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The grey future:  
Overgenerality of emotional future thinking in alcohol-use disorders

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## **Abstract**

**Background:** While previous research has highlighted the overgenerality of future thinking in alcohol-use disorders (AUD), the emotional characteristics of future thinking were not taken into account. We therefore evaluated the ability to retrieve episodic (i.e., events that happened at a particular place and time and lasted for a day or less) emotional future events in AUD.

**Methods:** We invited 36 participants with AUD and 40 control participants to imagine positive, negative and neutral future scenarios and analyzed these scenarios regarding their episodic characteristics (i.e., the ability of participants to imagine future events situated in time and space enriched with phenomenological details).

**Results:** Analysis demonstrated lower episodic positive, negative and neutral future thinking in participants with AUD than in control participants. Participants with AUD also demonstrated lower episodic positive and negative future thinking compared to episodic neutral future thinking. Interestingly, high depression scores were associated with overgenerality of neutral, positive, and negative future thinking in AUD participants.

**Conclusions:** These findings demonstrate overgenerality of both positive and negative future thinking in AUD. This overgenerality may represent an avoidance strategy in which individuals with AUD may try to avoid the hopelessness and/or conflicts that may be activated when constructing future scenarios.

**Keywords:** Alcohol; Alcohol-Use Disorders; Depression; Emotion; Future Thinking;

## **1. Introduction**

Individuals with alcohol-use disorders (AUD) typically demonstrate overgenerality of future thinking. In other words, they demonstrate a tendency to imagine general rather than episodic future events that may occur in a specific time and space (D'Argembeau et al., 2006; El Haj et al., 2019). The overgenerality of future thinking in AUD may represent an avoidance strategy in which individuals with AUD construct general future scenarios to replace feelings associated with projecting themselves into the future with abstract thought and, therefore, to avoid emotional experiences (El Haj et al., 2019; Moustafa et al., 2018). The overgenerality of future thinking in AUD has also been associated with difficulties in initiating appropriate problem-solving strategies for upcoming challenges, as well as with difficulties in imagining potential achievements, resulting in negative self-image, low self-esteem and motivations, and consequently in relapses (El Haj et al., 2019). As this previous work investigated the overgenerality of future scenarios in individuals with AUD in neutral situations without considering the emotional characteristics of these scenarios, we investigated the ability of these individuals to retrieve episodic (i.e., events that happened at a particular place and time and lasted for a day or less) emotional future events.

The overgenerality of future thinking in AUD was investigated by D'Argembeau et al. (2006) who invited individuals with AUD and control participants to imagine events that might happen to them in the future in as much detail as possible (e.g., imagining when and where the events would occur, the people who would be present). After having imagined the events, participants were invited to rate sensory details such as the amount of visual details, amount of sounds, and amount of smell/taste. They were also invited to rate the representation of contextual information triggered during their future thinking, such as the clarity of the time of day, the

location, and the spatial arrangement of objects and people. Results demonstrated that individuals with AUD subjectively experienced fewer contextual details during future thinking than control participants. While the study of D'Argembeau et al. (2006) highlighted the overgenerality of future thinking in AUD, the latter was mainly assessed by asking participants to rate subjectively the amount of contextual details. In other words, it did not objectively assess whether individuals with AUD tend to demonstrate overgenerality of future thinking. This issue was investigated by El Haj et al. (2019) who invited individuals with AUD and control participants to retrieve past events and to imagine events that might happen to them in the future. The authors analyzed whether these events described general or episodic events. Results demonstrated overgenerality of past and future thinking in individuals with AUD than in control participants. Interestingly, significant correlations were observed between past/future thinking and depression in individuals with AUD.

While the study of El Haj et al. (2019) highlighted the overgenerality of future thinking, as well as the relationship between this overgenerality and depression in AUD, it did not examine the emotional characteristics of future thinking. This issue is important because AUD has been associated with difficulties in processing emotional information and in emotion regulation. Emotional disorders, specifically the inability to identify and verbalize emotional states, are among the factors that influence substance use and relapse (Baker et al., 2004). Difficulties in perceiving and understanding one's own emotional states as well as those of others will hinder the individual's ability to respond to internal demands and those of the environment (Kornreich et al., 2011; Maurage et al., 2011). Such difficulties in perceiving emotional states for oneself and others are considered a permanent stress factor that the individual is unable to regulate and which leads to reinforcing addictive behaviors (Kornreich et al., 2011). These

emotional regulation difficulties may be observed in AUD because emotion regulation strategies rely on higher-order cognitive processes (e.g., executive function) that are impaired by alcohol (Curtin and Fairchild, 2003).

Together, research has consistently demonstrated that alcohol influences emotional responding. Building on this research, we investigated whether alcohol may also influence emotional future thinking. This aim was further motivated by the CaRFAX model (Capture, Rumination, Functional Avoidance, EXecutive Functioning) (Williams, 2006), according to which overgenerality of past thinking, as observed in AUD, is mediated by three different mechanisms that can operate independently or in combination: 1) an effect of capture due to rumination thinking, 2) a deficit in executive functioning and, critically, 3) the functional avoidance of emotions. Therefore, overgenerality can be associated with functional avoidance strategies in the sense that stopping memory retrieval at a general level rules out access not only to episodic memories but also to the emotional charge that is associated with them (Dalgleish et al., 2008; Williams et al., 2007). A similar suggestion was made by the AMAUD (Autobiographical Memory and Alcohol Use Disorders) model (Nandrino et al., 2017), according to which compromise of emotion regulation in AUD can be associated with a weak aspiration to construct detailed memories during retrieval. The model postulates that distribution of emotional processing in AUD leads not only to the compromise of past thinking but also to that of future thinking, an assumption that has not yet been tested empirically. Therefore, we investigated the effects of AUD on emotional future thinking by examining whether individuals with AUD tend to construct overgeneral rather than episodic emotional future scenarios. We also evaluated whether this expected overgenerality is associated with depression. The latter objective was not solely based on the prevalence of depression in AUD (Foulds et al., 2015) or even on the

fact that AUD and depression typically co-occur (Gilman and Abraham, 2001), but also on the assumption that depression impedes the progression of memory search and consequently the retrieval of episodic memories in AUD (Williams, 2006).

While previous research has demonstrated the overgenerality of future thinking in AUD (D'Argembeau et al., 2006; El Haj et al., 2019), the emotional characteristics of future thinking have received little attention. We therefore evaluated whether the overgenerality of future thinking in AUD varies according to the emotional valence (i.e., positive vs. negative) of the constructed scenarios. To do so, we invited individuals with AUD to construct positive future scenarios (i.e., cued with the word “happy”), negative future scenarios (i.e., cued with the word “unhappy”), and scenarios cued with the word “city” as this word has been considered as a neutral cue (Maki et al., 2013). We expected less episodic future scenarios, especially for negative ones, in individuals with AUD than in control participants. We also expected significant correlations between the overgenerality of negative future thinking and depression in individuals with AUD.

## **2. Method**

### **2.1. Subjects**

The study included 36 participants suffering from AUD (15 women and 21 men;  $M$  age = 45.19 years,  $SD = 6.62$ ;  $M$  years of formal education = 11.12,  $SD = 2.61$ ) recruited from day hospitals and hospital departments in the north and west of France. These participants were evaluated by an addiction specialist and met the criteria of DSM-V for AUD (APA, 2013). Alcohol use difficulties had been present for at least one year and the actual duration of abstinence was at least three weeks. As a control group, we recruited 40 participants (17 women and 23 men;  $M$  age = 44.78 years,  $SD = 6.21$ ;  $M$  years of formal education = 11.87,  $SD = 2.36$ )

from the local community. Control participants were matched with the AUD participants on sex ratio [ $\chi^2(1, N = 76) = .005, p > .10$ ], age [ $t(74) = .28, p > .10$ ], and educational level [ $t(74) = 1.31, p > .10$ ]. Exclusion criteria were history of neurological or psychiatric disorders (other than alcohol dependence for the AUD group). Participants with previous and current drug consumption (cannabis and opiates except for tobacco) were also excluded. All participants underwent a cognitive examination to confirm that they had no cognitive impairment. They were all native French speakers. The study was conducted in accordance with the Helsinki Declaration and all participants provided their written informed consent.

## **2.2. Procedures**

### **2.2.1. Cognitive and clinical evaluation**

We evaluated general cognitive functioning, executive function (i.e., inhibition) and depression (Table 1) in all participants. General cognitive functioning was assessed with the Montreal Cognitive Assessment, a 30-point cognitive test that evaluates orientation, attention, language, verbal memory, visuospatial and executive function (Nasreddine et al., 2005). Inhibition was evaluated with the Stroop test consisting of three subtests: word-reading, color-naming, and color-word interference. In the word-reading subtest, participants had to read words printed in black ink, all words naming colors. In the color-naming subtest, they had to name the color of colored ink squares. In the color-word interference subtest, they had to name the color of color words printed in incongruously colored ink (for instance, the word “blue” was written in red). The inhibition score was the completion time (in seconds) for the interference condition minus the average completion time for word-reading and color-naming. Note that we evaluated inhibition rather than other executive functions such as flexibility or updating in light of the model of Miyake et al. (2000), who considered inhibition as a core executive function. We also



evaluated inhibition because it has been shown to be affected by AUD (Harper et al., 2018; Quoilin et al., 2018; Stock et al., 2016). It is worth noting, however, that, while the Stroop task mainly assesses inhibition, it also assesses other executive functions such as flexibility (Cox et al., 2018), not surprisingly as executive tasks are typically not process-or factor-pure in the sense that performance is determined not only by the targeted executive function but also by other executive processes (Miyake et al., 2000). Regarding depression, we used the Beck Depression Inventory (Beck et al., 1988) consisting of 21 items in which participants were invited to indicate the statement that best describes how they felt in the past two weeks. The overall score provided the level of depression (no depression: a score between zero and 11 points; mild depression: a score between 12 and 19 points; moderate depression: a score between 20 and 30 points; and severe depression: > 30 points).

### **2.2.2. Future thinking**

Participants were invited to construct verbally one positive future event, one negative future event, and one neutral future event. They had to have a reasonable likelihood of occurring, be it in the near or distant future. Participants were invited to be precise and specific, i.e. events had to last no more than a day and details had to be provided (e.g., where the event would occur, what they would do during it, who would be present, what their feelings would be). We also provided some examples to illustrate what would be considered as an episodic event. They were instructed that the first projection should be "neutral" (i.e. without emotional induction on the part of the investigator), the second projection was to be associated with negative content, and the last with positive content. The three conditions were randomly counterbalanced across participants. Participants were allocated two minutes to describe each of the three events and the duration was made clear so that the participants could structure the events accordingly.

### **2.2.2.1. Analysis of episodic future thinking.**

We analyzed episodic future thinking (i.e., the ability to imagine future events situated in time and space enriched with phenomenological details) using the TEMPau scale (Test épisodique de mémoire du passé) (Piolino et al., 2002), which was derived from classic autobiographical evaluations (Kopelman, 1994) and translated into French. For each event, we attributed the following: zero if there was no response or only general information about a theme; one point for a repeated or an extended event; two points for an event situated in time and/or space; three points for an episodic event lasting less than 24 h and situated in time and space; and four points for an episodic event situated in time and space enriched with phenomenological details such as feelings, perceptions, thoughts, or visual imagery. To avoid a bias in scoring, a second independent rater not associated with the current study rated a random sample of 20% of the data. Inter-rater Cohen's kappa was .90. Cases of disagreement were subjected to joint evaluation.

### **2.3. Results**

We compared the episodic positive, negative and neutral future thinking between AUD participants and controls. We also compared differences in episodic positive, negative and neutral future thinking in each population. Because data were not normally distributed as observed by Kolmogorov-Smirnov tests, the Mann-Whitney U-test was used for inter-group comparisons, and the Friedman test was used for within-group comparisons, followed by Wilcoxon's signed-rank test. We provided effect sizes using Cohen's  $d$  (Cohen, 1992): 0.20 = small, 0.50 = medium, 0.80 = large. Cohen's  $d$  was calculated for non-parametric tests according to the recommendations of Rosenthal and DiMatteo (2001), and Ellis (2010). Second, we analyzed correlations between future thinking and depression in each population. Correlations

were analyzed with non-parametric Spearman's tests. For all tests, the level of significance was set at  $p \leq 0.05$ ,  $p$  values between 0.051 and 0.10 were considered as trends, if any.

### **2.3.1. Low episodic emotional future thinking in AUD**

Episodic scores for future thinking are summarized in Figure 1. Compared to control participants, participants with AUD demonstrated lower episodic positive ( $Z = -7.12$ ,  $p < .001$ , Cohen's  $d = 2.83$ ), negative ( $Z = -6.78$ ,  $p < .001$ , Cohen's  $d = 2.47$ ), and neutral future thinking ( $Z = -4.76$ ,  $p < .001$ , Cohen's  $d = 1.30$ ). Analysis also demonstrated significant differences in episodic future thinking across the three emotional conditions (i.e., positive, negative, and neutral future thinking) in participants with AUD [ $\chi^2(2, N = 36) = 11.47$ ,  $p < .001$ , Cohen's  $d = 1.37$ ]. Follow-up comparisons in participants with AUD demonstrated lower positive episodic future thinking than neutral episodic future thinking ( $Z = -3.16$ ,  $p < .01$ , Cohen's  $d = 1.23$ ), lower negative episodic future thinking than neutral episodic future thinking ( $Z = -2.96$ ,  $p < .01$ , Cohen's  $d = 1.13$ ), but no significant differences between positive episodic future thinking and negative episodic future thinking ( $Z = -.15$ ,  $p > .10$ , Cohen's  $d = .05$ ). Regarding control participants, no significant differences were observed across the three emotional conditions [ $\chi^2(2, N = 40) = 1.46$ ,  $p > .10$ , Cohen's  $d = .39$ ].

### **2.3.2. Relationship between future thinking and depression in alcohol dependence**

As demonstrated in Figure 2, analysis showed significant negative correlations between positive future thinking and depression, negative future thinking and depression, and neutral future thinking and depression in AUD participants. In other words, high depression scores were associated with overgenerality in these participants. However, no significant correlations were observed between depression and future thinking in control participants. We carried out complementary analyses and found no significant correlations between future thinking and

general cognitive functioning or between future thinking and inhibition in AUD participants and controls.

### **3. Discussion**

This paper is the first to investigate emotional future thinking in AUD. Our analysis demonstrated lower episodic positive, negative and neutral future thinking in participants with AUD than in control participants. Participants with AUD also demonstrated lower episodic positive and negative future thinking compared to neutral future thinking. Interestingly, neutral and emotional future thinking were correlated with depression in AUD participants.

While previous research demonstrated lower episodic future thinking in AUD (D'Argembeau et al., 2006; El Haj et al., 2019), those studies were not concerned with the emotional characteristics of future thinking. Our study extends this research by demonstrating low episodic positive and negative future thinking in AUD. This overgenerality may represent an avoidance strategy in which individuals with AUD may try to avoid the hopelessness and/or conflicts that may be activated when constructing future scenarios, regardless of their emotional valence. This hypothesis is supported by the correlations between emotional future thinking and depression observed in AUD participants. Depression is typically associated with overgenerality, probably to avoid the processing of upsetting or distressful events or even mood disturbances (Williams, 2006). The relationship between depression and overgenerality has not been solely reported for past thinking but also for future thinking (Moustafa et al., 2018). Depression is characterized by a low ability to imagine episodic future scenarios. This overgenerality has been attributed to rumination and avoidance strategies (Addis et al., 2016) as well as to reduced activity in brain areas associated with episodic richness and visual imagery such as the hippocampus, precuneus and cuneus (Hach et al., 2014). The overgenerality of emotional future

thinking in AUD may represent an avoidance strategy in which individuals with AUD construct general rather than episodic emotional future scenarios to dwell on negative past experiences and/or to avoid coping with hopelessness and the processing of distressful future scenarios.

The assumption that individuals with AUD tend to construct general emotional future scenarios to avoid coping with hopelessness and the processing of distressful future scenarios (regardless of their emotional valence) is supported by research demonstrating difficulties in emotional regulation in AUD in general. As mentioned in the introduction, research has shown how individuals with AUD have difficulties in experiencing emotional states and in using cognitive reappraisal processes to modify these states and/or to initiate actions to modify these affective experiences or expressive behaviors (Gross and John, 2003). These difficulties have also been evidenced by research demonstrating how alcohol may be consumed to avoid emotional experiences or conflicts (Breese and Knapp, 2016; Conger, 1951), especially in social interactions (Fairbairn and Sayette, 2014; Jones et al., 2001). Our study extends these findings by showing that emotional avoidance is a characteristic of future thinking in AUD. Interestingly, this avoidance was found both for positive and negative thinking. The lower episodic positive and negative future thinking compared to neutral future thinking in AUD may be associated with hopelessness. In other words, individuals with AUD may feel that few positive outcomes will occur when imagining positive scenarios, and that only negative ones will occur when imagining negative scenarios. Thus, individuals with AUD may tend to be rather pessimistic and have little desire to construct detailed events when imagining future scenarios. This hopelessness may also be due to the activation of past (negative) experience when they construct future emotional scenarios. This assumption is supported by the episodic simulation hypothesis according to which elements of past experiences are extracted and recombined during the construction of

future events (Addis et al., 2007; Schacter et al., 2012). Another explanation for the overgenerality of emotional future thinking in AUD may be the lack of motivation to construct episodic future scenarios. This assumption can be supported by research demonstrating the involvement of motivation in drinking outcomes (Hunter-Reel et al., 2010).

The overgenerality of emotional future thinking in AUD found in this study may also be associated with neurological mechanisms. The amygdala, a brain area widely associated with emotional processing (Davis and Whalen, 2001; LeDoux, 1996, 2003), plays a key role in neuroscientific models of alcohol consumption (Goode and Maren, 2019; Koob and Volkow, 2016; Ron and Barak, 2016; Volkow et al., 2016). Furthermore, research in rodents has demonstrated that alcohol acutely dampens the functioning of this brain area (Pandey et al., 2008; Sharko et al., 2013, 2016). The impact of alcohol on the amygdala has also been observed in humans, with research reporting the dampened reactivity of amygdala to emotional stimuli owing to alcohol consumption (Costafreda et al., 2008; Gilman et al., 2012; Hur et al., 2018). Therefore, the overgenerality of emotional future thinking in AUD might be due to the dampened reactivity of the amygdala, a hypothesis that should be addressed by neuroimaging studies.

Regarding the control participants, the lack of significant difference regarding neutral and emotional episodic future thinking is surprising considering the positive bias typically observed for future thinking in non-pathological populations (Berntsen and Bohn, 2010; Berntsen and Jacobsen, 2008; D'Argembeau and Van der Linden, 2004; Finnbogadóttir and Berntsen, 2013; Newby-Clark and Ross, 2003; Ross and Newby-Clark, 1998). Unlike negative future thinking, positive future thinking is typically more frequent and imagined faster (D'Argembeau et al., 2011; Newby-Clark and Ross, 2003), triggers more sensorial details, clear representations of

contextual information, more feelings of pre-experiencing (D'Argembeau and Van der Linden, 2004; de Vito et al., 2015), and plays a central role in maintaining one's self-image (Rasmussen and Berntsen, 2013). Indeed, it is generally assumed that people with non-pathological conditions are optimistic about the future and tend to conceive it in a favorable light (Sharot et al., 2007). Therefore, positive future thinking could be expected to be more episodic than negative future thinking in people with non-pathological conditions. However, this was not the case here, perhaps owing to the ceiling episodic scores in these participants.

A potential limitation to this study is the strict exclusion criteria. While the results can be confidently related to AUD, they may lack representativeness as we excluded participants with neurological/psychiatric disorders or significant cognitive decline. Another limitation may be lack of assessment of anxiety as AUD is typically characterized by anxiety (Kushner et al., 2000) or even the lack of assessment of individual differences in coping styles as depression and substance use disorders have been associated with avoidant coping styles.

To conclude, this paper demonstrates the overgenerality of emotional future thinking in AUD. This is of clinical relevance because overgenerality may have a protective function as individuals with AUD may use it to avoid the resurgence of undesirable emotional future scenarios. In our view, this protective function may have serious consequences as it may impede the emotional processing of the future or even the ability of individuals with AUD to look to the future and imagine themselves as recovered. In turn, this may increase the sense of hopelessness, impact self-esteem and reduce motivation, leading to increased alcohol consumption. By focusing on emotional thinking, clinicians may help individuals with AUD to disengage from the gray and poor image of the future and/or to escape from the "here and now", or even from the negative past, in order to build an alternative (colored) future experience. Moreover, the

impoverishment of emotional processing during future thinking can be considered as an index of the ability of patients with AUD to integrate positive information into their life scripts, or even to process positive information in general. This flattening of emotional charges may contribute to a stereotypical and impoverished representation of the world and could thus be a risk factor for alcohol consumption. Psychotherapeutic interventions that seek to empower patients to process emotional information during future thinking may promote their ability to seek alternative (and positive) scenarios when dealing with hopelessness and the grey image of the “here and now”.



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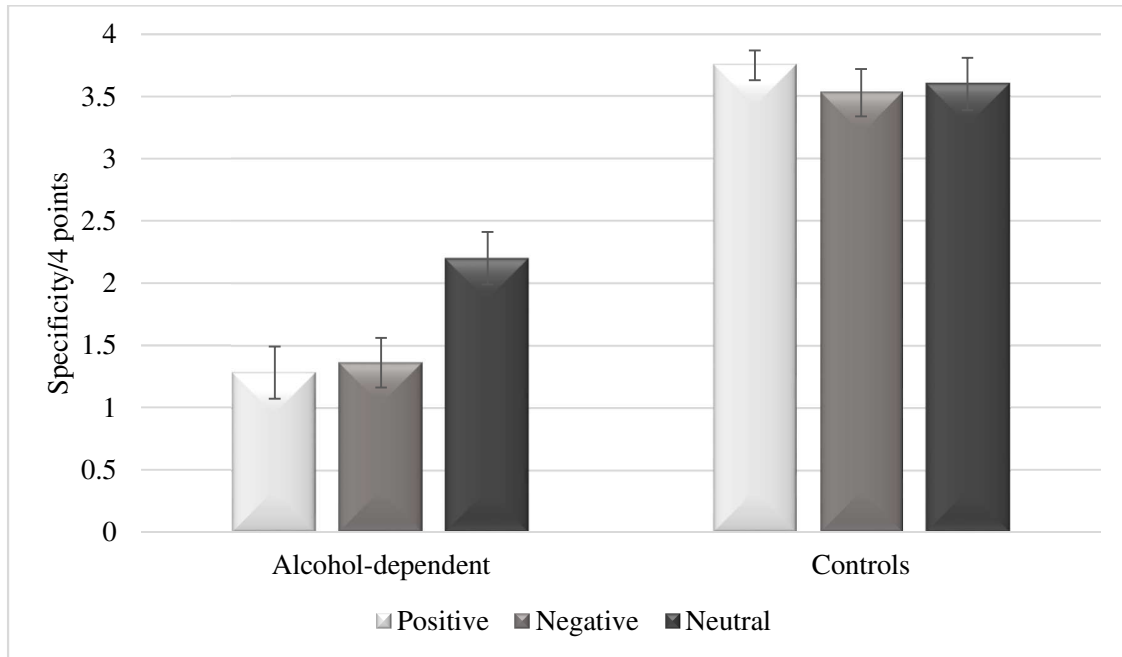
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## **Figure Legend**

**Figure 1.** Specificity of emotional and neutral future thinking in participants with alcohol use disorders and control participants. Error bars are 95% within-subject confidence intervals.

**Figure 2.** Correlations between depression and positive (Figure 2a), negative (Figure 2b), and neutral future thinking (Figure 2c) in alcohol-dependent participants.





**Figure 1.**

Figure 2a:  $r = -.33, p < .05, 95\% \text{ CI } [-.59, -.002]$

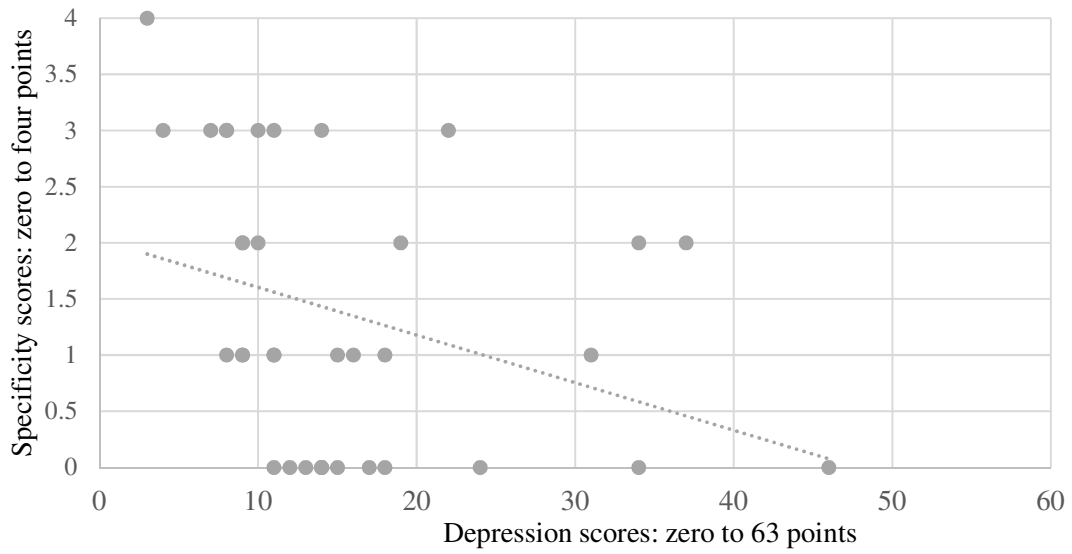


Figure 2b:  $r = -.40, p < .05, 95\% \text{ CI } [-.64, -.08]$

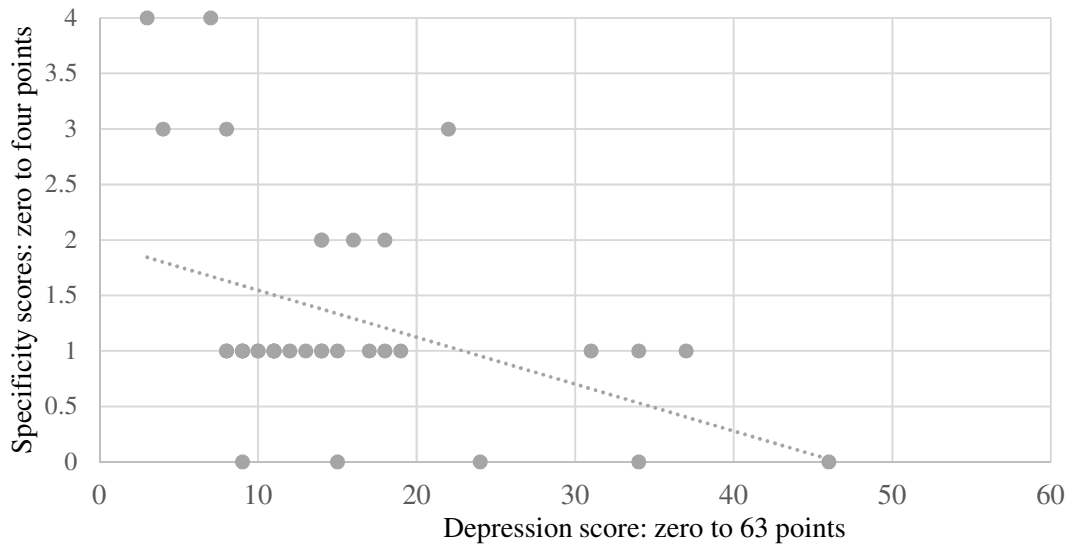
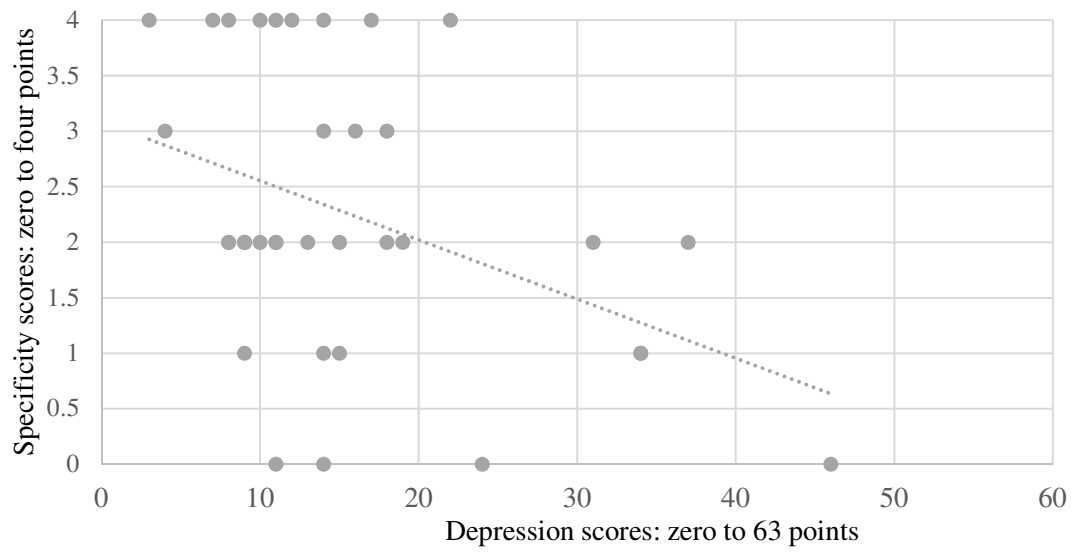


Figure 2c:  $r = -.41, p < .05, 95\% \text{ CI } [-.65, -.10]$



**Table 1.** Cognitive and clinical performances of individuals with alcohol use disorders and control participants

	<b>Tasks</b>	<b>Alcohol</b> <i>n</i> = 36	<b>Controls</b> <i>n</i> = 40	<b>Between-group</b> <b>comparisons</b>
<b>General cognitive functioning</b>	Montreal Cognitive Assessment	26.05 (3.02)	26.77 (1.33)	$t(74) = 1.36, p > .1$
	Stroop task	63.42 (24.05)	58.51 (17.83)	$t(74) = 1.03, p > .1$
<b>Depression</b>	Beck Depression Inventory	15.69 (9.75)	3.13 (2.74)	$t(74) = 7.82, p < .001$

*Note.* Standard deviations are shown in parentheses; the maximum score on the Montreal Cognitive Assessment is 16 points; performance on the Stroop task refers to completion time (in seconds); scores above 30 points indicate severe depression on the Beck Depression Inventory.