

## Short communication

## Social perception and knowledge impairments in severe alcohol use disorder: Group and individual-level findings

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## ABSTRACT

**Background:** Consistent data highlight the presence and clinical significance of social cognition impairments in severe alcohol use disorder (SAUD). However, social perception and knowledge (i.e., the ability to interpret social situations and to identify latent social rules), an important social cognition component, has not yet been explored in this disorder.

**Method:** 35 patients with SAUD and 35 healthy controls (HC) completed the Social Perception and Knowledge test (PerSo), an experimental task requiring participants to comprehensively describe social situations and to identify the social rules illustrated in 8 pictures. We performed group and single-case analyses.

**Results:** Patients with SAUD, as a group, spontaneously identified less relevant “where”/“who”/“what” aspects of the social situations (social perception) than HC. They were however able to provide these elements when explicitly asked to. They were also less able to identify the social rules that subtended the situations (social knowledge). Single-case analyses revealed that 23 % of patients were significantly impaired for social perception, and 34 % for social knowledge.

**Discussion:** We provide novel evidence that SAUD is associated with social perception and knowledge impairments at the group level, and that these impairments strongly vary across patients. Such results should lead to the integration of social perception and knowledge impairments in the conceptualization and treatment of socio-affective difficulties in SAUD.

## 1. Introduction

Severe alcohol use disorder (SAUD) is associated with impairments in social cognition (the ability to perceive/interpret social information; Bora and Zorlu, 2017; Le Berre, 2019). These impairments predict interpersonal problems (Hoffman et al., 2019; Kornreich et al., 2002) and poorer treatment adherence (Foisy et al., 2007; Rupp et al., 2017). Social cognition therefore represents a high-priority research domain that may help conceptualize and address functional and clinical issues in SAUD.

However, social cognition studies in SAUD currently overemphasize specific components. Indeed, authoritative taxonomies (Green et al., 2008; Green and Horan, 2010) outlined four social cognition facets: emotion processing, Theory of Mind, attributional bias, as well as social perception and knowledge (SPK). Nevertheless, investigations in SAUD

have been restricted to the first two facets (Bora and Zorlu, 2017; Le Berre, 2019). Only one study explored attributional biases (revealing more hostile intentions attributions among patients with SAUD; Pabst et al., 2020), and none directly explored SPK.

SPK designates the ability to interpret social situations (social perception) and to identify latent social rules, conventions or expectations (social knowledge; Green et al., 2008; Green and Horan, 2010). Unlike other social cognition components focusing on individual characteristics (e.g., emotions, beliefs), SPK relates to the situation as a whole. It requires context processing (e.g., location, time), identifying interpersonal relationships (e.g., statuses, roles, intimacy), and accessing social settings-specific semantic knowledge, to infer the meaning and likely unfolding of a social situation. SPK is related to social functioning, especially social problem solving (Couture et al., 2006), in healthy and psychiatric populations (Addington et al., 2006; Cusi et al.,

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2012; Fett et al., 2011; Schmidt et al., 2011; Schroeder, 1995). SPK impairments may thus contribute to social problem solving anomalies and to the profound social disruptions observed in SAUD (Levola et al., 2014; Nutt et al., 2010; Schmidt et al., 2016).

Preliminary evidence suggested preserved social knowledge in SAUD (Khemiri et al., 2012). However, this was based on ratings of “how wrong” a series of morally questionable actions were, measuring the ability to evaluate specific behaviours rather than to extract implicit rules from complex social scenes. Conversely, support for SPK impairments in SAUD notably derives from social skills (i.e., behaving appropriately in social settings) and irony detection difficulties (Amenta et al., 2013), both requiring to integrate social cues within their broader context (social perception) and knowledge of what is typically expected (social knowledge). However, no study directly assessed perception and knowledge of social situations in SAUD.

We therefore tested the hypothesis of impaired SPK in SAUD, using a recently developed task (Peyroux et al., 2019) evaluating this ability. We also explored whether SPK was related to alcohol consumption and psychopathological symptoms in SAUD. Finally, given the previously reported heterogeneity in social cognition impairments in SAUD (Maurage et al., 2015, 2021), we investigated variations of SPK impairments across patients.

## 2. Methods and measures

### 2.1. Participants (Table 1)

Thirty-five patients with a DSM-5 diagnosis of SAUD in the third week of their detoxification program (Saint Luc Hospital, Brussels, Belgium) and 35 age/gender matched healthy controls (HC) participated in the study (data collected between September 2014 and June 2015). The sample size was not determined using an a priori power computation but rather based on the sample sizes presented in earlier studies evaluating social cognition in SAUD, in which groups typically encompass between 20 and 40 participants. Patients had no comorbid psychiatric disorder, as assessed by the MINI (Sheehan et al., 1998) except for nicotine dependence, and had been abstinent for at least 14 days. Twenty-four patients still received low doses of benzodiazepines (mean = 17.57 mg/day, SD = 14.87). Preliminary analyses showed no significant associations between benzodiazepines doses and primary outcome measures (all  $p$ s > 0.43). HC had no history of psychiatric disorder except nicotine dependence. Neurological disorders, major medical problems and other substance abuse constituted exclusion criteria. The local medical school provided ethical approval and the study complied with the Declaration of Helsinki. The present data are part of a larger project exploring social cognition in SAUD (Maurage et al., 2016, 2021; Pabst et al., 2020).

### 2.2. Social perception and knowledge

The Social Perception and knowledge test (PerSo; Peyroux et al., 2019) assessed participants' ability to interpret social situations and identify social rules depicted in 8 pictures from the material “ColorCards – Social behavior” (e.g., a librarian having a personal phone call while clients are waiting in line). For each picture, participants had to 1) list as much elements contained in the picture as possible for 90 s, without restrictions, yielding a *fluency score* (sum of elements reported for each picture), serving as a control measure of general attentional/perceptual or semantic labelling difficulties; 2) comprehensively describe what is happening in the picture without cueing, providing a *non-cued interpretation score* (0–24, 1 point per correctly reported “Where”/“Who”/“What” element, see below); 3) respond to queries about a) the context in which the scene takes place; “Where?”, b) the identity of the main characters (e.g., one librarian and two clients); “Who?” and c) the nature of their interaction (e.g., the clients are upset because the employee has a personal conversation instead of doing their job);

**Table 1**

Socio-demographic, psychopathological, alcohol-related and experimental measures among patients with severe alcohol use disorder (SAUD) and healthy controls (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 <sup>a</sup>	10.42 (7.66)	2.37 (3.00)
STAI-A <sup>b</sup>	39.43 (14.87)	29.09 (7.16)
STAI-B <sup>b</sup>	47.26 (11.82)	36.74 (9.68)
<i>Alcohol consumption measures</i>		
AUDIT score		3.20 (1.73)
Number of previous detoxifications	0.71 (0.79)	
Duration of SAUD (in years)	8.20 (7.09)	
Number of alcohol units per day <sup>c</sup>	21.49 (10.63)	2.66 (1.98)
<i>PerSo</i>		
Fluency	187.46 (44.45)	231.97 (38.23)
Non-cued interpretation	21.31 (1.64)	22.40 (1.44)
Cued interpretation	23.42 (0.98)	23.77 (0.49)
Comprehension	4.89 (2.08)	6.43 (1.33)

<sup>a</sup> Beck Depression Inventory (Beck and Steer, 1987).

<sup>b</sup> State (A) / Trait (B) Anxiety Inventory (Spielberger and Gorsuch, 1983).

<sup>c</sup> Before detoxification for patients with SAUD (an alcohol unit corresponds to 10 g of ethanol).

“What?”, had these elements been previously omitted, producing a *cued interpretation score* (0–24, 1 point per correct answer, elements correctly reported in phase 2 were scored 1 in this phase) and 4) indicate the illustrated social rule (e.g., respect for customers), yielding a *comprehension score* (0–8, 1 point per correctly identified rule). The PerSo's ability to discriminate between patients with schizophrenia and HC (i.e., known-groups validity; Bin Kitoko et al., 2020; Peyroux et al., 2019) provides initial support for its construct validity.

### 2.3. Psychopathological symptoms

Beck Depression Inventory (BDI; Beck and Steer, 1987) and State-Trait Anxiety Inventory (STAI; Spielberger and Gorsuch, 1983) scores quantitatively indexed participants' depression and anxiety symptoms.

### 2.4. Alcohol consumption

Participants provided the average number of alcohol units (1 unit = 10 g of ethanol) consumed per day before detoxification, the age of SAUD onset and the number of previous detoxifications.

### 2.5. Data analysis

We tested group differences in fluency and comprehension scores using independent samples *t*-tests (with Welch's correction where appropriate) and interpretation scores were submitted to a 2 (group: SAUD/HC, between) x 2 (interpretation type: non-cued/cued, within) repeated measures ANOVA. We also tested whether group differences in interpretation and comprehension scores persisted after controlling for fluency scores by including this variable, together with group (dummy coded) in a general linear model.

Associations between interpretation/comprehension scores and alcohol consumption, and psychopathological symptoms within the SAUD group were explored using Pearson's correlations.

Finally, we determined the percentage of patients with SAUD presenting significant SPK impairments by comparing each patient's

interpretation and comprehension scores to those of an age/gender matched group of 5 HC using Crawford's t-tests:  $t = [(\text{mean patient} - \text{mean group}) / (\text{SD group} \sqrt{((N \text{ group} + 1) / N \text{ group}))}]$  (Crawford and Garthwaite, 2005; Crawford and Howell, 1998). Patient's scores significantly lower than the control group's mean (1-tailed p-value < 0.05) reflected impairments. Additional analyses investigated age, gender and education effects on SPK (Supplementary Materials 1). Analyses were performed using R (R Core Team, 2019). There were no missing data in the present dataset.

### 3. Results

#### 3.1. Socio-demographic variables and psychopathological symptoms

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 had lower education (i.e., completed years since starting primary school) [ $t(68) = 3.34, p = 0.001$ ] than HC. We therefore explored associations between education and PerSo scores in the correlational analyses. Patients with SAUD also reported more depressive symptoms [ $t(44.20) = 5.79, p < 0.0001$ ], state anxiety [ $t(48.95) = 3.71, p = 0.0005$ ], and trait anxiety [ $t(68) = 4.07, p = 0.0001$ ].

#### 3.2. Social perception and knowledge (Fig. 1)

Patients with SAUD had lower fluency [ $t(68) = 4.49, p < 0.0001, d = 1.07$ ] and comprehension [ $t(57.89) = 3.689, p = 0.0005, d = 0.88$ ] scores than HC. Regarding interpretation scores, the ANOVA revealed a main effect of group [ $F(1,68) = 8.94, p = 0.004, \eta_p^2 = 0.12$ ], with lower interpretation scores in the SAUD group, as well as a main effect of interpretation type [ $F(1,68) = 108.13, p < 0.0001, \eta_p^2 = 0.61$ ], with higher interpretation scores in the cued condition, and a group x interpretation type interaction [ $F(1,68) = 4.91, p = 0.03, \eta_p^2 = 0.07$ ]. Bonferroni-corrected follow-up between-group contrasts revealed that patients with SAUD had lower interpretation scores in the non-cued [ $t(68) = 2.94, p = 0.009, d = 0.70$ ] but not in the cued condition [ $t(50.05) = 1.85, p = 0.14, d = 0.44$ ]. Group effects on non-cued interpretation ( $p = 0.026$ ) and comprehension scores ( $p = 0.002$ ) remained significant after controlling for fluency scores.

#### 3.3. Correlational analyses

No significant correlations emerged between non-cued interpretation (all  $p_s > 0.08$ ) or comprehension scores (all  $p_s > 0.16$ ) and education, alcohol consumption variables or psychopathological symptoms within the SAUD group (Supplementary Materials 2).

#### 3.4. Single-case analyses

Crawford's t-tests revealed that 22.86 % of SAUD were impaired regarding non-cued interpretation scores, whereas 34.29 % were impaired regarding comprehension scores (see Supplementary Materials 3 for additional results).

### 4. Discussion

We assessed SPK, a central social cognition subcomponent (Green et al., 2008; Green and Horan, 2010), among patients with SAUD and matched HC, and evidenced SPK impairments in SAUD. Patients, as a group, were less able to identify relevant contextual aspects and less frequently reported the main characters' identities and the correct nature of their interactions (social perception). They were however able to provide these elements when specifically asked to, hinting toward specific difficulties in spontaneous social perception rather than a fundamental inability. Patients were also less able to pinpoint the social rules subtending the situations (social knowledge). These impairments did not merely reflect general perceptual, attentional or semantic difficulties since SPK impairments persisted after controlling for fluency.

These findings extend the SAUD-related social cognition literature beyond emotion processing and Theory of Mind domains, and highlight SPK impairments as important processes for modelling socio-affective difficulties in SAUD. Indeed, failing to process interpersonal cues (e.g., employee-employer relationships at a dinner) or to perceive and apply social rules in specific contexts (e.g., using formal language and dressing appropriately at a job interview) may interfere with social functioning. Specifically, based on Couture et al. (2006), SPK impairments may explain SAUD-related social problem solving difficulties, characterized by the generation of socially insensitive solutions not aimed at preserving interpersonal relationships (Schmidt et al., 2016). They may also partly explain patients' inability to adapt their behaviour to social demands, generating interpersonal problems (Amenta et al., 2013;

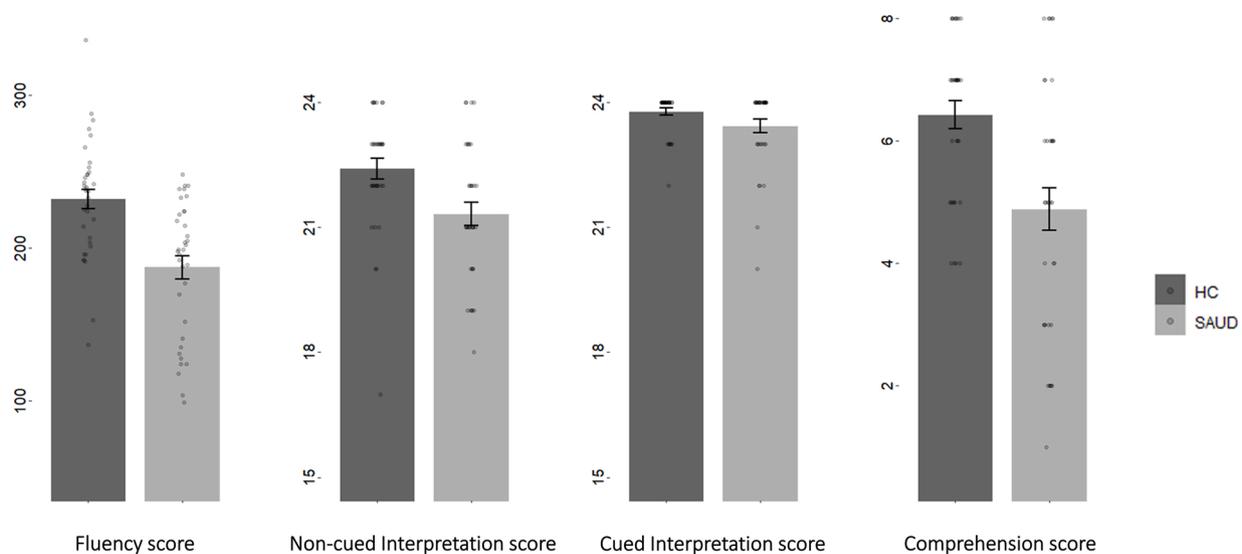


Fig. 1. Scores obtained by patients with severe alcohol use disorder (SAUD) and healthy controls (HC) for the fluency, non-cued interpretation, cued interpretation and comprehension tasks. This Figure also shows the score obtained by each participant at each task, dots representing individual performances. Error bars represent the standard error of the mean.

Kornreich et al., 2002). More broadly, together with evidence of hostile attributional biases (Pabst et al., 2020), our findings substantiate the proposal that SAUD is associated with general social cognition impairments.

Correlational analyses revealed no significant relationship between SPK and alcohol consumption variables (despite a trend-level negative association between non-cued interpretation and age of SAUD onset) or psychopathological symptoms. Insufficient power for detecting small-to-moderate interindividual differences associations may explain these results. Alternatively, they may suggest that SPK impairments are not exclusively substance-induced and might constitute risk factors for the disorder (Mahedy et al., 2021; Rupp et al., 2021).

Finally, single-case analyses showed that despite moderate-to-large group differences, less than 25 % of patients displayed social perception impairments and one third presented social knowledge impairments. Note, however, that Crawford's tests yield conservative estimates of percentages of impaired cases (Crawford and Howell, 1998; Crawford and Garthwaite, 2006). Put differently, although most patients had reduced SPK, only a subgroup exhibited clinically significant impairments. Echoing emotion perception (Maurage et al., 2021) and Theory of Mind (Maurage et al., 2015) studies, this implies that SPK impairments, rather than being core features of SAUD, vary between individuals.

At the clinical level, considering the above-mentioned social correlates of SPK and the established role of interpersonal factors in treatment success (e.g., Sliedrecht et al., 2019; Zywiak et al., 2003), it seems warranted for social cognition rehabilitation programs in SAUD to incorporate a SPK module. Additionally, given the heterogeneity of impairments, evaluation and treatment of this component should be individualized. The normalized performance of the SAUD group in the cued interpretation condition suggests that explicit instructions and training to attend the "Where/Who/What" aspects may be beneficial.

Future priorities include: 1) empirically confirming the association between SPK and social functioning; 2) longitudinally investigating the evolution of SPK over abstinence and its links with relapse; 3) identifying the factors driving the variability of SPK impairments in SAUD.

In conclusion, SAUD is related to SPK impairments, with marked interindividual variability. Such impairments have been linked with disrupted social functioning in other disorders and should hence be considered in the conceptualization and treatment of socio-affective difficulties in SAUD.

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#### Contributors

All authors contributed to draft the study design. EP and PM created the study. AP, EP and PdT recruited the participants and collected the data. AP, MG and PM conducted the statistical analyses. AP 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 that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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#### Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.drugalcdep.2021.109009>.

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