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Socio-affective processing biases in severe alcohol use disorders: Experimental and therapeutic perspectives.

Running title: Socio-affective biases in alcohol use disorders.

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Abstract

Previous literature has consistently reported socio-affective information processing impairments in patients with severe alcohol-use disorder (SAUD). Some recent studies have also suggested that these patients might exhibit biases toward stimuli indicating social threat, such as angry or disgusted faces. Such biases have been largely documented in other psychopathological disorders like anxiety, where they play a critical role in the emergence and maintenance of the disorder. A comprehensive understanding of these biases in SAUD would thus deepen the understanding of interpersonal difficulties and relapse-related factors. However, to date, no study has directly explored these biases in SAUD. In order to initiate efforts to address this issue, we first review preliminary evidence supporting the hypothesis of biased processing of social threat in SAUD. Then, we identify possible pathways through which such biases might negatively impact the course of the disorder. Finally, we provide precise recommendations and available materials to develop research in this promising field, and underline the related theoretical and clinical perspectives.

Keywords: Alcohol use disorder; socio-affective processing; attentional bias; interpersonal functioning; relapse; eye tracking

1. Introduction

As social individuals, human beings have a strong need to feel included and related to others. When this need is thwarted, psychological well-being (Matthews et al., 2016; Taylor et al., 2018) and even life expectancy (Holt-Lunstad et al., 2015; Tanskanen & Anttila, 2016) are reduced. Interpersonal difficulties play an important role in severe alcohol use disorders (SAUD), as defined in the DSM-5 (American Psychiatric Association, 2013). Indeed, situations of social exclusion and interpersonal conflict are frequent in SAUD and influence the disease's course by constituting significant relapse triggers (Marlatt, 1996; Mau et al., 2019; Witkiewitz et al., 2004; Zywiak et al., 2003). Conversely, the presence of social support is a predictor of long-term abstinence (Sliedrecht et al., 2019). Therefore, it is paramount to improve our understanding of the downstream causes that negatively affect social relationships in SAUD.

Several societal factors contribute to interpersonal problems in SAUD. For example, this population is at high risk of being confronted with stigma (i.e., negative attitudes and social rejection; Pescosolido et al., 2010; Schomerus et al., 2011) and dehumanization (i.e., the denial of one's human features; Fontesse et al., 2019) from the general population, which underlines the need for sensitization campaigns raising awareness on this disorder. Beyond these external variables, neuroscientific studies have also highlighted that intrapersonal factors might negatively affect interpersonal relations in SAUD, shedding light on valuable individual treatment targets. Most recently, numerous studies have documented socio-affective impairments in SAUD, with facial emotion decoding and Theory of Mind (broadly defined as the ability to infer other's mental state, beliefs, and feelings) abilities being most affected (Bora & Zorlu, 2017; Castellano et al., 2015; Donadon & Osório, 2014; Le Berre, 2017; 2019; Maurage et al., 2019) and predicting treatment dropout and relapse (Rupp et al., 2017). Moreover, this line of work also suggested that patients with SAUD, like many other psychiatric populations (Bantin et al., 2016; García-Blanco et al., 2017; Hommer et al., 2014; Leyman et al., 2007; Mogg et al., 2000) might process socio-affective information in a biased fashion, and

particularly exhibit biases[1] towards negative or socially threatening cues. These biases are conceptualized as transdiagnostic factors contributing to psychopathology-related social stress and exclusion (Reinhard et al., 2019). They might also underpin the above-mentioned socio-affective impairments: a selective processing of negative social information may prevent patients from correctly assessing and accurately reacting to social situations. Their presence could thus have tremendous implications for the understanding of SAUD development and related interpersonal problems. Surprisingly, no scientific effort has been devoted to their direct exploration in SAUD. In this paper, we thus aim at (i) reviewing the preliminary empirical evidence supporting the presence of socio-affective biases in SAUD, (ii) discussing the mechanisms through which they might negatively influence the course of SAUD, and (iii) outlining innovative research avenues to move forward in the exploration of these biases.

2. Current evidence for socio-affective biases in SAUD

While socio-affective biases have never been directly measured in SAUD, several arguments suggest that they are involved in this disorder:

(1) Patients with SAUD exhibit modified processing of socially threatening emotions. They are less accurate and slower than controls to identify emotions conveyed by faces, as well as to estimate emotional intensity (e.g., Foisy et al., 2007; Kornreich et al., 2001a;2001b;2002;2013; Maurage et al., 2009; Philippot et al., 1999). However, differences across emotions remain to be clarified. In a recent meta-analysis, Bora & Zorlu (2017) underlined that patients' modified emotion processing abilities are most evident for faces displaying anger and disgust, with only small-sized effects observed for other emotions and no difference for happy faces. Therefore, rather than being characterized by general socio-affective impairments, patients with SAUD

[1] Here, we define biases as the preferential allocation of cognitive resources to specific stimuli (e.g., alcohol-related stimuli or social stimuli).

might exhibit selective changes for processing anger and disgust, which are construed as emotions signaling social threat by eliciting behavioral tendencies destined to punish moral violators (Chapman et al., 2009; Seip et al., 2014).

(2) Patients with SAUD over-estimate the presence of socially threatening emotions. Beyond the reduced decoding accuracy presented above, SAUD is actually related to a confusion between emotions, and to an over-estimation of anger and disgust. Indeed, Philippot et al. (1999) evidenced a tendency to perceive negative emotions in happy faces and to misattribute anger and contempt (which the authors interpreted as signals of interpersonal conflict) to faces actually displaying other emotions. Frigerio et al. (2002) further showed that patients with SAUD more frequently misrecognized sad faces as angry or disgusted. Foisy et al. (2007) also found both a tendency to misperceive anger and disgust as sadness and to report disgust in sad faces. Later, Maurage and colleagues (2009) showed that patients overestimate the intensity of facial stimuli presenting anger, and confirmed that they also detect anger in stimuli actually presenting sadness, fear, and even neutral emotions. More recently, Freeman et al. (2018) further supported previous findings by revealing specific error patterns in SAUD when categorizing emotional facial expressions, with patients more often perceiving anger and disgust in other negative and neutral emotions. Altogether, these behavioral studies using different tasks and measures support the view that people with SAUD exhibit, beyond the mere reduced performance in emotion decoding, biases towards the over-estimation of socio-affective information signaling social threat.

(3) Patients with SAUD have modified brain activations related to social threat. Congruent with the proposal of altered social threat processing, patients with SAUD display increased dorsal anterior cingulate cortex (dACC) activation compared to healthy controls when processing angry faces (Park et al., 2015). Moreover, they show greater insula and dACC activation when confronted with social threat, namely during social exclusion (Maurage et al., 2012). Interestingly, higher dACC activation to specific stimuli (smoking cues) is related to attentional

biases (AB) towards the same specific stimuli in smokers (Luijten et al., 2011). Additionally, the dACC and insula are involved in the attribution of salience to and the detection and appraisal of social threat (Heilig et al., 2016; Kawamoto et al., 2015). Therefore, this pattern of neural activation may reflect a heightened sensitivity to stimuli signaling social threat in SAUD, which might underlie the biased processing of these stimuli.

3. Impact of socio-affective biases in SAUD

Given the above-mentioned influence of social factors on SAUD development and maintenance, we argue that the biased processing of social threat may act as harbingers of relapse, via two complementary pathways:

(1) At short term, it may increase patients' perception of social threat and augment their vulnerability to social rejection. This proposal is supported by results among healthy participants showing that experimentally inducing an AB social threat led to increased anxiety during social exclusion (Heeren et al., 2012). Furthermore, such biases could impede their ability to regulate the negative affects resulting from social exclusion (Gerber & Wheeler, 2009), as shown by persistent brain activations related to negative emotions and social exclusion even after the end of the actual exclusion episode (Maurage et al., 2012). Conversely, when excluded, healthy participants typically attend to positive social information, which is viewed as an adaptive way to recover from the negative effects associated with it (DeWall et al., 2009). The tendency of patients with SAUD to show biases toward social threat rather than positive social signals following social exclusion might thus exacerbate its negative consequences and deprive patients from typical emotion regulation resources, leading them to resort to alcohol as an alternative way of coping with social exclusion feelings (Fairbairn & Sayette, 2014).

(2) In the long run, biases toward social threat may facilitate the deterioration of social relationships and prevent the emergence of new ones, reducing social support. For instance, biases toward socially threatening information might favor the interpretation of ambiguous social situations as hostile, and thus lay the ground for inappropriate responses such as aggression or avoidance, lowering social bonding. In accordance with this view, studies showed that AB towards social threat are implicated in the negative interpretation of ambiguous social signals (Haller et al., 2017; White et al., 2011). Furthermore, both the tendency to misperceive anger in non-angry stimuli and AB towards social threat are linked with the frequency of aggressive behaviors (Hall, 2006; Miller & Johnston, 2019; Penton-Voak et al., 2013). Consequently, biases towards social threat in SAUD might influence the interpersonal problems encountered in this population, by promoting social avoidance or aggression among patients as well as a resulting desire for social distance among other individuals. The resulting social seclusion would again expose patients to higher relapse risk (Sliedrecht et al., 2019).

4. Towards a comprehensive investigation of socio-affective biases in SAUD

Previous sections underscored the pertinence of studying socio-affective biases in SAUD. Here, we provide means to initiate a research program in this promising field. A crucial first step is to ascertain the genuineness of the bias via direct experimental examination. Such a goal can be achieved by employing validated cognitive bias paradigms such as the dot-probe task (MacLeod et al., 1986), which has been largely used in other psychopathological states to measure AB. Here, we focus on AB rather than memory or interpretation biases because AB may be upstream determinants of the two other biases: selectively attending to specific stimuli in a scene may influence its interpretation and facilitate the encoding and recall of these stimuli (Blaut et al., 2013; Bowler et al., 2017; Everaert et al., 2014; Haller et al., 2017; White et al., 2011). In the dot-probe task, pairs of images (one emotional, one neutral) are presented, one

image being subsequently replaced by a target that participants are instructed to characterize as fast and accurately as possible. Faster reaction times to targets replacing the emotional image are a typical AB index. This task has often been employed in SAUD to measure alcohol-related AB (i.e., using pictures of alcoholic versus soft drinks; Field & Cox, 2008), but it has never been used to study socio-affective material in this population. This gap can be filled by using socio-affective stimuli, such as emotional faces: by showing pairs consisting of one neutral and one emotionally-loaded face of different valences (e.g., happy, sad, fearful, angry, disgusted), one can directly test whether patients exhibit biased attentional processing of certain socio-affective information and whether it is specific to socially threatening ones (as predicted by previous studies). At a later stage, task specificities can be modified to draw more ecologically valid conclusion by testing whether the bias persists when the stimuli of interest (i.e., presenting socially threatening emotions) are paired with non-neutral emotions (e.g., non-socially threatening but negative emotions like sadness) rather than neutral stimuli. Its generalization towards non-socially threatening stimuli (e.g., visual scenes depicting situations related to anger or disgust) should also be tested.

Reaction-time based AB indices reveal the location of attention when images disappear, but fail to capture attentional deployment over time (McNally, 2019). Therefore, complementing the dot-probe task with eye tracking measures is valuable to study the dynamics of attention. Eye tracking is a useful tool to unfold the nature of attentional processes in alcohol-related disorders (Maurage et al., 2020), and eye-movements yield more reliable AB indices than reaction times (Christiansen et al., 2015). Eye tracking measures would thus track the evolution of overt attention allocation over time by computing gaze indices for different time windows of the trials (Schofield et al., 2012). It would also help in the characterization of the biases, with initial gaze orienting or first fixation latency indices reflecting rather automatic attentional capture, whereas total dwell time indexes more controlled processes (Armstrong & Olatunji, 2012). This precise characterization is paramount since different mechanisms (i.e. attentional, but also perceptive, memory or executive processes) might underpin the biases.

Especially, SAUD is characterized by neurocognitive deficits (Bühler & Mann, 2011; Stavro et al., 2013), which may play a role in the proposed biases. The eye tracking indices described above can shed light on the cognitive processes involved: longer dwell time on threatening faces can, for example, reflect patient's inability to exert executive control over attention. The implication of cognitive control deficits can be further explored by manipulating explicit instructions during the dot-probe task (e.g., "do not look at threatening faces"). In this paradigm, the number of fixations on the threatening face indexes failures to voluntarily control attention. Finally, the processes underlying AB can be further revealed through the identification of neural underpinnings of the biases using neuroimaging or neuromodulation techniques.

After evidencing socio-affective biases in SAUD, another critical step would be to investigate their interpersonal and clinical impact, notably by manipulating AB. Indeed, using the eye tracker, attention can be trained away from negative stimuli (or towards positive ones) through gaze-contingent operant conditioning (positive/negative feedback is provided when participants look at positive/negative stimuli; e.g., Sanchez et al., 2016, 2019 but see Heeren et al., 2015a ,2015b for criticism of attentional bias modification procedures). We previously mentioned that biases toward social threat might play a causal role in exacerbating the negative consequences of social exclusion in SAUD. This can be tested by manipulating AB in patients before inducing social exclusion (see Reinhard et al., 2019 for a review of social exclusion studies in psychiatry) and measuring the resulting affective state. Note that this protocol can be flexibly adapted to test the causal role of AB in the interpretation of ambiguous social stimuli (Sanchez et al., 2017) or avoidance behaviors of social situations (Rougier et al., 2019). We also predicted that patients with SAUD would not display typical biases towards positive social cues following exclusion, leading to the impaired regulation of the associated negative feelings. Contrasting the performance of patients and controls using a dot-probe task (containing both positive and threatening social stimuli) following social exclusion, and monitoring their negative affects directly after exclusion and after the dot-probe task, would

allow stating on the validity of our prediction. Importantly, if our hypotheses regarding the social and clinical impact of the biases in SAUD are supported by their experimental manipulation described above, their reduction through such manipulation should lead to positive effects in clinical contexts. Therefore, if experimental protocols prove successful in modifying the biases, they could constitute a worthy intervention technique for practitioners. Raising awareness on the existence and impact of the bias may also help people with SAUD to develop their ability to regulate and counteract negative affects and behavioral consequences (e.g., favoring reappraisal and approach of social situations rather than avoidance; Bernstein & Zvielli, 2014; Zvielli et al., 2016).

5. Conclusion

We argued that studying socio-affective biases in SAUD constitutes an innovative and promising research avenue holding critical implications. At the fundamental level, it will enrich the growing body of literature reporting socio-affective abnormalities in SAUD, and provide novel mechanistic insights vis-à-vis the interpersonal difficulties characterizing this population. At the clinical level, the description of cognitive biases toward social threat in SAUD can lead to targeted interventions complementing current treatments, particularly the attentional bias modification procedures that have proven to be useful in social anxiety (Lazarov et al., 2017) and are transposable to SAUD.

Declaration of interest

None

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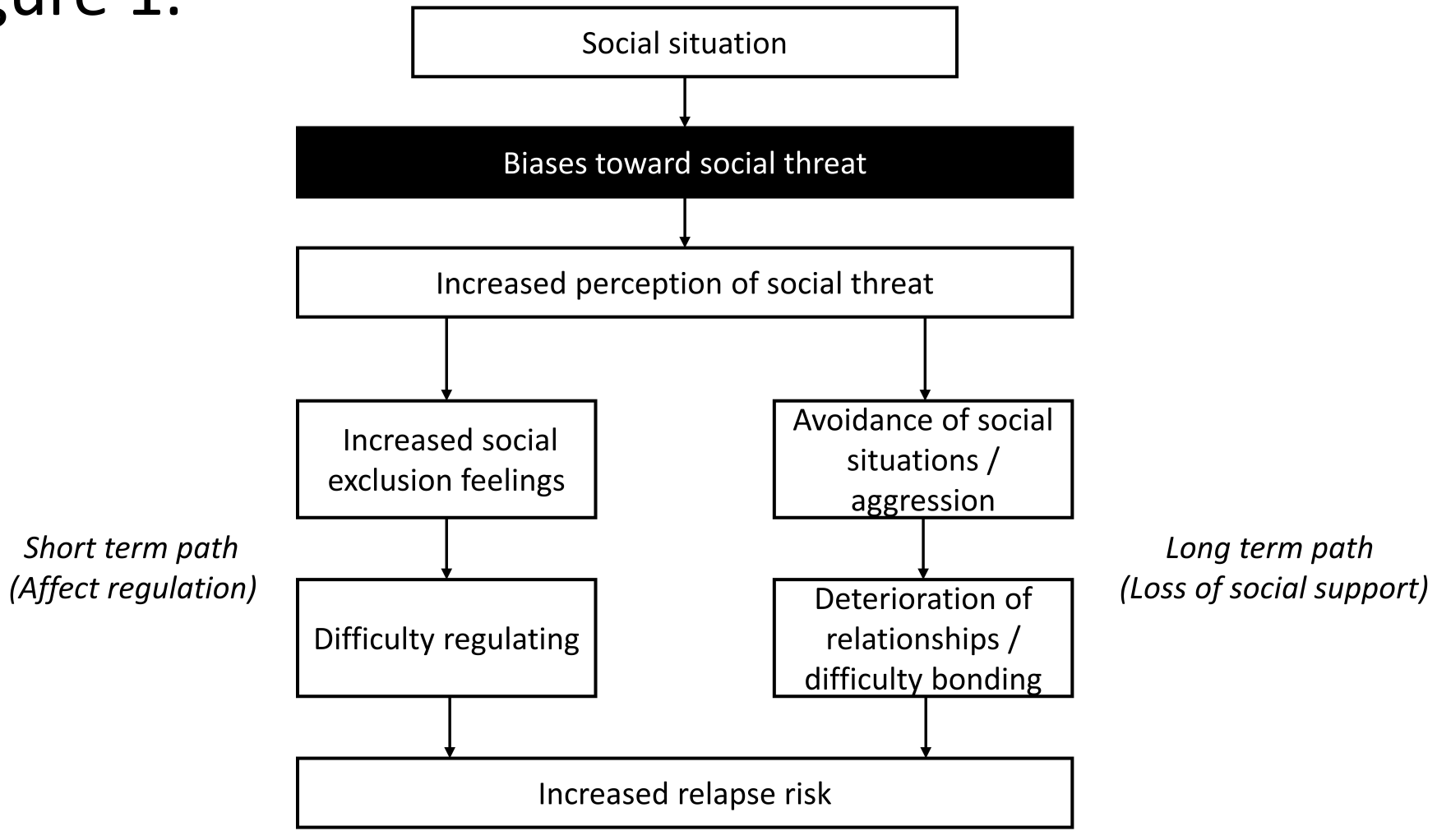
Figure Caption

Figure 1. Schematic representation of the postulated short and long term paths leading from socio-affective biases towards interpersonal threat to clinical outcomes.

Figure 1.


Social situation
Biases toward social threat
Increased perception of social threat
Increased social exclusion feelings
Avoidance of social situations / aggression
Short term path (Affect regulation)
Long term path (Loss of social support)
Difficulty regulating
Deterioration of relationships / difficulty bonding
Increased relapse risk

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Conflict of Interest

The authors declare no conflict of interest.

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