintana, Lyvers & Guastella, 2016). The association with alcohol has sometimes been assumed to reflect a consequence of chronic alcohol on the brain (e.g., Kopera et al., 2014). Arguing against that notion is the recent evidence that alexithymia, a relatively stable personality trait (Picardi, Toni & Caroppo, 2005), is strongly associated with alcohol misuse as well as deficient facial recognition of emotions. This would appear to imply that at least part of the association between alcohol misuse and deficient emotion recognition is mediated by alexithymia – particularly the EOT facet - as a pre-drinking trait rather than as a consequence of alcohol exposure. Further, the negative associations of alexithymia and its EOT facet with emotional empathy may be secondary to the facial emotion recognition

deficit, such that those who have difficulty recognizing the emotional states of others should logically be impaired in their ability to identify such states in others and empathize with them. These ideas were examined in the present study.

The prevalence of high levels of alexithymia among adults within the general population has been reported at 5-13 percent (e.g., Franz et al., 2008; Mattila, Salminen, Nummi, & Joukamaa, 2006), but is far greater among substance dependent samples at 40-67 percent (e.g., Lyvers, Hinton et al., 2014; Thorberg et al., 2009). Alexithymia is associated with deficits in the ability to recognize and label facial expressions of both positive and negative emotions, as well as deficiencies of emotional empathy and affective theory of mind (e.g., Demers & Koven, 2015; Grynberg, Luminet, Corneille, Grezes & Berthoz, 2010; Lyvers et al., in press). Prakachin, Casey and Prkachin (2009) reported significant negative associations between TAS-20 alexithymia scores and recognition of facial expressions of basic emotions including sadness, anger and fear, suggesting that those scoring high on the alexithymia spectrum may tend to misread others' emotions and fail to respond appropriately. A more recent study (Lyvers et al., in press) found that TAS-20 total alexithymia scores, and EOT subscale scores in particular, were negatively related to facial emotion recognition on the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste & Plumb, 2001) as well as emotional empathy as indexed by the Empathic Concern (EC) subscale of the Interpersonal Reactivity Index (IRI; Davis, 1980). Other recent research by Grynberg et al. and Demers and Koven has obtained similar findings. Like Lyvers et al., Demers and Koven found that EOT uniquely and negatively predicted variance in both facial emotion recognition (as indexed by RMET) and an index of emotional empathy that was similar to EC.

Maurage et al. (2011) reported that facial emotion recognition performance on the RMET was impaired in detoxified clients undergoing treatment for alcohol dependence

compared to controls, a finding consistent with evidence of theory of mind deficits in alcohol use disorders (Kopera et al., 2014; Onuoha et al., 2016). Given the strong associations of trait alexithymia with alcohol and other substance use disorders (Lyvers, Hinton et al., 2014; Thorberg et al., 2009; Thorberg et al., 2016), deficient facial emotion recognition in an alcohol-dependent sample would seem plausibly attributable to the high levels of alexithymia commonly found in such samples; however, Maurage et al. reported that the RMET performance of their alcohol dependent sample was independent of alexithymia and other trait factors. By contrast, Lyvers et al. (in press) recently reported that after controlling for alcohol consumption as well as negative moods and demographic variables in a sample of social drinkers, EOT uniquely and negatively predicted RMET facial emotion recognition as well as IRI-EC emotional empathy scores. An impact of chronic alcohol on the brain was unlikely to account for the deficits in facial emotion recognition and emotional empathy associated with EOT in their study given the young, non-clinical sample and the independence of the associations from alcohol use. In non-clinical samples of young adults, higher scores on the TAS-20 index of alexithymia are often associated with heavier and riskier alcohol consumption as defined by instruments such as the Alcohol Use Disorders Identification Test, or AUDIT (e.g., Lyvers, Onuoha, Thorberg & Samios, 2012), suggesting that high trait alexithymia is a risk factor for such consumption. The present study examined the hypothesis that relationships between riskier or more problematic drinking and deficiencies of facial emotion recognition and emotional empathy would be mediated by EOT in a non-clinical sample, consistent with a pre-drinking trait interpretation of such relationships rather than a consequence of long-term alcohol exposure.

The externally oriented thinking or EOT facet of alexithymia is distinct from the difficulties identifying and describing one's emotional feelings (DIF and DDF) facets in a number of respects (Herbert, Herbet & Pollatos, 2011; Vanheule, Meganck & Desmet, 2011).

For example, although all three TAS-20 subscales – DIF, DDF, and EOT - were significantly correlated with measures of executive cognitive dysfunction in research by Lyvers, Makin, Toms, Thorberg and Samios (2014), only DIF and DDF were related to indices of negative moods, and the correlation of .58 between DIF and DDF was nearly twice as high as the correlations of either subscale with EOT. Alexithymia has consistently been found to comprise these three dimensions (e.g., Nemiah, Freyberger, & Sifneos, 1976; Taylor et al., 1997), however the DIF and DDF facets reflect poor awareness of one's own internal emotional states, whereas the EOT facet is more associated with deficits in recognizing and understanding the emotions of others (Demers & Koven, 2015). Demers and Koven reported that EOT was the only significant predictor of facial emotion recognition accuracy as indexed by RMET in their study. They also reported a significant negative relationship between EOT and emotional empathy as measured by the Questionnaire Measure of Emotional Empathy (QMEE; Davis, 1994).

Similar results were recently reported by Lyvers et al. (in press), who found that EOT was the only alexithymia dimension of the three to predict facial emotion recognition as measured by the RMET, and that EOT negatively predicted scores on the IRI-EC index of emotional empathy. Because EOT was a unique negative predictor of both RMET and EC scores, the negative relationship between EOT and emotional empathy might logically be mediated by impaired facial emotion recognition. However, in Lyvers et al.'s (in press) predominantly female undergraduate psychology student sample, the correlation between RMET and EC fell short of statistical significance (though RMET was significantly correlated with the Perspective Taking IRI subscale, a measure of the cognitive aspect of empathy). Lyvers et al. (in press) concluded that the relationship they observed between EOT and the EC index of emotional empathy might reflect a more fundamental processing deficit rather than simply a deficit in facial recognition of emotion, perhaps a deficit in

metacognition as hypothesized by Demers and Koven. Yet previous work by Lyvers, Makin et al. (2014) found that although the DIF and DDF facets of alexithymia showed substantial negative associations with scores on the Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003), the correlation of EOT with MAAS was virtually zero. Thus to the extent that trait mindfulness reflects metacognition – a notion supported by other findings in the study by Lyvers, Makin et al. (2014) - those results would seem to argue against the hypothesis of Demers and Koven.

An alternative possibility is that a larger and more representative sample than that used in the Lyvers et al. (in press) study – which primarily consisted of young female undergraduate psychology students - would show statistically significant links between RMET facial emotion recognition and IRI-EC emotional empathy scores, with the negative association between EOT and emotional empathy mediated by deficient facial recognition of emotion. The aims of the present study were thus twofold: (1) to investigate whether the concrete thinking or EOT facet of alexithymia mediates the association of risky or problematic drinking with deficiencies of facial emotion recognition and emotional empathy, and (2) to test the hypothesis that impaired facial emotion recognition mediates the relationship between EOT and low emotional empathy in a larger and more representative sample than that used in the Lyvers et al. (in press) study. The goal was to help elucidate the theoretical basis of the consistently reported associations of alcohol misuse with emotion recognition and empathy deficits, as well as the negative relationship of alexithymia and its EOT facet to emotional empathy.

Method

Participants

The initial sample of 191 participants included undergraduate students and members

of the local community. University student participants were recruited via a university student research participation pool for an incentive of one credit point in a psychology subject. Community participants were recruited from advertisements in local newspapers for the incentive of a $40 shopping voucher. The notices asked for social drinkers who did not use illicit drugs more often than once per month. After identifying cases that did not meet the inclusion criteria for the study, 18 cases were removed, including 9 participants who indicated not having normal or corrected to normal vision (crucial for the RMET); 1 participant who reported previously experiencing a traumatic brain injury; and 8 participants who reported that they had been diagnosed with a psychiatric or neurological illness. A further 12 cases were removed as multivariate outliers, leaving a final sample of 161 participants (72 males, 89 females) aged 18-63 years (M = 22.64, SD = 7.15). Of these, 114 (71 percent) were recruited from the local community.

The highest level of education achieved was year 12 for 83% of participants, a Bachelor's degree for 14%, and a Master's degree for 4%. In terms of AUDIT risk categories (defined below), 24% met AUDIT criteria for low risk drinking, 47% for hazardous drinking, and 27% for harmful drinking, which was very similar to other recent samples of young Australian adults (e.g., Lyvers, Hasking, Albrecht & Thorberg, 2012). For the TAS-20 alexithymia categories (defined below), 71% were defined as having low or no alexithymia, 21% as borderline high alexithymia, and 8% as high alexithymia, well in line with the population prevalence estimates cited earlier above.

Materials

The following instruments were administered to all participants.

Demographics. These questions asked for the participant's gender, age, country of origin, highest level of completed education and English proficiency. The participants were also asked if they consume alcohol, and if applicable, at what age they began consuming

alcohol weekly. Additional questions asked if they had normal or corrected to normal vision, had previously experienced a traumatic brain injury, and whether or not they had been diagnosed with any psychiatric or neurological illness, all of which reflected exclusion criteria.

Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 1992). The AUDIT is a 10 item self-report screening tool for problematic alcohol consumption. The instrument includes three items that assess alcohol consumption (e.g. "How often do you have a drink containing alcohol?"), three items that examine alcohol dependence (e.g. "How often during the last year have you found that you were not able to stop drinking once you had started?") and four items that assess drinking consequences (e.g. "How often during the last year have you been unable to remember what happened the night before because you had been drinking?"). Items 1-8 are scored on a five-point Likert scale with response options from 0-4. The final two questions are scored on a three-point Likert scale from 0 (*no*) to 4 (*yes, during the last year*). Total scores are calculated by summing items and can range from 0 to 40. Scores between 0 and 7 reflect low risk drinking, whereas scores of 8-15 indicate hazardous drinking, and scores of 16 and above represent harmful drinking. In the present sample the internal consistency coefficient Cronbach's alpha for the AUDIT was .81.

Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is 21 item self-report instrument assessing depression, anxiety and stress via corresponding 7-item subscales. Participants are instructed to indicate the extent to which each statement applied to them over the past week on a four-point Likert scale that ranges from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). The depression subscale consists of items tapping depressive symptomology such as "I felt I wasn't worth much as a person"; the anxiety subscale consists of items assessing anxious

symptomology such as “I felt I was close to panic”; and the stress subscale consists of stress-related items such as “I find it hard to wind down.” As the DASS-21 is a short form version of the original 42-item DASS, scores are multiplied by two to be comparable. The present study used the total DASS-21 score as an index of negative mood, yielding a Cronbach’s alpha of .91.

Interpersonal Reactivity Index (IRI; Davis, 1980). The IRI is a self-report measure that assesses cognitive and emotional dimensions of empathy. It contains 28 items comprising four subscales: perspective taking (PT), fantasized thinking (FT), empathic concern (EC) and personal distress (PD). The PT subscale assesses one’s tendency to consider the perspectives of others (e.g., “I sometimes try to understand my friends better by imagining how things look from their perspective”); the FT subscale measures one’s tendency to fantasize about emotional situations, particularly those of fictional characters (e.g., “I day dream and fantasize, with some regularity, about things that may happen to me”); the EC scale assesses one’s ability to be emotionally affected by the situations of others (e.g., “I often have tender, concerned feelings for people less fortunate than me”); and the PD subscale measures one’s tendency to remain calm in emotional situations (e.g., “I tend to lose control during emergencies”). Responses are measured on a five-point Likert scale that ranges from 0 (*does not describe me well*) to 4 (*describes me very well*). The Cronbach alpha for the IRI was .82 in the present study.

Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The RMET is a unidimensional measure that uses 36 black and white photographs of male and female eyes to assess facial emotion recognition via eye gaze. Each photograph is accompanied by four emotion words, and the participant is instructed to select the word they believe best describes what the person is feeling. A glossary is provided to help participants understand the definition of any response options they do not understand. A non-

scored practice item is given before the task. Participants are given one point for every correct response, and zero points for incorrect responses. Total scores range from 0 to 36, with higher scores denoting better facial emotion recognition. In the present study the Cronbach's alpha for the RMET was .76.

Toronto Alexithymia Scale (TAS; Bagby, Parker, & Taylor, 1994). The TAS-20 is a 20-item self-report index of alexithymia. There are three subscales corresponding to the three facets of alexithymia, difficulty identifying feelings (DIF), difficulty describing feelings (DDF) and externally oriented thinking (EOT). The DIF subscale includes seven items and measures the extent to which one finds it difficult to identify their feelings (e.g. "When I am upset, I don't know if I am sad, frightened, or angry"); the DDF subscale includes five items which assess the extent to which one has difficulty describing their own feelings (e.g. "It is difficult for me to find the right words for my feelings"); and the EOT subscale includes eight items which measure one's tendency to think in a concrete manner (e.g., "I prefer to just let things happen rather than to understand why they turned out that way"). Responses to the TAS-20 are scored on a five-point Likert scale with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Of the 20 items, five are reverse-scored. Total scores range between 20 and 100, with higher scores denoting higher alexithymia. TAS-20 cut-offs specify low or no alexithymia as indicated by total scores of less than 52, whereas borderline high alexithymia is defined by scores of 52-60, and high alexithymia by scores over 60. In the present study Cronbach's alpha for the TAS-20 was .83.

Procedure

The present study obtained approval from the university ethics committee prior to data collection. Instruments were administered online via Survey Monkey. Interested individuals were instructed to e-mail one of the primary researchers, and were then sent a link to the online survey. Before participants were able to begin the survey, they were instructed

to read an explanatory statement which gave a summary of the study, explained that participation was voluntary and all responses were anonymous, and stated that participation could be withdrawn at any time. Incentives were provided after participants emailed the researchers a screen shot of the final page of the online survey.

Results

Pearson's product-moment correlations were calculated for the continuous measures and are shown in Table 1.

< INSERT TABLE 1 NEAR HERE>

The AUDIT index of risky or problematic drinking was positively correlated with all three TAS-20 alexithymia subscales and the negative mood index of total DASS-21, and negatively correlated with both RMET facial emotion recognition and the EC index of emotional empathy as predicted. The EOT subscale showed the predicted significant relationships with RMET and with all four subscales of the IRI including EC. RMET was positively correlated with IRI-EC, IRI-PT and IRI-FS. An index of duration of alcohol exposure was created by subtracting age at onset of weekly drinking from current age; this "drinking history" measure was uncorrelated with RMET and all TAS-20 and IRI subscales, which would appear inconsistent with an interpretation of the negative relationships of risky drinking with facial emotion recognition and emotional empathy as reflecting an impact of chronic alcohol exposure on the brain (e.g., Kopera et al., 2104).

Regression Analyses

Regression analyses were undertaken to test predictions involving mediation. The Steps Approach proposed by Baron and Kenny (1986) was followed. First, the predictor variable was confirmed to be related to the criterion variable. A regression was then performed to demonstrate an association between predictor and the proposed mediator. Finally a hierarchical regression was run to examine whether the proposed mediator

accounted for variance in the criterion over and above that accounted for by the predictor. If so, a Sobel test (Sobel, 1982) was performed using Preacher and Leonardelli's online Sobel Calculator (http://quantpsy.org/sobel/sobel.htm). As age and the DASS-21 negative mood index were significantly correlated with some of the other variables of interest (see Table 1), and a multivariate analysis of variance on gender revealed significant ($p < .05$) differences between men and women on RMET and EC (such that women scored higher) and on AUDIT (such that men scored higher), age, gender and DASS-21 were treated as covariates in the regression analyses reported below. There were no gender differences on total TAS-20 scores, $p = .61$, nor on EOT subscale scores, $p = .87$.

Predicting Facial Emotion Recognition from Risky Drinking and Externally Oriented Thinking. Regressions were conducted to examine for mediation of the observed negative relationship between the AUDIT index of potential alcohol misuse and RMET facial emotion recognition by the TAS-20 index of concrete thinking EOT after controlling for the impact of demographic and mood variables. First, a simple regression was conducted on EOT scores with AUDIT scores. AUDIT was a significant predictor of EOT, $F(1, 152) = 10.43$, $p = .002$. AUDIT scores accounted for 6% of variance in EOT, $R^2 = .06$. The standardised regression coefficient for this index of risky or problematic drinking was significant with a 1 *SD* increase in the AUDIT resulting in a .25 *SD* increase in EOT, $\beta = .25$, $p = .002$.

A hierarchical regression was then conducted on RMET, with age, gender, DASS-21 and AUDIT entered at Step 1, followed by EOT at Step 2. As outlined in Table 2, the covariates of age, gender and negative mood, together with AUDIT scores, accounted for a significant portion of variance in facial emotional recognition accuracy, $F_{change}(4, 149) = 5.83$, $p < .001$, $R^2{}_{change} = .14$. At this step AUDIT was the only significant predictor. At Step 2, with the addition of EOT into the model an additional 5% of variance in RMET was

accounted for, F_{change} (1, 148) = 9.81, p = .002. AUDIT remained a significant predictor at this step (see Table 2).

< INSERT TABLE 2 NEAR HERE>

The Sobel test indicated that after controlling for age, gender and negative mood, the negative relationship between risky or problematic drinking and facial emotion recognition performance was partially mediated by EOT, z = 2.25, p = .025.

Predicting Emotional Empathy from Risky Drinking and Externally Oriented Thinking. A similar series of regressions was conducted to examine for mediation of the negative relationship between the AUDIT index of risky drinking and the EC index of emotional empathy by the TAS-20 index of concrete thinking EOT after controlling for demographic and mood variables. After AUDIT was found to be a significant predictor of EOT (see above), a hierarchical regression was conducted on EC, with age, gender, DASS-21 and AUDIT entered at Step 1, followed by EOT at Step 2 (see Table 2). At Step 1, the model was significant, accounting for 10% of the variance in emotional empathy, F_{change} (4, 149) = 4.25, p = .003. At this step, AUDIT and gender were significant predictors. At Step 2, with the addition of EOT, an additional 9% of variance in EC was explained, F_{change} (1, 148) = 16.16, p < .001. At this step, AUDIT was no longer a significant predictor (see Table 2). The Sobel test indicated that after controlling for age, gender and negative moods, the negative relationship between the AUDIT index of risky or problematic drinking and the EC index of emotional empathy was fully mediated by EOT, z = 2.52, p = .012.

Predicting Emotional Empathy from Externally Oriented Thinking and Facial Emotion Recognition. A final series of regressions was performed to examine for mediation of the negative relationship between EOT and the EC index of emotional empathy by the facial emotion recognition index RMET after controlling for demographic and mood variables. First a simple regression analysis assessed the relationship between the predictor

variable EOT and the proposed mediator variable RMET. The analysis revealed EOT to be a significant predictor of emotional facial recognition, $F(1, 157) = 16.34$, $p < .001$. EOT scores explained 9% of variance in RMET scores. The standardised regression coefficient for EOT was significant with a 1 *SD* increase in EOT resulting in a .31 *SD* decrease in RMET, $\beta = -.31$, $p < .001$.

Table 3 shows the results of the hierarchical regression conducted on EC with age, gender, DASS-21 and EOT at Step 1, followed by RMET at Step 2. At Step 1, the model was significant, accounting for 18% of variance in EC scores, F_{change} (4, 154) = 8.50, $p < .001$. Both gender and EOT were significant predictors. At Step 2, the addition of RMET scores explained an additional 5% of variance in EC scores, F_{change} (1, 153) = 9.71, $p = .002$. EOT remained a significant predictor of emotional empathy at Step 2 (see Table 3).

< INSERT TABLE 3 NEAR HERE>

Sobel Test indicated partial mediation, $z = 2.47$, $p = .014$. The negative relationship between the EOT facet of alexithymia and the EC index of emotional empathy thus appeared to be partially mediated by deficient facial recognition of emotions as indexed by RMET scores in the present sample. Figure 1 illustrates the relationships among variables.

< INSERT FIGURE 1 NEAR HERE>

Discussion

The hypotheses examined in the present study were supported. Relationships of risky or problematic alcohol use (as indexed by AUDIT) with deficits of both facial emotion recognition (as indexed by RMET) and emotional empathy (as indexed by the EC subscale of the IRI) showed evidence of mediation by the externally oriented thinking facet of alexithymia (as indexed by the EOT subscale of the TAS-20). The AUDIT-RMET relationship showed partial mediation and the AUDIT-EC relationship showed full mediation by EOT. Further, the negative relationship between EOT and EC was partially mediated by

RMET, suggesting that deficient ability to recognize the emotions of others may contribute to the low emotional empathy associated with alexithymia and specifically its EOT facet. This result fits well with previous evidence that, whereas the DIF and DDF facets of alexithymia indicate poor awareness of one's own emotional feelings, the EOT facet is more related to problems identifying the emotions of others via nonverbal cues such as facial expressions (Demers & Koven, 2015). In other words, the EOT facet of alexithymia may reflect not just concrete thinking but also poor ability to link external cues of emotion to internal emotional feelings, one logical result of which is low emotional empathy. Empathizing with others in terms of their emotional feelings should theoretically be impossible if one is unable to recognize those emotions in the first place.

Associations of alcohol misuse with deficits of facial emotion recognition, emotional empathy and theory of mind have been well documented (Kopera et al., 2014; Maurage et al., 2011; Onuoha et al., 2016). The present findings suggest that even before alcohol has had the chance to cause long-term changes in brain functioning, those who are predisposed to drink heavily may be more likely to show deficiencies in these domains due to inherent trait factors such as alexithymia, which is present at high levels in alcohol use disorders (Thorberg et al., 2009) and is strongly associated with more risky or problematic drinking (as defined by AUDIT) in non-clinical samples of young adults (Lyvers et al., 2012). In the present mostly young, non-clinical sample, drinking history – an index of the duration of alcohol exposure, defined by subtracting age at onset of regular (weekly) drinking from current age – was unrelated to indices of alexithymia, externally oriented thinking, facial emotion recognition and empathy. Thus the associations of current risky or problematic drinking with poorer facial emotion recognition and lower emotional empathy more likely reflected inherent characteristics related to a predisposition to alcohol misuse rather than long-term consequences of such drinking in the present sample. This interpretation of course does not

rule out an additional role of chronic alcohol exposure eventually causing task-relevant alterations of brain function after many years of alcohol misuse (and note that risky drinking remained a significant negative predictor of facial emotion recognition even after the EOT trait was added to the model at step 2 as shown in the left panel of Table 2). Nevertheless the present findings imply that even in samples of clients undergoing treatment for alcohol use disorders, deficiencies of facial emotion recognition and emotional empathy may reflect premorbid trait factors to a significant degree.

Kopera et al. (2014) argued against such an interpretation as they found no difference in RMET facial emotion recognition performance between young adults with a family history of alcohol dependence compared to those without such a family history. The authors concluded that the poorer RMET performance reported in alcohol dependent clients by Maurage et al. (2011) likely reflected an effect of chronic alcohol exposure rather than premorbid characteristics (contrary to the latter authors' interpretation). An important point in this regard, however, is that the relationship of inherent trait factors to elevated risk of alcohol misuse does not necessarily imply strong genetic involvement as reflected in familial alcoholism. For example, in Cloninger's (1987; Cloninger, Sigvardsson & Bohman, 1996) well-known typology of alcoholism, the more strongly genetic, early-onset Type II alcoholism is linked to traits such as reward sensitivity and impulsivity, whereas the more common Type I is later in onset, less genetically influenced, and more closely linked to anxiety and depression – both of which are common correlates of alexithymia. In a study of 8785 Danish twin pairs (Jorgensen, Zachariae, Skytthe & Kyvik, 2007), heritability of alexithymia was estimated at only 30-33 percent. The developmental trajectory from alexithymia – and particularly its EOT facet – to alcohol misuse may require many years of learning to use alcohol as a means of coping with negative moods and interpersonal difficulties, with gradual escalation of such use over time perhaps leading to Type I

alcoholism in some cases. Of course this is speculative and such issues can only be convincingly resolved by carefully conducted longitudinal research. In any case, the present findings would appear to argue for a significant role of pre-drinking traits such as EOT in the deficient emotion recognition and empathy observed in those who misuse alcohol in the general population, in addition to any potential long-term effect of chronic alcohol exposure on the brain that may also contribute to such deficits in clients undergoing treatment for alcohol use disorders.

Limitations of the present study include the cross-sectional, correlational design, which does not allow determination of causal relationships; the predominantly young adult sample; and the inherent limitations of self-report instruments, especially with regards to alexithymia where introspective abilities may be deficient among those with high levels of the trait (see Thorberg et al., 2010). Longitudinal studies using more broadly representative samples would be ideal for fully teasing out the nature of observed relationships between risky or problematic drinking, facial emotion recognition, emotional empathy, and alexithymia, particularly its EOT facet. In any case the current study obtained support for its hypotheses, with the results suggesting that the EOT trait contributes to associations of risky or problematic drinking with deficient facial emotion recognition and low emotional empathy - at least in social drinkers - and that deficient facial emotion recognition contributes to the association of EOT with low emotional empathy. The resulting social difficulties often reported by those with high levels of alexithymia (e.g., Qualter et al., 2009; Vanhuele et al., 2011) are likely to be among the reasons alexithymia is such a potent risk factor for alcohol use disorders (Thorberg et al., 2016).

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Table 1

Summary of Intercorrelations of Study Variables (N=161)

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. DIF	-											
2. DDF	.62***	-										
3. EOT	.30***	.30***	-									
4. DASS-21	.48***	.23**	.12	-								
5. PT	-.12	-.08	-.30***	-.14	-							
6. FT	.53	-.00	-.29***	.17*	.32***	-						
7. EC	-.06	-.09	-.36***	-.01	.61***	.41***	-					
8. PD	.31***	.20*	.22**	.33***	.00	.26**	.12	-				
9. RMET	-.19*	-.02	-.31***	-.19*	.30***	.30***	.35***	.01	-			
10. AUDIT	.33***	.20*	.25**	.20*	-.14	-.10	-.27**	-.05	-.35***	-		
11. DH	-.03	.03	-.00	.18*	.03	-.07	.04	-.10	.07	-.21**	-	
12. Age	-.05	.00	-.03	.17*	.03	-.06	.06	-.08	.09	-.27**	.99***	-

Note. DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking; DASS-21 = Depression Anxiety Stress Scales total score; PT = perspective taking; FT = fantasized thinking; EC = empathetic concern; PD = personal distress; RMET = the reading the mind in the eyes test; AUDIT = Alcohol Use Disorders Identification Test; DH = drinking history.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

Hierarchical Multiple Regression Analyses to Assess Relationships between Facial Emotional Recognition, Risky Drinking, Empathetic Concern and Externally Oriented Thinking, After Controlling for Age, Gender and Negative Mood

Predicting Facial Emotional Recognition from Risky Drinking and EOT						Predicting Empathic Concern from Risky Drinking and EOT					
Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*	Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*
Step 1	.14***					Step 1	.10**				
Constant			27.00	2.27	[22.51, 31.48]	Constant			17.42	1.97	[13.53, 21.30]
Age		.02	0.01	0.06	[-0.11, 0.13]	Age		-.03	-0.02	0.05	[-0.12, 0.09]
Gender		.09	0.93	0.85	[-0.75, 2.60]	Gender		.18*	1.56	0.74	[0.10, 3.01]
DASS-21		-.11	-0.06	0.05	[-0.16, 0.03]	DASS-21		.03	0.02	0.04	[-0.07, 0.10]
AUDIT		-.29**	-0.24	0.07	[-0.38, -0.10]	AUDIT		-.22*	-0.15	0.06	[-0.28, -0.03]
Step 2	.05**					Step 2	.09***				
Constant			32.05	2.73	[26.65, 37.45]	Constant			22.93	2.32	[18.34, 27.52]
AUDIT		-.23**	-0.19	0.07	[-0.33, -0.05]	AUDIT		-.14	-0.10	0.06	[-0.22, 0.02]
EOT		-.24***	-0.31	0.10	[-0.51, -0.12]	EOT		-.31***	-0.34	0.09	[-0.51, -0.17]

Note. SE B = standard error of unstandardized coefficient; CI = confidence interval; DASS-21 = Depression Anxiety Stress Scales total score; AUDIT = Alcohol Use Disorders Identification Test; EOT = externally oriented thinking;
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Hierarchical Multiple Regression Analysis Predicting Empathetic Concern from Externally Oriented Thinking and Facial Emotional Recognition, After Controlling for Age, Gender and Negative Mood

Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*
Step 1	.18***				
Constant			21.86	2.12	[17.67, 26.05]
Age		.02	0.01	0.05	[-0.08, 0.10]
Gender		.23**	2.02	0.66	[0.73, 3.32]
DASS-21		.00	0.00	0.04	[-0.07, 0.07]
EOT		-.35***	-0.38	0.08	[-0.54, -0.22]
Step 2	.05**				
Constant			15.89	2.82	[10.32, 21.45]
EOT		-.28***	-0.31	0.08	[-0.47, -0.15]
RMET		.24**	0.21	0.07	[0.08, 0.33]

Note. SE B = standard error of unstandardized coefficient; CI = confidence interval; DASS-21 = Depression Anxiety Stress Scales total score; RMET = the reading the mind in the eyes test; EOT = externally oriented thinking.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Figure 1. Relationship between risky or problematic drinking and emotional empathy is mediated by externally oriented thinking and facial recognition of emotion.

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