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# Alexithymia and Mood: Recognition of Emotion in Self and Others

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The present study explored relationships between alexithymia—a trait characterized by difficulties identifying and describing feelings and an external thinking style—and negative moods, negative mood regulation expectancies, facial recognition of emotions, emotional empathy, and alcohol consumption. The sample consisted of 102 university (primarily psychology) students (13 men, 89 women) aged 18 to 50 years ( $M = 22.18$  years). Participants completed the Toronto Alexithymia Scale (TAS-20), Negative Mood Regulation Scale (NMRS), Depression Anxiety Stress Scales (DASS-21), Reading the Mind in the Eyes Test (RMET), Interpersonal Reactivity Index (IRI), and Alcohol Use Disorders Identification Test (AUDIT). Results were consistent with previous findings of positive relationships of TAS-20 alexithymia scores with both alcohol use (AUDIT) and negative moods (DASS-21) and a negative relationship with emotional self-regulation as indexed by NMRS. Predicted negative associations of both overall TAS-20 alexithymia scores and the externally oriented thinking (EOT) subscale of the TAS-20 with both RMET facial recognition of emotions and the empathic concern (EC) subscale of the IRI were supported. The mood self-regulation index NMRS fully mediated the relationship between alexithymia and negative moods. Hierarchical linear regressions revealed that, after other relevant variables were controlled for, the EOT subscale of the TAS-20 predicted RMET and EC. The concrete thinking or EOT facet of alexithymia thus appears to be associated with diminished facial recognition of emotions and reduced emotional empathy. The negative moods associated with alexithymia appear to be linked to subjective difficulties in self-regulation of emotions.

**KEYWORDS:** alexithymia, negative mood, negative mood regulation expectancies, facial emotion recognition, empathy, alcohol consumption

Alexithymia is defined by difficulty identifying and describing emotional feelings, difficulty differentiating between such feelings and bodily sensations, restricted imagination, and an externally oriented thinking style (Taylor, Bagby, & Parker, 1997). Evidence suggests that the etiology of alexithymia in-

volves developmental, biological, and psychological factors (e.g., Jorgensen, Zachariae, Skytthe, & Kyvik, 2007; Thorberg, Young, Sullivan, & Lyvers, 2009). Worldwide, the prevalence rate of alexithymia in adults within the general population is reported at 5–13% (Franz et al., 2008; Mattila, Salminen, Nummi,

& Joukamaa, 2006) but is considerably higher in clinical samples at 40–67% (Lyvers, Hinton, et al., 2014; Loas, Fremaux, Otmani, Lecercle, & Delahousse, 1997). Several studies have reported that alexithymia is associated with deficits in the ability to recognize and label facial expressions of both positive and negative emotions, which may be linked to problems with empathy and theory of mind (Bird et al., 2010; Cook, Brewer, Shah, & Bird, 2013; Demers & Koven, 2015; Grynberg et al., 2012; Prkachin, Casey, & Prkachin, 2009).

Alexithymia is often associated with negative mood states such as depression (Foran & O’Leary, 2013) and anxiety (Onur, Alkin, Sheridan, & Wise, 2013), suggesting that those with alexithymia experience difficulties in self-regulation of negative moods. The Negative Mood Regulation Scale (NMRS; Catanzaro & Mearns, 1990) was designed to assess the strength of an individual’s belief in being able to use effective cognitive and behavioral coping strategies for the regulation of negative emotions. Lyvers, Makin, Toms, Thorberg, and Samios (2014) assessed trait alexithymia via the Toronto Alexithymia Scale (TAS-20; Bagby, Parker, & Taylor, 1994) in 153 university students and found significant negative relationships between total alexithymia scores and negative mood regulation expectancies as measured by the NMRS and trait mindfulness as measured by the Mindful Attention Awareness Scale (Brown & Ryan, 2003). There were significant positive associations of alexithymia with depression, anxiety, and stress as measured by the Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995) and with everyday signs of frontal lobe dysfunction as measured by the Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001). These results suggested that those who scored higher on the TAS-20 index of alexithymia were more impaired in their ability to objectively evaluate and regulate their own negative moods, perhaps because of inherent deficits in prefrontal cortical functioning. The present study administered the TAS-20, DASS-21, and NMRS to test the hypothesis that impaired emotional self-regulation as indexed by NMRS would mediate the relationship between TAS-20 and DASS-21; that is, the association of alexithymia with negative moods reflects a lack of effective emotional regulation strategies.

The ability to identify and describe one’s own emotional states should logically extend to the ability to detect and relate to the emotions of others. The face, and in particular the eye region, plays an important role in the display of emotions (Parker, Taylor, & Bagby, 1993). Parker et al. assessed 216 Canadian university students for alexithymia using the TAS-20; students were also asked to identify the emotions expressed in black-and-white photographs of faces. Students with high levels of alexithymia (as defined by TAS-20 cutoff scores) were found to perform significantly worse than nonalexithymics for seven out of nine basic emotions. Similarly, Lane, Sechrest, Riedel, Shapiro, and Kaszniak (2000) found significant negative correlations between alexithymia scores and the ability to recognize facial expressions of positive and negative basic emotions. More recently, Prkachin et al. (2009) found significant negative correlations between TAS-20 alexithymia scores and recognition of facial expressions of basic emotions including sadness, anger, and fear. Surprisingly, those with high levels of alexithymia were also found to make facial emotion recognition errors such as mistaking positive emotions for negative ones (e.g., reporting happiness as fear). These findings suggest that alexithymics tend to misread others’ emotions and fail to respond appropriately, leading to social difficulties.

The Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) was formulated as an advanced theory of mind test to assess one’s ability to attribute mental states of another person. It was administered in the present study in light of previous reports of theory of mind and emotional facial recognition impairments in alexithymia (Demers & Koven, 2015; Grynberg et al., 2012). RMET performance has also been reported to be impaired in alcohol dependence (Maurage et al., 2011), a disorder in which more than half of sufferers have high levels of alexithymia (Thorberg et al., 2009). Clients undergoing residential treatment for a wide range of substance use disorders were recently found to show high TAS-20 alexithymia scores (Lyvers, Hinton, et al., 2014) and elevated signs of frontal lobe dysfunction as indexed by the FrSBe. In nonclinical samples of young adults, higher scores on the TAS-20 index of alexithymia are associated with heavier and riskier alcohol consumption (e.g., Lyvers, Onuoha, Thorberg, & Samios, 2012), sug-

gesting that trait alexithymia is a risk factor for problematic drinking. However, Maurage et al. found that the impaired RMET performance of those with alcohol dependence was independent of alexithymia and other trait factors and thus was attributed to chronic heavy drinking. For this reason, alcohol intake was taken into account in the present study, which administered the TAS-20 and RMET to determine whether TAS-20 alexithymia predicted RMET facial emotion recognition scores independent of alcohol use in a nonclinical sample. The Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 1992) was administered as an index of alcohol consumption.

Another issue addressed in the present study was whether deficits in facial emotion recognition associated with alexithymia are accompanied by lower emotional empathy. Previous research has indicated emotional empathy deficits in alexithymia (Grynberg, Luminet, Corneille, Grezes, & Berthoz, 2010). As in the Grynberg et al. study, the present study assessed empathy by administering the Interpersonal Reactivity Index (IRI; Davis, 1994), which measures both cognitive and emotional aspects of empathy. Of primary interest in the present context was the empathic concern (EC) subscale as an index of emotional empathy. Recently Demers and Koven (2015) reported that the externally oriented thinking (EOT) subscale of the TAS-20, an index of concrete thinking, uniquely predicted variance in both affective theory of mind as indexed by RMET and emotional empathy; therefore, the present investigation examined relationships of the EOT facet of alexithymia with both the EC measure of emotional empathy and the RMET measure of facial emotion recognition.

Based on the previous research cited earlier, we expected to find positive associations of TAS-20 total alexithymia scores with the DASS-21 negative mood index and the AUDIT measure of alcohol use, and a negative relationship of alexithymia scores with perceived ability to self-regulate negative moods as measured by the NMRS. The relationship between TAS-20 and negative moods as assessed by DASS-21 was expected to be fully mediated by NMRS, based on the notion that alexithymia is associated with difficulties in emotional self-regulation. Furthermore, we predicted that total TAS-20 alexithymia scores,

and the EOT subscale scores in particular, would be negatively related to both facial emotion recognition (RMET scores) and emotional empathy (EC scores) as a unique predictor, given the findings recently reported by Demers and Koven (2015).

## EXPERIMENT

### METHOD

#### *Participants*

Initially 109 (primarily psychology) students, all of whom were social drinkers, were recruited on the campus of Bond University. Mahalanobis distance indicated seven multivariate outliers. Removing these from the dataset resulted in a total of 102 cases (13 men, 89 women) aged 18 to 50 years ( $M = 22.18$  years) suitable for statistical analyses.

#### *Materials*

##### *DEMOGRAPHICS.*

This questionnaire collected information on participants' age, gender, country of origin, education, and substance use.

##### *NMRS (CATANZARO & MEARNES, 1990).*

The NMRS is a 30-item scale that measures beliefs in being able to use effective cognitive and behavioral strategies for the regulation of negative emotions (Catanzaro & Mearns, 1990). Items assess strategies to alleviate negative mood, including cognitive (e.g., "I'll feel better when I understand why I feel bad"), social (e.g., "Going out to dinner with friends will help"), and solitary (e.g., "Catching up with my work will help me calm down") strategies, and beliefs that negative moods can or cannot be alleviated (e.g., "I can usually find a way to cheer myself up"). All items begin with the same stem, "When I'm upset, I believe that. . ." Items are rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Possible scores range from 30 to 150, with higher scores indicating greater belief in one's ability to regulate negative emotions.

##### *TAS-20 (BAGBY ET AL., 1994).*

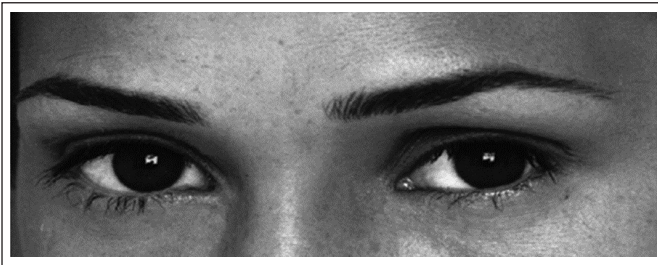
The TAS-20 is a 20-item questionnaire measuring levels of alexithymia. Seven items address difficulty identifying feelings (DIF; e.g., "I am often confused about what emotion I am feeling"); five items address difficulty describing feelings (DDF; e.g., "It is difficult for me to find the right words for my feelings");

and eight items address externally oriented thinking (EOT; e.g., “I prefer talking to people about their daily activities rather than their feelings”). Items are rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Possible scores range from 20 to 100, with higher scores indicating greater levels of alexithymia.

**RMET** (BARON-COHEN ET AL., 2001).

The RMET is a 36-item measure containing black-and-white photographs of the eye region of faces that depict complex emotional expressions (Figures 1 and 2) and includes an equal number of male and female eye gaze photographs. The RMET assesses the ability to attribute emotional states of others as expressed through facial eye gazes. Each photograph is shown separately and is surrounded by four emotion words, one of which is the target emotion. Emotional states include a mixture of positive items (e.g., “relaxed”), negative items (e.g., “irritated”), and neutral items (e.g., “reflective”). Correct target words are scored as 1 and incorrect foils scored as 0.

Possible scores range from 0 to 36, with higher scores indicating greater ability to detect facial expressions of emotion.



**FIGURE 1.** An example of a female eye gaze stimulus in the RMET. The word choices are *arrogant*, *grateful*, *sarcastic*, and *tentative* (correct)



**FIGURE 2.** An example of a male eye gaze stimulus in the RMET. The word choices were *apologetic*, *friendly*, *uneasy* (correct), and *dispirited*. Source: [http://www.autismresearchcentre.com/arc\\_tests](http://www.autismresearchcentre.com/arc_tests)

**IRI** (DAVIS, 1994).

The IRI is a 28-item self-report scale that assesses cognitive and emotional aspects of empathy. There are four subscales, a 7-item Perspective-Taking scale (PT; e.g., “I try to look at everybody’s side of a disagreement before I make a decision”), a 7-item Fantasy scale (FS; e.g., “I really get involved with the feelings of the characters in a novel”), a 7-item Empathic Concern scale (EC; e.g., “I often have tender, concerned feelings for people less fortunate than me”), and a 7-item Personal Distress scale (PD; e.g., “Being in a tense emotional situation scares me”). Items are rated on a 5-point Likert scale ranging from 0 (*A: does not describe me well*) to 4 (*E: describes me very well*). The EC scale was of primary interest as an index of emotional empathy.

**AUDIT** (BABOR ET AL., 1992).

The AUDIT is a 10-item self-report measure that screens for risky alcohol use. Items include three items measuring alcohol consumption (e.g., “How many standard drinks do you have on a typical day when you are drinking?”), three items measuring alcohol dependence (e.g., “How often during the last year have you failed to do what was normally expected of you because of drinking?”), and four questions measuring alcohol-related problems (e.g., “Have you or someone else been injured because of your drinking?”). Items are scored on a 4-point scale such that possible total scores range from 0 to 40, with higher scores indicating more hazardous levels of alcohol consumption.

**DASS-21** (LOVIBOND & LOVIBOND, 1995).

The DASS-21 is a 21-item self-report measure that assesses depression, anxiety, and stress. Participants are asked to respond to items by rating the degree to which they experienced each symptom over the past week. Each subscale, Depression (e.g., “I couldn’t seem to experience any positive feeling at all”), Anxiety (e.g., “I felt I was close to panic”), and Stress (e.g., “I found it difficult to relax”), has 7 items measured on a 4-point Likert scale ranging from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much, or most of the time*). Possible scores range from 0 to 63, with higher scores indicating higher levels of negative mood.

#### Procedure

The research was conducted in accordance with approval obtained from the university ethics committee. The online survey was created using software provided by Qualtrics.com. Student participants were

recruited from the Bond University online psychology research participant pool, advertisements in the student daily digest e-mails, and distribution of flyers. Prospective participants were provided with a hyperlink that directed them to an explanatory statement inviting them to participate in a survey exploring personality, mood, alcohol consumption, and visual emotion recognition. The explanatory statement indicated that participation was voluntary, responses were anonymous, and they had the right to withdraw at any time without providing a reason. Participants were informed that the survey would take approximately 40 min to complete and that they would be eligible to participate if they were aged 18 years or older, were social drinkers, and had normal or corrected-to-normal vision. To encourage participation, undergraduate psychology students were informed that they would be granted 1% course credit, and nonpsychology students were given the chance to enter a random drawing to win a \$50 gift card.

## RESULTS

Table 1 shows the descriptive statistics and Cronbach's  $\alpha$ s for the measures used in this sample. Consistent with previous research cited earlier, 14% of the present sample scored as fully alexithymic by TAS-20 criteria (i.e., total score of 61 or higher). There was no relationship between gender and alexithymia in the present sample,  $p = .84$ .

### Correlations

DASS-21 negative mood scores were moderately positively skewed, so a square root transformation was applied. Pearson's correlations were calculated to assess relationships between the variables of interest (Table 2). TAS-20 total alexithymia scores were significantly negatively correlated with age and with scores on the negative mood regulation (NMRS), facial emotion recognition (RMET), and emotional empathy (IRI-EC) indices as predicted. Total TAS-20 alexithymia scores were significantly positively correlated with all DASS-21 negative mood indices and the AUDIT index of alcohol use, also as expected. The TAS-20 subscales showed mostly similar relationships; however, only the externally oriented thinking (EOT) subscale was significantly related to facial emotion recognition (RMET) and alcohol use (AUDIT).

**TABLE 1.** Descriptive Statistics and Internal Consistencies for the Primary Measures ( $N = 102$ )

Measure	No. of items	<i>M</i>	<i>SD</i>	$\alpha^a$
NMRS	30	110.90	12.13	.84
TAS-20	20	46.66	11.89	.88
RMET	36	26.68	4.16	.65
IRI	28	65.80	11.77	.81
DASS	21	4.48	2.01	.91
AUDIT	10	9.19	5.19	.81

Note. AUDIT = Alcohol Use Disorders Identification Test; DASS-21 = Depression Anxiety Stress Scales; IRI = Interpersonal Reactivity Index; NMRS = Negative Mood Regulation Scale; RMET = Reading the Mind in the Eyes Test; TAS-20 = Toronto Alexithymia Scale.

<sup>a</sup>Cronbach's  $\alpha$  reliability coefficient.

### Path Analysis on Negative Mood Regulation Expectancies (NMRS)

Based on theoretical considerations, negative mood regulation strategies as indexed by NMRS were hypothesized to mediate the relationship of TAS-20 alexithymia to negative moods as indexed by DASS-21 total scores. Before the path analysis was run, the assumptions for mediation were assessed (Baron & Kenny, 1986). First, a significant relationship was found between the predictor variable TAS-20 and the dependent variable DASS-21,  $F(1, 100) = 18.00$ ,  $p < .001$ , accounting for 15% of the variance. Second, a significant relationship was found between the predictor variable TAS-20 and the mediator NMRS,  $F(1, 100) = 61.75$ ,  $p < .001$ , accounting for 38% of the variance. Third, a hierarchical multiple regression with TAS-20 (Step 1) and TAS-20 and NMRS (Step 2) found that in Step 2, with NMRS and TAS-20 as predictors, TAS-20 was no longer significant,  $\beta = .10$ ,  $p = .34$ . Only NMRS,  $\beta = -.47$ ,  $p < .001$ , showed univariate significance. As all four conditions were met, these findings indicated that the NMRS index of one's perceived ability to self-regulate negative moods fully mediated the relationship between TAS-20 alexithymia and the DASS-21 negative mood index. A Sobel test confirmed full mediation,  $Z = 3.78$ ,  $p < .001$ , as illustrated in Figure 3.

### Hierarchical Multiple Regression on RMET

To test the hypothesis that emotion recognition would be impaired in participants with higher

**TABLE 2.** Intercorrelations Between Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Age														
2 TAS-Total	-.32**													
3 TAS-DIF	-.23*	.80***												
4 TAS-DDF	-.26**	.83***	.49***											
5 TAS-EOT	-.28**	.77***	.35***	.57***										
6 DASS-Anx	-.12	.38***	.56***	.23*	.06									
7 DASS-Dep	-.07	.37***	.47***	.26**	.12	.57***								
8 DASS-Str	.10	.28**	.39***	.24*	.01	.62***	.69***							
9 AUDIT-Tot	-.25*	.21*	.04	.17	.32**	.17	.11	.08						
10 NMRS-Tot	-.22*	-.62***	-.57***	-.52***	-.38***	-.42***	-.57***	-.40***	-.13					
11 IRI-PT	.18	-.40***	-.23*	-.36***	-.40***	-.04	-.12	-.02	-.06	.44***				
12 IRI-FS	-.03	-.11	.13	-.13	-.32**	.09	.00	-.12	-.01	.04	.25*			
13 IRI-EC	.11	-.38***	-.22*	-.34***	-.37***	-.10	-.11	-.08	-.13	.30**	.49***	.34***		
14 IRI-PD	-.18	.31**	.27**	.25*	.21*	.12	.14	.18	.28**	-.48***	-.29**	.07	.03	
15 RMET-Tot	.21*	-.20	-.14	-.07	-.28**	.05	.08	.16	-.03	.08	.22*	.18	.12	-.11

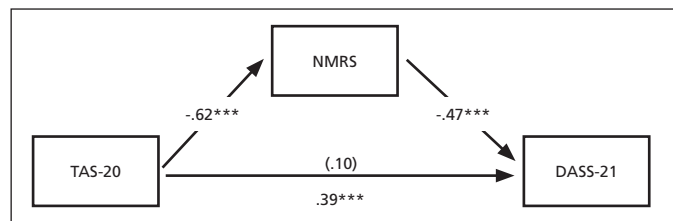
Anx = anxiety; AUDIT = Alcohol Use Disorders Identification Test; DASS = Depression Anxiety Stress Scale; DDF = difficulty describing feelings; Dep = depression; DIF = difficulty identifying feelings; EC = Empathic Concern scale; EOT = externally oriented thinking; FS = Fantasy scale; IRI = Interpersonal Reactivity Index; NMRS = Negative Mood Regulation Scale; PD = Personal Distress scale; PT = Perspective Taking scale; RMET = Reading the Mind in the Eyes Test; Str = stress; TAS = Toronto Alexithymia Scale; Tot = total.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

TAS-20 alexithymia (especially EOT) scores after controlling for age, gender, alcohol consumption, and negative mood states, we used a hierarchical multiple regression analysis. Predictor variables were entered in the order of age and gender (Step 1), AUDIT (Step 2), DASS-21 (Step 3), and TAS-20 subscales (Step 4), with RMET as the criterion variable. At Step 1, the model was not significant,  $F(2, 98) = 2.93, p = .06$ , with age and gender accounting for 6% of the variance in RMET,  $R = .24$ . At Step 2, the addition of AUDIT did not significantly improve prediction of RMET,  $R = .24, F\ change(1, 97) < 1$ , resulting in a nonsignificant model,  $F(3, 97) = 1.93, p = .13$ . At Step 3, the addition of DASS-21 did not significantly improve prediction of RMET,  $R = .26, F\ change(1, 96) = 1.20, p = .28$ , accounting for an additional 7% of variance and retaining a nonsignificant model,  $F(4, 96) = 1.75, p = .15$ . At Step 4, the addition of TAS-20 subscales significantly improved prediction of RMET,  $R = .39, F\ change(3, 93) = 3.19, p = .03$ , accounting for an additional 16% of variance and resulting in a significant model,  $F(7, 93) = 2.44, p = .02$ . When all variables were combined in Model 4, EOT ( $p = .02$ ) emerged as the only significant predictor of unique variance in RMET performance. Unstandardized ( $B$ ) and standardized ( $\beta$ ) regression coefficients and  $\Delta R^2$  for each step of the hierarchical multiple regression analysis are reported in Table 3.

#### Regression on Empathic Concern

To test the hypothesis that emotional empathy as indexed by the EC scale of the IRI would be negatively related to TAS-20 alexithymia (especially EOT) scores after controlling for age, gender, alcohol consumption, and negative mood states, we used a hierarchical multiple regression analysis. Predictor variables were entered in the order of age and gender (Step 1), AUDIT (Step 2), DASS-21 total scores (Step 3), and TAS-20 (Step 4), with EC as the criterion variable. At Step 1, the model was not significant,  $F(2, 99) = 1.63, p = .20$ , with age and gender accounting for 3% of the variance in EC,  $R = .18$ . At Step 2, the addition of AUDIT did not significantly improve the prediction of EC,  $R = .20, F\ change(1, 98) < 1$ , accounting for an additional 4% of variance and resulting in a nonsignificant model,  $F(3, 98) = 1.32, p = .27$ . At Step 3, the addition of DASS-21



**FIGURE 3.** NMRS mediates the relationship between TAS-20 and DASS-21 total scores. All values are standardized regression weights. \*\*\* $p < .001$

**TABLE 3.** Age, Gender, Alcohol Use (AUDIT), Negative Moods (DASS-21), and Toronto Alexithymia Scale (TAS-20) Subscales as Predictors of RMET Facial Emotion Recognition

	Variable	B	$\beta$	t	R <sup>2</sup> change
Step 1	(Constant)	25.86		9.12	.06*
	Age	0.15	.21	2.18*	
	Gender	-1.38	-.11	-1.09	
Step 2	(Constant)	25.77		7.97	.00
	Age	0.15	.22	2.12	
	Gender	-1.36	-.11	-1.06	
	AUDIT	0.01	.01	0.08	
Step 3	(Constant)	25.33		7.79	.01
	Age	0.15	.21	2.09*	
	Gender	-1.36	-.11	-1.06	
	AUDIT	-0.01	-.01	-0.07	
	DASS-21	0.03	.11	1.10	
Step 4	(Constant)	30.81		8.15	.09*
	Age	0.10	.14	1.38	
	Gender	-1.43	-.11	-1.15	
	AUDIT	0.03	.04	0.38	
	DASS-21	0.04	.17	1.44	
	TAS-DIF	-0.13	-.18	-1.35	
	TAS-DDF	0.16	.17	1.33	
TAS-EOT	-0.27	-.30	-2.41*		

Note. AUDIT = Alcohol Use Disorders Identification Test; DASS-21 = Depression Anxiety Stress Scales; DDF = difficulty describing feelings; DIF = difficulty identifying feelings; EOT = externally oriented thinking; TAS-20 = Toronto Alexithymia Scale.

\* $p < .05$ .

did not significantly improve the prediction of EC,  $R = .22, F\ change(1, 97) < 1$ , accounting for an additional 5% of variance and retaining a nonsignificant model,  $F(4, 97) = 1.18, p = .33$ . Only with the addi-



tion of TAS-20 subscales at Step 4 did the model become significant,  $R = .43$ ,  $F \text{ change}(3, 94) = 5.21$ ,  $p = .002$ , accounting for an additional 18% of variance and resulting in a significant model,  $F(7, 94) = 3.00$ ,  $p = .007$ . When all variables were combined in Model 5, only EOT ( $p = .04$ ) predicted unique variance in EC. Unstandardized ( $B$ ) and standardized ( $\beta$ ) regression coefficients and  $\Delta R^2$  for each step of the hierarchical multiple regression analysis are reported in Table 4.

## DISCUSSION

As predicted, total TAS-20 alexithymia scores were significantly negatively correlated with negative mood regulation expectancies (NMRS), ability to detect emotions via eye gaze (RMET), and emotional empathy (EC). Alexithymia was significantly positively correlated with alcohol consumption (AUDIT) and negative moods (DASS-21) as in previous work (e.g., Lyvers et al., 2012; Thorberg et al., 2010). Negative mood regulation expectancies fully mediated the relationship between alexithymia and negative moods, indicating that the negative moods associated with alexithymia are tied to deficits in emotional self-regulation. The finding that the EOT subscale of the TAS-20, but not the other two subscales, was a unique negative predictor of both RMET and the EC measure of emotional empathy supports the recent findings of Demers and Koven (2015), who used a different index of emotional empathy.

Importantly, the EOT subscale of the TAS-20 was a unique negative predictor of facial emotion recognition on the RMET even after we controlled for age, gender, alcohol consumption, and negative moods. This result seems contrary to the findings of Muraige et al. (2011) who found that the poorer RMET performance of alcoholics compared with controls could not be attributed to alexithymia despite the significantly higher TAS-20 alexithymia scores of their alcohol-dependent sample. However, the present study used a nonclinical sample, and therefore the results are not comparable to their findings in alcohol-dependent patients. Further research on this issue appears warranted in any case, as the facial emotion recognition deficits associated with alcohol dependence may not necessarily be a result of heavy drinking, given the high prevalence of alexithymia in alcohol-dependent samples (Thorberg et al., 2009). In the present study, EOT scores negatively predicted RMET performance even after alcohol use was taken into account. EOT appears to be the most stable facet of alexithymia (see Demers & Koven, 2015), and therefore the observed negative relationship between the EOT index of concrete thinking and deficient facial emotion recognition as indexed by RMET probably reflects fundamental trait attributes rather than consequences of chronic heavy alcohol use, especially given the young, nonclinical sample.

**TABLE 4.** Age, Gender, Alcohol Use (AUDIT), Negative Moods (DASS-21), and Toronto Alexithymia Scale (TAS-20) Subscales as Predictors of Empathic Concern

	Variable	<i>B</i>	$\beta$	<i>t</i>	$R^2$ change
Step 1	(Constant)	13.55		4.65	.03
	Age	0.08	.10	1.02	
	Gender	1.88	.14	1.45	
Step 2	(Constant)	14.88		4.50	.01
	Age	0.06	.08	0.78	
	Gender	1.72	.13	1.32	
	AUDIT	-0.07	-.11	1.03	
Step 3	(Constant)	15.35		4.57	.01
	Age	0.06	.08	0.80	
	Gender	1.67	.13	1.23	
	AUDIT	-0.06	-.08	-0.73	
	DASS-21	-0.02	-.09	-0.87	
Step 4	(Constant)	23.42		6.17	.14**
	Age	-0.02	-.03	-0.25	
	Gender	1.66	.13	1.34	
	AUDIT	0.00	.00	-0.00	
	DASS-21	-0.00	-.01	-0.06	
	TAS-DIF	-0.04	-.05	-0.38	
	TAS-DDF	-0.17	-.17	-1.39	
	TAS-EOT	-0.24	-.26	-2.11*	

Note. AUDIT = Alcohol Use Disorders Identification Test; DASS-21 = Depression Anxiety Stress Scales; DDF = difficulty describing feelings; DIF = difficulty identifying feelings; EOT = externally oriented thinking; TAS-20 = Toronto Alexithymia Scale.

\* $p < .05$ . \*\* $p < .01$ .

As predicted, the concrete thinking dimension of alexithymia, EOT, was a significant negative predictor of scores on the IRI-EC subscale, which Davis (1994) described as an affective measure of empathy, even after controlling for age, gender, alcohol consumption, and negative moods. Demers and Koven (2015) argued that concrete thinking as indexed by EOT signifies a low capacity for abstraction and mentalization, which are prerequisites for perspective taking and emotional empathy. Although the EOT subscale of the TAS-20 was of special interest in the present context given the recent findings of Demers and Koven, both the DDF and DIF subscales of the TAS-20 were also negatively related to emotional empathy in the present study. EOT was negatively related to two other subscales of the IRI—the PT and FS—as well, also consistent with the argument of Demers and Koven cited earlier. Given that EOT and total TAS-20 alexithymia scores were negatively related to both facial emotion recognition and emotional empathy in the present study, the negative relationship between TAS-20 alexithymia and emotional empathy as indexed by EC might logically be attributed to the deficient facial recognition of emotions, as indexed by RMET, that was also associated with alexithymia. However, RMET and EC were uncorrelated in the present study, suggesting that a more fundamental deficit in emotion-related processing may underlie the observed negative relationship between alexithymia and emotional empathy. One possibility, as suggested by Demers and Koven, is that the association between concrete thinking and deficits in both facial emotion recognition and emotional empathy reflects an underlying deficit in metacognition associated with alexithymia (cf. Lyvers, Makin, et al., 2014).

The present study had several limitations. The cross-sectional nature of the study limits interpretation of the findings, as the correlational design does not allow causation to be inferred. Furthermore, given the prevalence of female students in psychology programs today, the current sample was majority female and may not generalize to samples that are more balanced in gender. Future research therefore should recruit larger and more representative samples. Nevertheless, all predictions were supported, consistent with current theoretical interpretations of alexithymia. The present findings, like those of

Demers and Koven (2015), point to special relevance of the concrete thinking facet of alexithymia for deficiencies in both facial emotion recognition and emotional empathy and suggest that further research on the nature of these relationships is warranted.

#### NOTES

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