



Short communication

Hostile attributional bias in severe alcohol use disorder

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ABSTRACT

Impairments in social cognition have been documented in severe alcohol use disorder (SAUD) over the past two decades. They have been linked with lower social functioning and poor treatment outcomes, illustrating their key role in the disorder. However, studies investigating social cognition in SAUD have largely focused on emotional decoding and theory of mind abilities, neglecting other important processes. We expand this line of research by exploring the association between SAUD and hostile attributional biases (i.e., the tendency to attribute hostile intentions to others), another clinically relevant subcomponent of social cognition. Thirty-five patients with SAUD and thirty-five matched healthy controls completed the short version of the Ambiguous Intentions Hostility Questionnaire, a validated measure assessing participants' perceived hostility, blame attribution and aggression in relation to vignettes depicting social situations with negative outcomes and ambiguous intent. Patients with SAUD attributed more hostile intentions to others than did healthy controls. Moreover, this hostile attributional bias was associated with increased interpersonal problems in SAUD, as measured through the Inventory of Interpersonal Problems. We thus evidence hostile attributional bias in SAUD and extend the growing literature on social cognition impairments in this population. Furthermore, these findings corroborate the recent proposal that patients with SAUD exhibit biases toward socially threatening information. The association between hostile attributional bias and interpersonal problems suggests that targeting this bias in treatment may reduce the relapse risk resulting from interpersonal deficits. Recommendations are made to further explore the clinical relevance of hostile attributional bias in SAUD.

1. Introduction

Social cognition, globally referring to processes required to perceive, interpret, and act upon social information (Green et al., 2008), has been explored in severe alcohol use disorder (SAUD) during the last two decades (e.g., Le Berre, 2019). This literature shows that patients with SAUD exhibit strong impairments in emotional facial expressions decoding and Theory of Mind (see Bora and Zorlu, 2017; Castellano et al., 2015; Onuoha et al., 2016 for recent meta-analyses). Importantly, such impairments are of high clinical relevance since they are related to real-life interpersonal problems (Kornreich et al., 2002) as well as higher rates of treatment drop-out and relapse (Rupp et al., 2017; Sliedrecht et al., 2019). Compromised social cognition may thus play a critical role in SAUD by underlying social difficulties and poor treatment outcomes, two major issues in this disorder.

The influential taxonomy proposed by Green and colleagues (2008)

identified five subcomponents of social cognition warranting consideration in psychiatric populations, namely 1) emotion decoding; 2) Theory of Mind; 3) social perception; 4) social knowledge; and 5) attributional bias. In the context of SAUD, the investigation of social cognition has been largely circumscribed to the first two subcomponents, with some preliminary results regarding social perception (Maurage et al., 2012; Schmidt et al., 2016) and social knowledge (Amenta et al., 2013; Carmona-Perera et al., 2014; Khemiri et al., 2012). Conversely, attributional biases have never been explored in SAUD, thus restraining a comprehensive understanding of social cognition profiles in this disorder. Such attributional biases, and specifically the tendency to ascribe hostile intentions to others in ambiguous situations with negative outcomes (i.e., hostile attributional bias; HAB), could be particularly relevant to SAUD. Indeed, HAB are known predictors of maladaptive interpersonal functioning (Klein Tuente et al., 2019) and negative affects (Banks et al., 2018; Wang et al., 2019), which are common in SAUD

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and are, in turn, related to higher relapse risk (Litt et al., 2000; Zywiak et al., 2003).

The increased occurrence of HAB in SAUD would be consistent with the proposal that patients with SAUD display cognitive biases toward social threat signals (e.g., hostility cues), which might lead them to interpret ambiguous social situations as negative, ultimately reducing social functioning (Pabst et al., 2020). Indirect support for the presence of such HAB in SAUD comes from emotion decoding studies, that showed a tendency to over-detect hostile emotions such as anger, disgust or contempt in faces actually depicting non-hostile negative (sadness) or even neutral emotions (Freeman et al., 2018; Frigerio et al., 2002; Maura et al., 2009; Philippot et al., 1999). Yet, these effects might stem from more fundamental deficits in emotion recognition and therefore do not constitute definite proof for HAB in SAUD. A recent study also reported negatively biased interpretations of social scenarios in polysubstance abusers (Beard et al., 2019), but the specific association between SAUD and HAB remains unexplored.

The present study addresses this issue by directly testing the presence and extent of HAB in SAUD. We used the Ambiguous Intentions Hostility Questionnaire (Combs et al., 2007a), which explicitly requires participants to provide causal explanations for people's behavior in realistic social scenarios with negative outcomes. We also explored potential associations between HAB, interpersonal problems and clinical factors in SAUD.

2. Material and methods

2.1. Participants

Thirty-five patients diagnosed with SAUD following DSM-5 criteria, who were in the third week of their detoxification stay (St Luc University Hospital, Brussels, Belgium), and thirty-five healthy controls participated in the study. Patients with SAUD had abstained from alcohol for at least 14 days, and were free of psychiatric comorbidity, as assessed by the MINI (Sheehan et al., 1998), except for nicotine dependence. Healthy controls had no history of psychiatric disorder or substance abuse, except for nicotine dependence, and had a score lower than 8 at the Alcohol Use Disorders Identification Test (Saunders et al., 1993), indicating low-risk alcohol consumption. Twenty-four patients with SAUD still received low doses of benzodiazepines (mean = 17.57 mg diazepam/day, SD = 14.87). Major medical problems, neurological disorders and other substance abuse constituted exclusion criteria. The study was approved by the ethical board of the local medical school and was conducted in compliance with the Declaration of Helsinki. Study objectives were disclosed to the participants before participation and they all provided written informed consent. This study was part of a larger collaborative project exploring social cognition in SAUD (e.g., Maura et al., 2016).

2.2. Measures and procedure

2.2.1. Psychopathology

Depression and anxiety symptoms were respectively assessed with the Beck Depression Inventory (Beck and Steer, 1987) and the State-Trait Anxiety Inventory (Spielberger et al., 1983).

2.2.2. Interpersonal problems

The Inventory of Interpersonal Problems (Horowitz et al., 1988) evaluated participants' difficulties during social interactions. Respondents rated a list of 127 social behaviors, either presented as being difficult to perform or used too often, on a 4-point Likert scale (1 = "This problem does not apply to me at all" to 4 = "This problem totally applies to me"). A mean total score was computed, along with 6 subscores: difficulty being assertive/sociable/submissive/intimate, and excessive feeling of responsibility/self-control.

2.2.3. Hostile attribution biases

The Ambiguous Intentions Hostility Questionnaire (Combs et al., 2007a) constituted our experimental measure. Participants read vignettes depicting social situations with negative outcomes (e.g., "You walk past a bunch of teenagers at the mall and you hear them start laughing") and had to imagine themselves being the victims. They then provided a written statement explaining the reasons behind the other persons' behavior and rated whether the behavior was intentional (1 = "definitely no" to 6 = "definitely yes"), how angry they would be (1 = "not angry at all" to 5 = "very angry") and how much they would blame the persons (1 = "not at all" to 5 = "very much"). A composite blame score composed of these intentionality, anger and blame ratings was computed. Finally, they wrote down how they would respond to the situation. An independent research assistant coded the two written answers following the original procedures (Combs et al., 2007a), yielding a hostility score (1 = "not hostile at all" to 5 = very hostile) for the first answer and an aggression score (1 = "not aggressive at all" to 5 = "very aggressive") for the second one, these coded scores being used in the present study. Following previous recommendations (Combs et al., 2007b), we used a short version of the Ambiguous Intentions Hostility Questionnaire composed by the 5 vignettes in which the intent of the "perpetrators" was deemed ambiguous by a sample of 200 students, as these are most sensitive to social cognition biases.

2.3. Data analytic plan

Group differences were explored using chi-squared tests for gender and independent samples t-tests (Welch's degrees of freedom correction was applied in cases of unequal variances) for all other socio-demographic, psychopathological, interpersonal problems and experimental variables. Cohen's *ds* were computed for group-differences in experimental variables. Complementary analyses explored the associations of attribution scores with psychopathological, interpersonal problems and clinical variables (number of previous detoxifications, SAUD duration and number of alcohol units consumed daily before detoxification) within the SAUD group using bivariate Pearson's correlations. Finally, we tested for the confounding effect of variables that (1) significantly differed between groups, and (2) significantly correlated with experimental measures in either group, by individually including them, along with group (dummy coded) in a multiple linear regression model predicting experimental measures. This parsimonious data-driven strategy was preferred over more common approaches simultaneously including all potential confounders in a single model because such approaches require larger sample sizes and are likely to strongly compromise the construct validity of SAUD, limiting inferences about this population (Miller and Chapman, 2001).

3. Results

3.1. Socio-demographic, psychopathological and interpersonal problems variables (Table 1)

Groups did not differ regarding age [$t(68) = 1.18, p = 0.24$] or gender [$\chi^2(1) = 2.06, p = 0.15$], but patients with SAUD presented lower education level (i.e., education years since starting primary school) [$t(68) = 3.34, p = 0.001$]. We therefore explored the association between education and experimental measures in the complementary analyses. Patients with SAUD also had higher depression [$t(44.20) = 5.79, p < 0.0001$], state anxiety [$t(48.95) = 3.71, p = 0.0005$], trait anxiety [$t(68) = 4.07, p = 0.0001$] and interpersonal problems (all $ts > 2.90$, all $ps < .005$) scores (total score and every subscore, except difficulty being assertive [$t(68) = 1.66, p = 0.10$]).

3.2. Experimental measures

Patients with SAUD attributed more hostile intentions in ambiguous

Table 1

Socio-demographic, psychopathological, alcohol-related and experimental measures among participants with severe alcohol use disorder (SAUD) and healthy control participants (HC): mean (SD).

	SAUD (n = 35)	HC (n = 35)
<i>Socio-demographic measures</i>		
Gender ratio (M/F)	21/14	15/20
Age	47.91 (10.40)	45.06 (9.91)
Education level (in years)	7.86 (1.99)	9.40 (1.88)
<i>Psychopathological measures</i>		
BDI^a	10.42 (7.66)	2.37 (3.00)
STAI-A^b	39.43 (14.87)	29.09 (7.16)
STAI-B^b	47.26 (11.82)	36.74 (9.68)
<i>Alcohol consumption measures</i>		
AUDIT	/	3.20 (1.73)
Number of previous detoxifications	0.71 (0.79)	/
SAUD duration	8.20 (7.09)	/
Number of alcohol units per day	21.49 (10.63)	2.66 (1.98)
<i>Interpersonal problems</i>		
Total	1.56 (0.48)	1.05 (0.50)
Difficulty being Assertive	1.67 (0.59)	1.41 (0.73)
Difficulty being Sociable	1.63 (0.72)	1.12 (0.69)
Difficulty being Submissive	1.51 (0.60)	1.01 (0.55)
Difficulty being Intimate	1.36 (0.77)	0.63 (0.53)
Excessive feeling of Responsibility	1.93 (0.83)	1.37 (0.80)
Excessive feeling of Selfcontrol	1.24 (0.50)	0.65 (0.47)
<i>Attributional biases</i>		
Hostility	1.75 (0.65)	1.30 (0.30)
Aggression	1.83 (0.45)	1.73 (0.18)
Blame	2.06 (0.65)	2.15 (0.37)

Significant group differences are in bold text.

^a BDI = Beck Depression Inventory (Beck and Steer, 1987).

^b STAI = State (A) and Trait (B) Anxiety Inventory (Spielberger et al., 1983).

Table 2

Correlations (Pearson's *r* and *p*-value) between hostility scores and socio-demographic, psychopathological as well as alcohol-related measures among patients with severe alcohol use disorder (SAUD) and healthy control participants (HC).

	SAUD (n = 35)		HC (n = 35)	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
<i>Socio-demographic measures</i>				
Education level (in years)	-0.44	0.008**	-0.34	0.046*
<i>Psychopathological measures</i>				
BDI ^a	0.25	0.14	0.20	0.25
STAI-A ^b	0.34	0.04*	0.29	0.10
STAI-B ^b	0.25	0.14	0.25	0.14
<i>Alcohol consumption measures</i>				
Number of previous detoxifications	0.22	0.21	/	
SAUD duration	0.14	0.44	/	
Number of alcohol units per day	0.13	0.47	/	
<i>Interpersonal problems</i>				
Total	0.16	0.34	0.17	0.32
Difficulty being Assertive	0.02	0.90	0.16	0.35
Difficulty being Sociable	0.12	0.50	0.09	0.57
Difficulty being Submissive	0.29	0.09	-0.14	0.40
Difficulty being Intimate	-0.23	0.18	0.24	0.17
Excessive feeling of Responsibility	0.49	0.003**	0.25	0.15
Excessive feeling of Selfcontrol	0.23	0.18	0.22	0.20

p* < 0.05, *p* < 0.01.

^a BDI = Beck Depression Inventory (Beck and Steer, 1987).

^b STAI = State (A) and Trait (B) Anxiety Inventory (Spielberger et al., 1983).

scenarios than healthy controls [*t* (47.74) = 3.76, *p* = 0.0005, *d* = 0.90]. No group differences were observed regarding aggression [*t* (44.83) = 1.25, *p* = 0.22, *d* = 0.30] or blame [*t* (53.94) = -0.77, *p* = 0.44, *d* = -0.18] scores (Fig. 1). Therefore, complementary analyses were conducted on hostility scores only.

3.3. Complementary analyses (Table 2)

3.3.1. Education

There was a negative correlation between education and hostility scores in SAUD [*r* (33) = -0.44, *p* = 0.008]. The group effect on hostility scores remained significant after controlling for education (*p* = 0.016).

3.3.2. Psychopathological variables

State anxiety was correlated with hostility scores in SAUD [*r* (33) = 0.34, *p* = 0.044]. No other correlation reached significance (all *ps* > 0.14). The group effect on hostility scores remained significant after controlling for state anxiety (*p* = 0.018).

3.3.3. Clinical variables

No significant correlations were found between alcohol consumption factors and hostility scores (all *ps* > .21).

3.3.4. Interpersonal problems

In SAUD, hostility scores were correlated with the excessive feelings of responsibility subscore [*r* (33) = 0.49, *p* = 0.003]. There was also a trend-level association between hostility scores and the “difficulty being submissive” subscore [*r* (33) = 0.29, *p* = 0.09]. No other correlation reached significance (all *ps* > 0.17). The group effect on hostility scores remained significant after controlling for excessive feeling of responsibility (*p* = 0.01).

4. Discussion

We assessed the presence and extent of HAB in SAUD, and showed that patients with SAUD attribute more hostile intentions to others in ambiguous social situations. This constitutes a direct evidence of HAB in SAUD and extends the growing literature on social cognition in SAUD to the previously unexplored attributional bias subcomponent. These findings also complement previous emotion recognition studies suggesting an over-detection of social threat in SAUD, and reinforce the proposal that patients with SAUD process ambiguous social situations in a threatening/hostile way (Pabst et al., 2020). Furthermore, the positive association between state anxiety and HAB suggests that patients with SAUD may be especially prone to display HAB in stressful situations.

The results regarding associations of HAB with interpersonal problems are mixed. On the one hand, HAB was correlated, although only at a trend level, with the difficulty being submissive subscore, such that patients with higher HAB scored higher on items such as “I get angry too easily”, “I get irritated or annoyed too easily” or “I quarrel too often with people”. This is consistent with established links between HAB, anger and aggression (Klein Tuente et al., 2019; Wang et al., 2019), and suggests that HAB may be an important mechanism in SAUD-related interpersonal conflicts. On the other hand, despite attributing more hostility to others, patients with SAUD did not report attributing more blame or reacting more aggressively than healthy controls. Social desirability and/or difficulty accessing present anger feelings in patients with SAUD (Park et al., 2016) may explain these findings. Alternatively, perceiving hostility in others may lead some patients to think that they have wronged them, generating feelings of guilt rather than anger. This is supported by the positive association found between hostility scores and the excessive feeling of responsibility subscore, encompassing items such as “I feel too guilty for what I have done” or “Disappointing others preoccupies me a lot”, and aligns with studies showing higher guilt-proneness in SAUD (Grynberg et al., 2017). As guilt is associated with psychological distress and attempts to “repair” the damage caused (Tangney et al., 2006), the joint presence of HAB and guilt may heighten the frequency of negative affect and awkward interpersonal situations, ultimately fostering relapse (Sliedrecht et al., 2019; Zywiak et al., 2003). More work is needed to clarify the association between HAB and specific subcomponents of interpersonal problems in SAUD. Moreover, future studies should explore the link between HAB and SAUD patient's

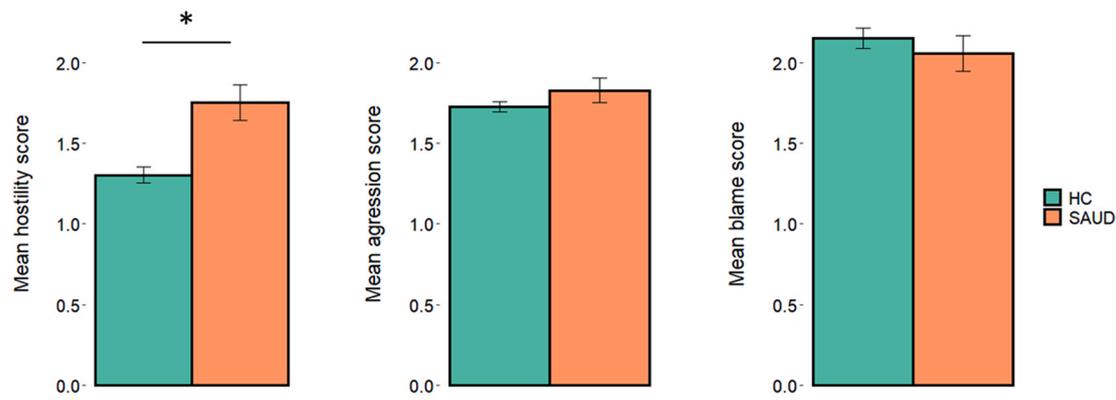


Fig. 1. Mean hostility, aggression and blame scores in patients with severe alcohol use disorder (SAUD) and healthy control participants (HC).

sensitivity to social exclusion (Maurage et al., 2012). Indeed, HAB may lead to the overestimation of rejection cues and hamper their effective regulation. Finally, an interesting avenue would be to explore the relations between HAB and other impaired social cognitive components in SAUD, as authors have proposed that HAB may reflect reduced Theory of Mind skills (Runions and Keating, 2007) and as some evidence suggests that psychiatric populations known to display HAB for social vignettes also misidentify emotional facial expressions (Smeijers et al., 2017).

In conclusion, this article identifies attributional biases in SAUD through the presence of HAB, which are in turn linked with increased interpersonal problems. At a theoretical level, these findings highlight that beyond classically reported impairments of social cognitive processes (i.e., emotion perception and Theory of Mind), negative biases in the processing of socio-affective information may also play an important role in patients with SAUD, and therefore warrant further investigation. Such biases may greatly interfere with interpersonal functioning, exacerbate social stress and even partly underlie more global social cognitive deficits (Pabst et al., 2020). At the clinical level, the association with interpersonal problems indicates that targeting HAB in treatment settings could hold value in reducing relapse related to social factors (Rolland et al., 2019). Future studies should confirm the therapeutic pertinence of HAB in SAUD by investigating its relation to other clinically relevant processes such as craving and drinking refusal self-efficacy (Beard et al., 2019).

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Authors contribution

All authors contributed to draft the study design. EP created the stimuli and paradigm. PdT and PM recruited the participants and collected the data. AP, BR and PM conducted the statistical analyses. AP and PM drafted the manuscript and all authors provided critical revisions for important intellectual content. The final version of the manuscript was also approved by all authors.

Declaration of competing interest

The authors declare no conflict of interest.

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References

- Amenta, S., Noël, X., Verbanck, P., Campanella, S., 2013. Decoding of emotional components in complex communicative situations (irony) and its relation to empathic abilities in male chronic Alcoholics : an issue for treatment. *Alcohol Clin. Exp. Res.* 37 (2), 339–347. <https://doi.org/10.1111/j.1530-0277.2012.01909.x>.
- Banks, D.M., Scott, B.G., Weems, C.F., 2018. Anxiety, hostile attributions, and differences in heart rate response to ambiguous situational vignettes in adolescents. *Emotion* 18 (2), 248–259. <https://doi.org/10.1037/emo0000352>.
- Beard, C., Peckham, A.D., Griffin, M.L., Weiss, R.D., Taghian, N., McHugh, R.K., 2019. Associations among interpretation bias, craving, and abstinence self-efficacy in adults with substance use disorders. *Drug Alcohol Depend.* 205, 107644. <https://doi.org/10.1016/j.drugalcdep.2019.107644>.
- Beck, A.T., Steer, R.A., 1987. *Manual for the Beck Depression Inventory*. Psychological Corp. ; Harcourt Brace Jovanovich.
- Bora, E., Zorlu, N., 2017. Social cognition in alcohol use disorder : a meta-analysis. *Addiction* 112 (1), 40–48. <https://doi.org/10.1111/add.13486>.
- Carmona-Perera, M., Clark, L., Young, L., Pérez-García, M., Verdejo-García, A., 2014. Impaired decoding of fear and disgust predicts utilitarian moral judgment in alcohol-dependent individuals. *Alcohol Clin. Exp. Res.* 38 (1), 179–185. <https://doi.org/10.1111/acer.12245>.
- Castellano, F., Bartoli, F., Crocamo, C., Gamba, G., Tremolada, M., Santambrogio, J., Clerici, M., Carrà, G., 2015. Facial emotion recognition in alcohol and substance use disorders : a meta-analysis. *Neurosci. Biobehav. Rev.* 59, 147–154. <https://doi.org/10.1016/j.neubiorev.2015.11.001>.
- Combs, D.R., Adams, S.D., Penn, D.L., Roberts, D., Tiegreen, J., Stem, P., 2007a. Social Cognition and Interaction Training (SCIT) for inpatients with schizophrenia spectrum disorders : preliminary findings. *Schizophr. Res.* 91 (1), 112–116. <https://doi.org/10.1016/j.schres.2006.12.010>.
- Combs, D.R., Penn, D.L., Wicher, M., Waldheter, E., 2007b. The Ambiguous Intentions Hostility Questionnaire (AIHQ) : a new measure for evaluating hostile social-cognitive biases in paranoia. *Cognit. Neuropsychiatry* 12 (2), 128–143. <https://doi.org/10.1080/13546800600787854>.
- Freeman, C.R., Wiers, C.E., Sloan, M.E., Zehra, A., Ramirez, V., Wang, G.-J., Volkow, N. D., 2018. Emotion recognition biases in alcohol use disorder. *Alcohol Clin. Exp. Res.* 42 (8), 1541–1547. <https://doi.org/10.1111/acer.13802>.
- Frigerio, E., Burt, D.M., Montagne, B., Murray, L.K., Perrett, D.I., 2002. Facial affect perception in alcoholics. *Psychiatr. Res.* 113 (1–2), 161–171.
- Green, M.F., Penn, D.L., Bentall, R., Carpenter, W.T., Gaebel, W., Gur, R.C., Kring, A.M., Park, S., Silverstein, S.M., Heinssen, R., 2008. Social cognition in Schizophrenia : an NIMH workshop on definitions, assessment, and research opportunities. *Schizophr. Bull.* 34 (6), 1211–1220. <https://doi.org/10.1093/schbul/sbm145>.
- Grynberg, D., de Timary, P., Van Heuverswijn, A., Maurage, P., 2017. Prone to feel guilty : self-evaluative emotions in alcohol-dependence. *Drug Alcohol Depend.* 179, 78–82. <https://doi.org/10.1016/j.drugalcdep.2017.06.030>.
- Horowitz, L.M., Rosenberg, S.E., Baer, B.A., Ureno, G., Villaseñor, V.S., 1988. Inventory of interpersonal problems : psychometric properties and clinical applications. *J. Consult. Clin. Psychol.* 56 (6), 885–892. <https://doi.org/10.1037/0022-006x.56.6.885>.
- Khemiri, L., Guterstam, J., Franck, J., Jayaram-Lindström, N., 2012. Alcohol dependence associated with increased utilitarian moral judgment : a case control study. *PloS One* 7 (6), e39882. <https://doi.org/10.1371/journal.pone.0039882>.
- Klein Tuente, S., Bogaerts, S., Veling, W., 2019. Hostile attribution bias and aggression in adults—a systematic review. *Aggress. Violent Behav.* 46, 66–81. <https://doi.org/10.1016/j.avb.2019.01.009>.
- Kornreich, C., Philippot, P., Foisy, M.-L., Blairy, S., Raynaud, E., Dan, B., Hess, U., Noël, X., Pelc, I., Verbanck, P., 2002. Impaired emotional facial expression recognition is associated with interpersonal problems in alcoholism. *Alcohol Alcohol* 37 (4), 394–400. <https://doi.org/10.1093/alcal/37.4.394>.
- Le Berre, A.-P., 2019. Emotional processing and social cognition in alcohol use disorder. *Neuropsychology* 33 (6), 808–821. <https://doi.org/10.1037/neu0000572>.

- Litt, M.D., Cooney, N.L., Morse, P., 2000. Reactivity to alcohol-related stimuli in the laboratory and in the field : predictors of craving in treated alcoholics. *Addiction* 95 (6), 889–900. <https://doi.org/10.1046/j.1360-0443.2000.9568896.x>.
- Maurage, P., Campanella, S., Philippot, P., Charest, I., Martin, S., de Timary, P., 2009. Impaired emotional facial expression decoding in alcoholism is also present for emotional prosody and body postures. *Alcohol Alcohol* 44 (5), 476–485. <https://doi.org/10.1093/alcalc/agg037>.
- Maurage, P., D'Hondt, F., Timary, P. de, Mary, C., Franck, N., Peyroux, E., 2016. Dissociating affective and cognitive theory of mind in recently detoxified alcohol-dependent individuals. *Alcohol Clin. Exp. Res.* 40 (9), 1926–1934. <https://doi.org/10.1111/acer.13155>.
- Maurage, P., Joassin, F., Philippot, P., Heeren, A., Vermeulen, N., Mahau, P., Delperdange, C., Corneille, O., Luminet, O., de Timary, P., 2012. Disrupted regulation of social exclusion in alcohol-dependence : an fMRI Study. *Neuropsychopharmacology* 37 (9), 2067.
- Miller, G.A., Chapman, J.P., 2001. Misunderstanding analysis of covariance. *J. Abnorm. Psychol.* 110 (1), 40–48. <https://doi.org/10.1037//0021-843x.110.1.40>.
- Onuoha, R.C., Quintana, D.S., Lyvers, M., Guastella, A.J., 2016. A meta-analysis of theory of mind in alcohol use disorders. *Alcohol Alcohol* 51 (4), 410–415. <https://doi.org/10.1093/alcalc/agg137>.
- Pabst, A., Heeren, A., Maurage, P., 2020. Socio-affective processing biases in severe alcohol use disorders : experimental and therapeutic perspectives. *Addict. Behav.* 106382 <https://doi.org/10.1016/j.addbeh.2020.106382>.
- Park, M.-S., Lee, B.H., Sohn, J.-H., 2016. Neural substrates involved in anger induced by audio-visual film clips among patients with alcohol dependency. *J. Physiol. Anthropol.* 36 (1), 5. <https://doi.org/10.1186/s40101-016-0102-x>.
- Philippot, P., Kornreich, C., Blairy, S., Baert, I., Den Dulk, A., Le Bon, O., Streeel, E., Hess, U., Pelc, I., Verbanck, P., 1999. Alcoholics' deficits in the decoding of emotional facial expression. *Alcohol Clin. Exp. Res.* 23 (6), 1031–1038.
- Rolland, B., D'Hondt, F., Montègue, S., Brion, M., Peyron, E., D'Aviau de Ternay, J., de Timary, P., Nourredine, M., Maurage, P., 2019. A patient-tailored evidence-based approach for developing early neuropsychological training programs in addiction settings. *Neuropsychol. Rev.* 29 (1), 103–115. <https://doi.org/10.1007/s11065-018-9395-3>.
- Runions, K.C., Keating, D.P., 2007. Young children's social information processing : family antecedents and behavioral correlates. *Dev. Psychol.* 43 (4), 838–849. <https://doi.org/10.1037/0012-1649.43.4.838>.
- Rupp, C.I., Derntl, B., Osthaus, F., Kemmler, G., Fleischhacker, W.W., 2017. Impact of social cognition on alcohol dependence treatment Outcome : poorer facial emotion recognition predicts relapse/dropout. *Alcohol Clin. Exp. Res.* 41 (12), 2197–2206. <https://doi.org/10.1111/acer.13522>.
- Saunders, J.B., Aasland, O.G., Babor, T.F., Fuente, J.R.D.L., Grant, M., 1993. Development of the alcohol use disorders identification test (AUDIT) : WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction* 88 (6), 791–804. <https://doi.org/10.1111/j.1360-0443.1993.tb02093.x>.
- Schmidt, T., Roser, P., Juckel, G., Brüne, M., Suchan, B., Thoma, P., 2016. Social cognition and social problem solving abilities in individuals with alcohol use disorder. *J. Clin. Exp. Neuropsychol.* 38 (9), 974–990. <https://doi.org/10.1080/13803395.2016.1180346>.
- Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., Dunbar, G.C., 1998. The Mini-International Neuropsychiatric Interview (M.I.N.I.) : the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *J. Clin. Psychiatr.* 59 (Suppl. 20), 22–33 quiz 34–57.
- Sliedrecht, W., de Waart, R., Witkiewitz, K., Roozen, H.G., 2019. Alcohol use disorder relapse factors : a systematic review. *Psychiatr. Res.* 278, 97–115. <https://doi.org/10.1016/j.psychres.2019.05.038>.
- Smeijers, D., Rinck, M., Bulten, E., van den Heuvel, T., Verkes, R.-J., 2017. Generalized hostile interpretation bias regarding facial expressions : characteristic of pathological aggressive behavior. *Aggress. Behav.* 43 (4), 386–397. <https://doi.org/10.1002/ab.21697>.
- Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., Jacobs, G.A., 1983. *Manual for the state-trait anxiety scale.* Consulting Psychologist.
- Tangney, J.P., Stuewig, J., Mashek, D.J., 2006. Moral emotions and moral behavior. *Annu. Rev. Psychol.* 58 (1), 345–372. <https://doi.org/10.1146/annurev.psych.56.091103.070145>.
- Wang, Y., Cao, S., Dong, Y., Xia, L.-X., 2019. Hostile attribution bias and angry rumination : a longitudinal study of undergraduate students. *PloS One* 14 (5). <https://doi.org/10.1371/journal.pone.0217759>. Scopus.
- Zywiak, W.H., Westerberg, V.S., Connors, G.J., Maisto, S.A., 2003. Exploratory findings from the reasons for drinking Questionnaire. *J. Subst. Abuse Treat.* 25 (4), 287–292. [https://doi.org/10.1016/s0740-5472\(03\)00118-1](https://doi.org/10.1016/s0740-5472(03)00118-1).