# **The effect of desire thinking on facilitating beliefs in Alcohol Use Disorder: An experimental investigation**

# **Regular Article**

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**Abstract**

Permissive beliefs relate to the acceptability of engaging in alcohol use in spite of obvious potential negative consequences. They are considered the most proximal and precipitating cognitive factor in the decision to use alcohol and/or the activation of strategies to obtain it. Recent research suggested that ‘desire thinking’ may be involved in the escalation of craving and addictive behaviours, and can play a role in strengthening permissive beliefs.The current study tested whether the induction of desire thinking would have a stronger effect on rate of conviction in permissive beliefs compared to a control cognitive response in the form of neutral thinking; and whether this effect would be specific for patients with Alcohol Use Disorder (AUD). Thirty AUD patients and 30 social drinkers (SD) were randomly allocated to two thinking manipulation tasks (desire thinking and neutral thinking). Current permissive beliefs were measured before and after manipulation and after a resting phase. Findings showed that desire thinking increased the level of current permissive beliefs after manipulation relative to the neutral thinking condition for the AUD group but not for the SD group. This effect was not purely dependent on the concurrent level of perceived craving. This study supports a causal relationship between the induction of desire thinking and rate of conviction in permissive beliefs and highlight the relevance of targeting desire thinking in the treatment for AUD patients.

**Key words**: addiction, Alcohol Use Disorder, craving, cognition, desire thinking.

**Pratictioner messages**

* Thinking about desired targets like alcoholic beverage may strengthen permissive beliefs and facilitate decision to drink.
* This study highlights the importance of being aware of own thinking style and change it to reduce the risk of permissive beliefs toward alcohol use.
* Improve metacognitive awareness and control over desire thinking may be of value in treatment of AUD patients.

**Introduction**

Alcohol Use Disorder (AUD) involves loss of control over alcohol use, a strong desire or urge to use alcohol, and continued alcohol use in hazardous situations despite awareness of persistent or recurrent life problems caused by the effects of alcohol (DSM-5, APA, 2013). The harmful use of alcohol is one of the world’s leading health risks and has been implicated in 5.9% of deaths globally (World Health Organization, 2014).

A wide range of approaches have been developed to conceptualize and treat this disorder. Among these approaches, the cognitive-behavioral theoretical framework has highlighted the role of learning processes and addictive beliefs, which are presumed to maintain alcohol use as a strategy to cope with negative affect or to reach desired goals. Addictive beliefs have been conceptualized as a stable cognitive entity that may lead to engage in alcohol use once triggered by numerous potential external/internal circumstances (Beck, Wright, Newman & Liese, 1993). Addictive beliefs include anticipatory, relief-oriented, and permissive beliefs.

Permissive beliefs relate to the acceptability of engaging in alcohol use despite obvious potential negative consequences (e.g. “I deserve it. There is nothing wrong with taking risks”) (Wright, Beck, Newman & Liese, 1993). Within the cognitive-behavioural theoretical framework the activation of permissive beliefs is purported to direct attention to instrumental strategies for obtaining alcohol, which in turn lead to use. Permissive beliefs are considered the most proximal and precipitating cognitive factor in the decision to use alcohol and/or the activation of strategies to obtain it. The cognitive-behavioural theoretical framework suggests that permissive beliefs, once established, are not easily modified by experience. Repeated alcohol use can produce negative consequences (e.g. guilt and shame) that may act as trigger for the further activation of permissive beliefs, generating a vicious cycle.

The cognitive-behavioral framework has provided valuable insights in conceptualization and treatment of AUD even if it shows several limitations (Beck, Wright, Newman & Liese, 1993). Firstly, it does not establish if addictive beliefs (like permissive beliefs) play a causal role in the etiology and development of AUD rather than being an epiphenomenon of this condition. Secondly, the conceptualization of permissive beliefs as a stable entity, does not allow for: (1) the fluctuation of rate of conviction in such beliefs that may occur before and after a drinking episode; and (2) how people can hold permissive beliefs and continue to regulate appropriately their behavior. These structural weaknesses may explain why Cognitive-Behavioural Therapy (CBT) for AUD has shown only moderate effectiveness when compared to other forms of treatment, including medical management, treatment as usual, or active psychosocial treatments (e.g. Project MATCH Research Group, 1997; Anton et al., 2005; Balldin et al., 2003; Burtscheidt et al., 2002; Farren et al., 2014; Litt et al., 2003; Wetzel et al., 2004; Wolwer et al., 2011) and why its effects on primary outcomes and on addictive beliefs appear to diminish over time, especially at 6- to 9-month follow-up (Magill and Ray, 2009). The same weakness may lead to hypothesized alternative explanations about the potential transient nature of conviction in permissive beliefs and which kind of process can have an impact on such beliefs.

One potential candidate is ‘desire thinking’, a cognitive process that has been showed to be associated to dysfunctional beliefs and can be involved in the escalation of craving and addictive behaviours (Caselli & Spada, 2010; 2011; 2015; 2016; Martino et al., 2017, 2019; Mansueto et al., 2019). Desire thinking has been conceptualised as a conscious and voluntary cognitive process - a form of cognitive elaboration - aimed at orienting oneself to prefigure images, information, and memories about positive target-related experience. The target of desire thinking may be an activity, an object, or a state (Kavanagh, May & Andrade, 2009). Evidence indicates that desire thinking has a multi-dimensional structure, which consists of two sub-components: imaginal prefiguration and verbal perseveration (Caselli & Spada, 2011). The imaginal prefiguration component refers to the allocation of attentional resources to target-related information and a multi-sensory elaboration in the form of anticipatory positive imagery or positive target-related memories recall. The verbal perseveration component refers to prolonged self-talk regarding worthwhile reasons for engaging in target-related activities and their achievement.

Desire thinking appears to be a transdiagnostic process, with subjective reports indicating that this experience is qualitatively similar across a range of targets, including alcohol, food, soft drinks and tobacco (Caselli & Spada, 2010; 2015; May, Andrade, Panabokke & Kavanagh, 2004). Research has also demonstrated that desire thinking facets are active during a craving episode in individuals with alcohol abuse, nicotine dependence and problematic gambling (Caselli & Spada, 2010). In addition, desire thinking: (1) has been found to have a significant effect on craving across a range of addictive behaviors in a community and clinical samples (Caselli, Soliani & Spada, 2013; Caselli, Gemelli & Spada, 2017); (2) is associated to craving in alcohol abusers independently from level of alcohol use (Caselli & Spada, 2011;) and (3) plays a role across the continuum of various addictive behaviours controlling for gender, age, negative affect and craving (Caselli, Ferla, Mezzaluna, Rovetto, Spada, 2012; Caselli, Nikčević, Fiore, Mezzaluna & Spada, 2012; Fernie, Caselli, Giustina, Donato, Marcotriggiani & Spada, 2014; Marino et al., 2019; Spada, Caselli, Slaifer, Nikčević & Sassaroli, 2014, Spada et al., 2015). Finally, desire thinking has been found to longitudinally predict craving and binge drinking in a community sample (Martino et al., 2017) and to longitudinally predict drinking status following treatment in a clinical sample of patient with AUD (Martino et al., 2019).

No research, to date, has investigated the possible link between desire thinking and permissive beliefs. Two lines of reasoning suggest a potential causal relationship. Firstly, desire thinking has been shown to increase sense of deprivation for a craved target (Caselli & Spada, 2011), thus it may indirectly strengthen the need to achieve the target and consequently the salience of beliefs in support of this need. Secondly, the perseveration of positive target-related elaborated information (both imaginal and verbal) may bring to neglect inhibitory-related information (e.g. negative medium to longer term effects). As a consequence, the prolonged activation of desire thinking could bias information processing, selective attention and decision-making processes in favour of the *here and now* solution and increase the on-line conviction in permissive beliefs.

The purpose of this study was to undertake a first experiment to explore the direct causal effect of desire thinking on permissive beliefs. Several studies demonstrated that the induction of desire thinking had a significant effect on craving compared to distraction across a range of addictive behaviours in a community (Caselli, Soliani & Spada, 2013) and clinical sample of patients with AUD (Caselli, Gemelli & Spada, 2017). The impact of desire thinking was independent of baseline craving. The current study extends the investigation about the effect of desire thinking on permissive beliefs in a sample of social drinkers and patients with AUD. In particular, we aimed to test: (1) whether the induction of desire thinking would have a stronger effect on rate of conviction in permissive beliefs compared to a control cognitive response in the form of neutral thinking; and (2) whether this effect would be specific for AUD patients.

**Method**

**Participants**

The study involved two samples: AUD patients and social drinkers (SD). Both samples shared the same inclusion criteria: (1) at least 18 years of age; (2) understanding of written and spoken Italian; (3) absence of drug use apart from alcohol and nicotine in the last 12 months; (4) absence of cognitive deficits or mental retardation; and (5) absence of severe organic disorders. Two additional inclusion criteria were specified: (1) a score of more than 7 on the Alcohol Use Disorder Identification Test (AUDIT) and a diagnosis of AUD on the basis of DSM-5 (APA, 2013) for AUD patients sample; and (2) reported drinking alcoholic beverages at least once per week for SD sample.

AUD patients were recruited from individuals seeking treatment for alcohol-related problems at the Addiction Centre, Gruppo CEIS, Modena, Italy. The AUD group consisted of 30 patients (14 females) with a mean age of 45.73 years (*SD=*9.47, *Range=*22-64). The average number of years of schooling was 11.23 years (*SD=*3.45*, Range*=5-18). The average AUDIT score was 27.86 (*SD=*7.6*, Range*=14-38), which is within the highest range for risk of alcohol dependence (Babor, De la Fuente, Saunders & Grant; 1992). The average duration of alcohol-related problems was 11.31 years (*SD=*9.47*, Range*=2-36).

SD participants were recruited through leaflets and advertisements in the local health services of Modena, Italy and matched on age and gender with the AUD patients. The SD group consisted of 30 individuals (14 female) with a mean age of 43.63 years (*SD=*10.3, *Range=*26-64), a mean years of schooling of 12.40 years (*SD=*3.0, *Range=*5-18) and a mean AUDIT score of 4.28 (*SD=*1.96, *Range=*1-6). All participants were Caucasian.

**Materials**

***The Alcohol Use Disorders Identification Test***

(AUDIT; Babor, de la Fuente, Saunders, & Grant, 1992). AUDIT is the most used ~~a~~ screening tool for early identification of problem drinkers, developed by the World Health Organisation. AUDIT consists of ten questions regarding recent alcohol consumption, alcohol dependence symptoms, and alcohol-related problems. Respondents choose one of five statements (per question) that most applies to their use of alcohol beverages over the past year. Responses are scored from 1 to 4 in the direction of problem drinking. The summary score for the total AUDIT ranges from 0, indicating no presence of problem drinking behaviour, to 40 indicating marked levels of problem drinking behaviour and alcohol dependence. The threshold for indicating possible problem drinking pathology is a score of 8. This instrument has been extensively used and possesses good validity and reliability (Hester & Miller, 1995).

***Desire Thinking Questionnaire***

(DTQ; Caselli & Spada, 2011). The DTQ consists of 10 items, with two sub-scales of five items each, assessing desire thinking. The first sub-scale, verbal perseveration, concerns the perseveration of verbal thoughts about desire-related content and experience and includes items such as: “I mentally repeat to myself that I need to practice the desired activity”. The second sub-scale, imaginal prefiguration, concerns the tendency to prefigure images about desire-related content and includes items such as: “I imagine myself doing the desired activity”. Items are general in content and refer to the desired activity that may be specified in the instructions. Higher scores indicate higher levels of desire thinking. The DTQ total score and sub-scale scores have been shown to possess good factor structure, internal consistency, test-retest reliability, predictive and discriminative validity (Caselli & Spada, 2011).

***The Penn Alcohol Craving Scale***

*(PACS;* Flannery, Volpicelli & Pettinati, 1999). The PACS consists of 5 items assessing craving for alcohol. The first three questions are centred on the duration, frequency and intensity of craving. The fourth question asks to rate ability to resist drinking if alcohol were available. The final question asks to rate overall average craving for alcohol during the previous week. Each question is scaled from 0 to 6. Higher scores indicate higher levels of craving for alcohol. The PACS has been shown to possess good psychometric properties (Flannery, Volpicelli & Pettinati, 1999).

***Current craving measure****.*

Current craving was assessed using two visual-analogue scales. These scales assessed the strength of the urge for drinking and the urge to seek alcoholic beverages from 0 (extremely weak) to 100 (extremely strong).

***Current Permissive Beliefs Measure****.*

Current permissive beliefs were assessed using four visual analogue scales rated from 0 (“I do not believe at all”) to 100 (“I completely believe it is true”). These scales assessed the strength of conviction on each of them. The four items were: “after all I would deserve a drink”, “after all there would be no risk in having a drink”, “after all I would be able to stop when I want”, “after all, having a drink is not dangerous per se”. A mean score was been obtained from these items.

***Thinking manipulations****.*

The desire thinking and neutral thinking manipulations consisted of 24 items each. Items comprised suggestions and instructions that aimed to drive participants’ cognitive elaboration and were presented through a recorded audiotape with an interval of 20 seconds from one to another. The desire thinking manipulation was based on the tasks used by Caselli, Soliani and Spada (2012, see Appendix A). In the ‘desire thinking’ condition participants were asked to mentally prefigure themselves while drinking, remember past episodes, plan future opportunity to be involved in drinking and thinking about related advantages (e.g. *‘Try to visualize last time you drank and its positive effects’* or *‘think about advantages for you of having a drink’*). The neutral thinking manipulation was based on Nolen-Hoeksema and Morrow’s (1993) distraction task that was already applied in the field of alcohol use by Caselli, Soliani and Spada (2012). In the neutral thinking condition, participants focused their attention on items that were unrelated to alcohol use (e.g. ‘*Think about the shape of a large black umbrella’*, ‘*Think about a ship crossing the ocean’*). In each condition, participants were instructed to concentrate on the audio tape items for a total of 5 minutes. Participants were also asked to indicate what proportion of their thoughts (0-100%) during the experimental task were concerning alcohol.

**Design**

Participants of both groups were randomly allocated to two conditions: a desire thinking condition versus a neutral thinking condition. Groups were matched for gender. The overall design was a 2 (Group: AUD, SD) x 2 (Condition: neutral thinking, desire thinking) x 3 (Time: baseline, post-induction, post-resting phase) repeated measure design.

**Procedure**

Ethics approval for the study was obtained from the Italian Research Institute Studi Cognitivi Ethics Board. Participants received the research project content by direct distribution and all of them took part on a voluntary and unpaid basis. After the participants had given written informed consent, they were invited to complete the AUDIT together with a diagnostic interview conducted by an expert clinician to evaluate the presence of alcohol use disorder. During a second session, one week later, DTQ and PACS, current craving and current permissive beliefs were administered (Time 1). Participants were then randomly assigned to one of the two thinking manipulations conditions (desire thinking versus neutral thinking) and spent 5 minutes working through the thinking manipulation task. Following this, participants repeated the current craving, current permissive beliefs measure and manipulation check (Time 2). Finally, participants were asked to empty their mind and connect dots on a paper for 3 minutes and repeat the current craving and current permissive beliefs rating (post-resting phase, Time 3). At the end of experimental session all participants were debriefed by an expert psychologist. The manipulation task has been implemented as intended with all participants and no aversive effects emerged. All participants completed the procedure.

**Results**

Initial analyses were performed with gender as a between-participant variable. As there were no gender differences on the main measures of interest, all further analyses reported were collapsed across this variable.

**Baseline Psychological Characteristics**

To investigate whether there were differences in baseline psychological characteristics between groups, a series of ANOVAs were used with Age, AUDIT, PACS, DTQ and current permissive beliefs. Age did not show any significant differences between groups. A significant group effect was identified for the other variables (See Table 1). Bonferroni pairwise comparisons indicated that AUD patients scored higher than SD on the AUDIT (*MDifference* = 22.37, *p<*.001), PACS (*MDifference* = 15.52, *p<*.001), DTQ (*MDifference* = 10.08, *p<*.001) and current permissive beliefs (*MDifference* = 9.65, *p<*.001). No significant differences at baseline were observed between the desire thinking and neutral thinking conditions (See Table 1).

To test the efficacy of induction tasks, we compared scores on manipulation checks during the induction phase as reported by individuals at Time 2. As expected, participants in the desire thinking condition reported a significantly greater number of alcohol-related thoughts compared those in the neutral thinking condition [*t*(58) = 10.8; *p* < .01].

**Effect of Manipulation on Permissive Beliefs**

In order to establish if there was an overall effect of the thinking manipulation, a 2 (Group: AUD, SD) x 2 (Condition: neutral thinking, desire thinking) x 3 (Time: pre-manipulation, post-manipulation, post resting phase) repeated measure analysis of covariance (ANCOVA) was conducted with AUDIT, PACS and DTQ as covariates. Current permissive beliefs were entered as the dependent variable. There was a significant Group x Condition x Time interaction [*F*(2,42)=6,67; *p*<.01] (See Table 1 and Figure 1) while significant covariate effects were identified for the interaction between Time and AUDIT [*F*(2,42) = 5.95 ; *p* < .01] and PACS [*F*(2,42)= 4.03; *p*=.02] and no significant covariate effects were identified for the interaction between Time and DTQ [*F*(2,42) = 2.03 ; *p* = .14]. To examine this interaction further, repeated measures ANOVAs investigated the effects of the manipulation in AUD and SD participants separately. Results showed a significant Condition x Time interaction for the AUD group [*F*(2,26) = 8.14, *p*<.01] but not for the SD group [*F*(2,27) =.31; *p* =.74]. Bonferroni pairwise comparisons were further conducted to examine this interaction for AUD group. Results indicated that AUD patients in the desire thinking condition showed a significant increase on current permissive beliefs post-manipulation (*MDifference* = 10.02, *p*=.04, *d =* .55) and decrease at post-resting phase (*MDifference* = -11.60, *p*<.01, *d =* .60) relative to the neutral thinking condition that did not show significant changes (*MDifference* = -5.97, *p*=.64, *d = -*.01 after manipulation; *MDifference* = -2,40, *p*=1,00, *d =* .01 after resting phase). These results indicated that desire thinking condition increased the level of current permissive beliefs relative to the neutral thinking condition for the AUD group but not for the SD group (See Figure 1).

To investigate whether this effect could be accounted for by change in level of perceived craving we calculated an ANCOVA between conditions for the AUD group with the change score for current permissive beliefs between Time 1 and Time 2 as dependent variables, and change in current craving between Time 1 and Time 2 as covariate. The effect of conditions remained significant [F(2) = 5.58, *p* = .02] and perceived craving effect was also significant [F (1) = 5.40, *p =* .03]. Thus, the increase in current permissive beliefs following desire thinking was not purely dependent on the concurrent level of perceived craving.

**Discussion**

The goal of this study was to explore the direct causal effect of desire thinking on permissive beliefs for alcohol use. Our findings showed that desire thinking had a significant effect on increasing current permissive beliefs in patients with AUD, relative to neutral thinking, but not in social drinkers. This effect was independent of baseline severity of alcohol-related problems, levels of craving and desire thinking. In addition, the increase in current permissive beliefs following desire thinking was not purely dependent on the concurrent level of perceived craving.

Taken together, these findings align themselves to those observed in preliminary studies about the role of desire thinking in alcohol misuse (Caselli & Spada, 2015, 2016; Mansueto et al., 2019) and provide evidence consistent with the hypothesis that desire thinking plays a causal role in strengthening permissive beliefs but only in patients with AUD. Within this group, these findings highlight a potential link between the tendency to adopt desire thinking as a cognitive elaboration strategy of alcohol-related information and the inclination to approach alcoholic beverage. Possible explanations may lie in the action of several factors that require further investigation. Firstly, effects of prolonged desired thinking may increase salience and persistence of positive alcohol-related cognitive contents that, in turn, may facilitate cognitive distortions by increasing confidence in the positive effects of alcohol use and minimizing negative effects. This explanation is also in line with research about the impact of other forms of perseverative thinking on beliefs system. For example, depressive rumination has been shown to strengthen over-general autobiographical memories (Lyubomirsky & Nolen-Hoeksema, 1995) and global negative self-judgement (Rimes & Watkins, 2005). Secondly, perseveration of positive target-related elaborated information (both imaginal and verbal) may bring to neglect inhibitory-related information (e.g. negative medium to longer term effects). As a consequence of this, the prolonged activation of desire thinking could bias selective attentional and decision-making processes in favour of the *here and now* and increase on-line confidence in permissive beliefs.

The impact of desire thinking on permissive beliefs was not purely dependent on the concurrent level of perceived craving, in spite of the latter showing a significant impact on change score for current permissive beliefs. This gives rise to a potential indirect effect of desire thinking on permissive beliefs by increasing sense of deprivation for a craved target and its physiological correlates (Caselli & Spada, 2011).

Results from resting phase showed a significant decrease in level of permissive beliefs for the desire thinking condition in AUD participants and no significant change for the neutral thinking condition. A possible explanation may be associated to the instructions of the resting phase (empty one’s mind and connect dots) that may have generated the interruption of desire thinking and the consequent down-regulation of permissive beliefs. Unfortunately, we did not measure the proportion of alcohol-related thoughts during the resting phase.

Finally, a further fundamental question to address is “What makes the link between desire thinking and permissive beliefs specific for AUD participants?” A potential answer may lie in the abnormal disposition to desire thinking characteristic of the AUD population (see Caselli & Spada, 2015). This abnormal disposition, in terms of perseveration and poor self-regulation, is likely to occur when desire thinking is activated (1) in order to achieve self-regulation, (2) in response to unrealistic and/or unachievable targets, or (3) in response to targets whose achievement conflicts with other personal goals. An example of the latter is the activation of desire thinking about using alcohol when one’s personal goal is the abandonment of the activity. All these aspects concern the field of metacognitions that refer to knowledge or beliefs about one’s own cognitive system and factors that affect its functioning and regulation (Wells, 2000). The metacognitive model of addictive behaviours purports that metacognitions may play a central role in discriminating effects of desire thinking within clinical populations (Caselli & Spada, 2011, 2013; Spada, Caselli & Wells, 2009; 2013; Spada, Caselli, Nikcevic & Wells; 2015). According to Wells, metacognitions can be usefully divided into two broad sets: (1) positive metacognitions about importance of thoughts and usefulness of perseverative thinking such as “Rumination will help me get things sorted out in my mind” or “If I worry I will be prepared”; and (2) negative metacognitions concerning the significance, uncontrollability and danger of inner events, such as “It is bad to have certain thoughts” or “I cannot stop ruminating”. Metacognitions have been found to be associated with a wide array of psychological and behavioural problems (for a full review see Wells, 2009) including addictive behaviours such as alcohol use (for a full review see Spada, Caselli, Nikčević & Wells, 2015; Hammoniere & Varescon, 2018). Recent research has also suggested that metacognitions may indeed play a role in the activation and escalation of desire thinking (Caselli & Spada, 2010; Caselli & Spada, 2013). Positive metacognitions about desire thinking concern the usefulness of desire thinking in distracting from negative thoughts and emotions (e.g. “it helps not to be overwhelmed by my worries”), and in improve executive control over decisions and behaviours (e.g. “It helps to avoid bad decisions”, “It helps to have a greater control over my decisions”). These metacognitions are believed to be involved in the initiation of desire thinking and may increase the importance of thoughts resulting from desire thinking as relevant signals for decision making process and consequent intention to drink. Negative metacognitions about desire thinking concern the uncontrollability of target-related thoughts (e.g. “I cannot stop thinking about my desires”) and loss of control over behaviour (e.g. “Thinking too much about my desires make me lose control”). These metacognitions are believed to play a role in propagating perception of low control once a desire thinking episode has started which may possibly lead to set aside any inhibitory effort.

The clinical implications of these findings are that treatment strategies which focus on desire thinking both at assessment and at intervention phase may be relevant in the treatment of AUD. In terms of assessment, information could be gathered not only in relation to desire thinking and its impact on permissive beliefs and decision-making process. This process may aid to identify and share how cognitive processing style may generate bad decisions and potential relapse. With respect to interventions, the facilitation of skills that improve awareness of desire thinking process and its impact on decision making may be helpful to reduce the risk for overwhelming and prolonged experiences of craving and to produce a detached stance from permissive beliefs once activated. In parallel, skills aimed at improving metacognitive awareness and control or developing competitive plans of cognitive elaboration may be of value to reduce desire thinking process itself. Recently, Metacognitive Therapy (MCT; Wells, 2009) showed positive effects in the treatment of AUD (Caselli et al., 2018).

Results of this study must be considered with regards to design limitations. One potential limitation is that the study relies exclusively on self-report instruments, such that demand effects could account for the differences between inductions. A second limitation is that the self-report instruments of current permissive beliefs and craving consisted of general items with unknown validity and reliability. Finally, there is the lack of an independent check for the reliability of the diagnoses of alcohol use disorder.

Directions for future research include ascertaining the role of desire thinking through the use of implicit measurements of permissive beliefs and of beliefs system in general. Secondly, future studies should explore in detail the association between desire thinking, permissive beliefs and intentionality. Thirdly, a further confirmation of the causal relationship should be obtained by mixing the manipulation of desire thinking and permissive beliefs. Finally, future studies should explore whether changes in desire thinking can have a direct impact on decision making process in patients with alcohol use disorder or other addictive behaviours.

In conclusion, the relation between desire thinking and permissive beliefs in alcohol use disorder has been extended through an experimental design that showed a causal relationship between the induction of desire thinking and confidence in permissive beliefs, over and above the change in perceived craving.

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Table 1. *F* Values, Means and Standard Deviations for ANOVA Baseline Differences in AUDIT, PACS, DTQ, Age and current permissive beliefs between social drinkers and alcohol-dependent drinkers and *F* Values for direct effects and interaction for repeated measure ANOVA.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Alcohol Use Disorder** | | | **Social Drinkers** | | **Results of ANOVA** |
|  | **Neutral thinking**  **(*n =15)*** | | **Desire thinking**  **(*n =15)*** | **Neutral thinking**  **(*n =15)*** | **Desire thinking**  **(*n =15)*** |  |
| AUDIT | 30.2. (6.2) | | 25.4 (8.4) | 4.1 (1.9) | 4.5 (2.1) | Group: *F =*215.74\*\*\*  Condition: *F =* .04  Group x Condition: *F* = .20 |
| PACS | 18.6 (5.6) | | 19.4 (6.7) | 3.7 (4.0) | 3.3 (2.5) | Group: *F =* 124.69 \*\*\*  Condition: *F =* .03  Group x Condition: *F* = .19 |
| DTQ | 23.3 (8.1) | | 21.3 (8.6) | 13.0 (6.5) | 11.3 (1.3) | Group: *F=* 331.56\*\*\*  Condition: *F =* .94  Group x Condition: *F=* .01 |
| Age | 45.8 (9.9) | | 45.6 (9.3) | 43.7 (10.9) | 43.5 (10.0) | Group: *F =* .03  Condition: *F =* .33  Group x Condition: *F* = .01 |
| Alcohol Thoughts | 32.5 (12.5) | | 64.6 (10.9) | 0.83 (1.8) | 57.0 (14.1) |  |
| **Current permissive beliefs** | | | | | | |
| Pre-manipulation (T1) | 20.8 (17.4) | 15.8 (12.3) | | 6.2 (8.0) | 8.2 (10.7) | Group: *F =* 1.66  Condition: *F =* 2.8  Condition x Group: *F =* 1.26  Time: *F =* 5.17\*\*  Time x Condition: *F =* 5.27\*\*  Time x Group: *F =* 5.35\*\*  Time x Condition x Group: *F =* 6.67\*\* |
| Post-manipulation (T2) | 15.0 (13.4) | 24.3 (18.2) | | 6.5 (9.4) | 7.5 (8.4) |
| Post-resting phase (T3) | 13.8 (14.0) | 14.0 (16.9) | | 6.5 (8.6) | 8.3 (9.9) |

Note: \**p<.05, \*\*p<*.01, \*\*\**p*<.001

**Figure 1:** Ratings of current permissive beliefs at baseline (T1), post-induction (T2) and post- resting phase(T3).

AUD = Alcohol Use Disorder; SD = Social Drinkers

**Appendix A**

**Desire thinking task**

1. *Think about* yourself while drinking
2. *Think about* how you would feel when drinking
3. *Think about* the common place where you drink
4. *Think about* the positive sensation you feel when drinking
5. *Think about* the sensation of desire you feel to drink
6. *Think about* sensations you would feel by drinking
7. *Think about* the images of the typical alcoholic beverage you drink
8. *Think about* people you usually drink with and visualize drinking with them
9. *Think about* the last time you drunk and related sensations
10. *Think about* the last dinner or party where you drank
11. *Think about* of yourself involved in drinking as if it were a movie
12. *Think about* how you could drink once this experiment will have ended
13. *Think about* the positive images associated to drinking
14. *Think about* good reasons to drink
15. *Think about* your desire to drink
16. *Think about* the sensation of pleasure you feel when drinking and try to feel it now
17. *Think about* when and how you could drink
18. *Think about* the smells you feel when drinking
19. *Think about* why you deserve to have a drink
20. *Think about* a typical episode in which you drink
21. *Think about* and try to relive a situation in which you drunk
22. *Think about* all sensations you usually feel when you start to drink
23. *Think about* the context and associated feelings when you usually drink
24. *Think about* all taste sensations you feel while drinking