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Separating intentional inhibition of prepotent responses and resistance to proactive interference in alcohol-dependent individuals

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ABSTRACT

Background: Impulsivity is a hallmark of addictive behaviors. Addicts' weakened inhibition of irrelevant prepotent responses is commonly thought to explain this association. However, inhibition is not a unitary mechanism. This study investigated the efficiency of overcoming competition due to irrelevant responses (i.e., inhibition of a prepotent response) and overcoming competition in memory (i.e., resistance to proactive interference) in sober and recently detoxified alcohol-dependent individuals.
Methods: Three cognitive tasks assessing the inhibition of a prepotent response (Hayling task, antisaccade task and Stroop task) and two tasks tapping into the capacity to resist proactive interference (cued recall, Brown-Peterson variant) were administered to 30 non-amnesic recently detoxified alcohol-dependent individuals and 30 matched healthy participants without alcohol dependency. In addition, possible confounds such as verbal updating in working memory was assessed.
Results: Alcohol-dependent subjects performed worse than healthy participants on the three cognitive tasks assessing the inhibition of irrelevant prepotent responses but group performance was similar in the tasks assessing overcoming proactive interference in memory, updating of working memory and abstract reasoning.
Conclusions: These findings suggest that alcohol-dependence is mainly associated with impaired capacity to intentionally suppress irrelevant prepotent response information. Control of proactive interference from memory is preserved. Theoretical and clinical implications are discussed.

1. Introduction

An emerging view considers impulsivity as both a determinant and a consequence of addictive behaviors (Belin et al., 2008; de Wit, 2009). Impulsivity is a multi-dimensional construct, and some aspects of it have been linked to executive control processes, and inhibition in particular (for a review, see de Wit, 2009; Dalley et al., 2011). This study focuses on inhibition in alcohol-dependent individuals. Inhibition may be impaired as a possible consequence of both extended exposure to unsafe levels of alcohol use (e.g., Jentsch and Taylor, 1999; Noël et al., 2001) and the acute effects of alcohol (e.g., Fillmore, 2007). In line with this idea, research found impaired performance (e.g., Noël et al., 2001), abnormal brain electrophysiology (e.g., Kamarajan et al., 2006) and abnormal brain metabolism while alcohol-dependent individuals performed inhibition tasks (e.g., Schweinsburg et al., 2004; Li et al., 2009). Furthermore, inhibition is impaired in children of alcohol-dependent individuals (e.g., Habeych et al., 2006) and studies have shown that individual differences in inhibitory control could be a predictor of problem drinking in adolescents at risk for alcoholism (e.g., Nigg et al., 2006).

To date, most studies in alcohol-dependent individuals focused on problems with response inhibition, or the control of interference caused by prepotent but irrelevant, inappropriate responses. Many studies have shown that alcoholics' performance is impaired in tasks such as the go/no-go task (Noël et al., 2007), stop-signal task (Goudriaan et al., 2006), Hayling task (Noël et al., 2001), and Stroop task (Dao-Castellana et al., 1998). Most researchers assume that these tasks require overcoming prepotent responses, although it is still debated to what extent this always requires intentional inhibition (see MacLeod and Dodd, 2003; Verbruggen and Logan, 2008).

However, less is known to what extent alcohol-dependent individuals also have problems with controlling interference from memory. This function may be of the greatest importance to resist intrusive thoughts about appetitive targets, which are triggered automatically by external or physiological cues and by

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cognitive associates (Kavanagh et al., 2005). At the theoretical level, inhibition as such is not a singular concept (Friedman and Miyake, 2004; Nigg, 2000; Oberauer, 2009). For instance, latent variable analyses have shown that resistance to proactive interference is only weakly related to response-distractor inhibition as measured in tasks such as the stop-signal inhibition, Stroop interference, and Eriksen interference tasks (Friedman and Miyake, 2004). Furthermore, theoretical analyses suggest that these two inhibition-related functions (i.e., overcoming proactive interference and overcoming prepotent responses) may subserve different components of working memory (i.e., declarative and procedural working memory; Oberauer, 2009).

The aim of the present study was to directly compare overcoming interference caused by irrelevant responses (i.e., in the procedural memory; Oberauer, 2009) and overcoming interference caused by irrelevant long-term memory representations (i.e., in the declarative memory; Oberauer, 2009) within an alcohol-dependent patients sample. Our measures of proactive response inhibition were (i) the Brown-Peterson task (Kane and Engle, 2000) and (ii) the cued recall (Tolan and Tehan, 1999). In the Brown-Peterson, participants learn and later free recall successive lists that composed of words drawn from the same category. In the cued recall, participants view either one of two lists of four words; once they realize a second list is presented, they have to forget the first list and focus on the second one. At test, a category is cued and they have to recall the instance of that category in the most recent list. In both tasks, information from no-longer relevant word lists could interfere with recall. The ability to deliberately suppress automatic or prepotent responses was assessed by the anti-saccade task (suppressing the reflexive saccade toward a cue), the Stroop task (ignoring the dominant tendency to read the words) and the Hayling task (suppressing the dominant expected word congruent with a sentence's meaning).

2. Methods

2.1. Sample

2.1.1. Alcohol-dependent individuals (ALC). Thirty alcohol-dependent individuals were recruited for this study from an Alcohol Detoxification Program. They were tested between 18 and 21 days after the drinking cessation, which corresponds to their duration of abstinence from alcohol. At the time of testing, the ALC were no longer in acute withdrawal or taking any medication to control withdrawal. The participants had to meet DSM-IV criteria for alcohol dependence. Reasons for exclusion were other current DSM-IV Axis I diagnoses (as assessed by the Structured Clinical Interview for DSM-IV, SCID-IV), a history of significant medical illness and of drug abuse or dependence (other than alcohol abuse and dependence, respectively), and use of other psychotropic drugs or substances that influence cognition.

2.1.2. Controls (CONT). Thirty controls similar for sex, age, and educational level were recruited from the healthy community. We excluded any who had met an Axis I psychiatric diagnosis assessed by the SCID-IV; who had experienced a drug use disorder during the year before enrollment in the study; or who had consumed more than 54 g/d of alcohol for longer than 1 month. They were asked to avoid the use of drugs, including narcotic pain medication, for the 5 days prior to testing, and to avoid alcohol consumption for the preceding 24 h.

2.2. Current clinical status

Current clinical status (see Table 1) was rated using the Spielberger State Trait Anxiety Inventory (STAI Trait and State; Spielberger, 1983) and the Beck Depression Inventory (BDI; Beck, 1961).

Participants were breathalyzed and subjected to urine toxicology screening for opiates, stimulants and marijuana, immediately before the two sessions of the testing. Each session lasted 1.5–2 h. All participants completed the five tasks that measured overcoming interference in declarative or procedural working memory (see above), as well as an updating working memory task. The tests were administered in two different randomized orders. Initial tests showed that there was no effect of administration order was found, so order was not included as a factor in the final analyses. The Ethical committee of the Medical Faculty of the Université Libre de Bruxelles approved the design of the study; all participants gave written informed consent before testing.

2.3. Cognitive evaluation

2.3.1. Updating working memory. Updating working memory was assessed by the *n-back task* (Zimmerman et al., 1992), which is a visual sequential number memory task with a varying memory load from 1-back and 3-back. In the 1-back condition, the target was any number identical to the immediately preceding one. In the 3-back condition, the target was any number that was presented three trials back. Participants responded to each stimulus by pressing a button with their right middle finger for targets, and another button with the right index finger for non-targets. Dependent measures were the reaction times and the number of correct responses for each of the two memory load conditions.

2.4. Overcoming competition tasks

2.4.1. Dominant response inhibition tasks. The Hayling task (Burgess and Shallice, 1996) assesses the capacity to suppress (inhibit) a habitual response and was initially divided into two sections to examine both initiation (automatic) and inhibition (non-automatic) processes. This task consists of sentences in which the final words are omitted, but there is a particularly high probability of one specific response. The task consisted of two sections (A and B), each containing 15 sentences. In section A (initiation), sentences were read aloud to the subject who had to complete the sentence with the missing (expected) word, whereas in section B (inhibition), the subject had to complete the sentence with a word unrelated to the sentence. In Section B, the responses were scored 3 penalty points if the word made sense of the sentence, 1 if, although not making sense, it was semantically connected to the sentence, and 0 if it made no sense at all. In both sections, subjects were asked to reply as quickly as possible. Dependent measures were the total amount of penalty points in section B and the subtraction of the total time taken to respond in section B and the total time taken to respond in section A.

On each trial of the Antisaccade task (adapted from Roberts et al., 1994), a fixation point was first presented in the middle of the computer screen for a variable amount of time (one of nine times between 1500 and 3500 ms in 250-ms intervals). A visual cue (a black square) was then presented on one side of the screen (e.g., left) for 225 ms, followed by the presentation of a target stimulus (an arrow inside a square) on the opposite side (e.g., right) for 150 ms before being masked by gray cross-hatching. The participants' task was to indicate the direction of the arrow (left, up, or right) with a button press response. Given that the arrow appeared for only 150 ms before being masked, participants were required to inhibit the reflexive response of looking at the initial cue (a small black square) because doing so would make it harder to correctly identify the direction of the arrow. The dependent measure was the proportion of correct target responses.

The Stroop Color-Word Test (adapted from Golden, 1976) consists of three cards presented consecutively. On the first card, color words are printed in black. The

Table 1
Demographic and clinical variables of alcohol-dependent individuals (ALC) and non-alcoholic participants (CONT). Data are given as mean (standard error).

	ALC ($n = 30$)		CONT ($n = 30$)		Significance
	23/7		23/7		ns
	M	*SE*	*M*	*SE*	
Age	43.34	1.43	44.04	1.58	ns
Scholarship (years)	12.5	2.78	12.53	2.37	ns
Years of heavy drinking	10.43	1.18		–	
Number of prior detoxification treatments	2.97	.52	–	–	
Number of abstinence days	20.90	3.1	–	–	
MADRS score	10.05	1.36	2.48	0.38	$p < .001$
Anxiety (STAI)					
State anxiety score	39.87	2.07	32.20	1.91	$p < .01$
Trait anxiety score	52.47	1.84	32.20	1.71	$p < .001$

subject has to name the words as quickly as possible. The second card consists of colored rectangles, and the colors have to be named. The last card consists of color words printed in an ink color differing from the color name of the word. In this last condition the automatic word response has to be suppressed, and the ink color in which the words are printed has to be named. The dependent variable of this task was the interference effect: time in seconds needed to read the third card minus the time needed to read the second card, divided by the sum of these two realization times.

2.4.2. Proactive interference inhibition tasks. Using the Brown-Peterson variant, in each block, participants viewed four lists of eight words (based on Kane and Engle, 2000). They had to learn and later free recall each list. The first three lists were taken from the same category, so interference was occurred in the second and third lists. The last list was taken from a different category and served as the "release from proactive interference" list because there was no overlap with the three preceding lists. Between the presentation of each list and the recall phase, participants completed a distractor task: A letter paired with a two-digit number ranging from 10 to 90 (e.g., D-36) was presented, and participants alternated between counting aloud from the letter and number for 16-s, starting with the pair provided ("D-36, E-37, F-38," etc.). The procedure for each block was as follows: After viewing a 1500-ms warning, *!!Get Ready!!* (in blue ink color), participants read aloud the list of eight words (in black ink color). 250-ms after the last word disappeared, the letter–number pair appeared (in pink), and participants immediately began the distractor task and continued until the letter–number pair after disappeared 16-s. Subsequently, a green screen signaled them to recall orally the words from the list. They had 20-s to recall as many words as possible in any order. There were three blocks, and the dependent measure was the difference in recall for the first list and the second list in each block, summed across the three blocks.

In the cued recall task (Tolan and Tehan, 1999), participants saw either one of two "blocks" of four words; once they realize a second block was presented, they had to forget the first four words and focus on the second set. At test, a category was cued and they had to recall the instance of that category in the most recent set of words. On 12 trials ("one block" trials), they saw only one block of words (e.g., "cattle, mint, falsetto, ocean") before performing a short distractor activity, which consisted of eight magnitude judgments about two-digit numbers (i.e., whether the number was greater than or less than 50); after this task, they received a cue (e.g., *herb*) and had 5 s to retrieve the corresponding item in the list (*mint*). On 12 trials, they saw two blocks before the distracting activity and the cue ("two-block" trials). An example two-block trial was as follows: the participant read aloud "dress, couch, donkey, hockey"; then read silently *mosquito*, *football*, *cream*, *democracy*. This procedure was implemented to maximize the interference from the first list (Tolan and Tehan, 1999). Then they made magnitude judgments for eight numbers; after this task, they again received a cue (e.g., *dairy product*) and had 5 s to retrieve the correct answer from the most recent list (*cream*). There were also 12 two-block "lure" trials in which the first block contained a lure that corresponded to the cued category (e.g., the first list contained *blond* and the second list *auburn* for the cue *hair color*). The trials were presented in a fixed random order; hence, participants had to pay attention to the first lists in the two-block trials, because they did not know until after the list passed (and the second list started) whether they would need to remember or forget that list. The dependent measure was the number of items correctly recalled in the one-block trials minus the items correctly recalled in the two-block trials.

2.5. Statistical analyses

Differences of cognitive performance between individuals with and without alcohol dependence were analyzed when appropriate using Student's *t*-tests, repeated-measures ANOVA and post hoc analyses with a level of .05. In the prepotent responses inhibition analyses, dependent variables were performance in the Antisaccade task (correct responses), the Hayling task (total score of penalty; time part B minus time part A), and the Stroop task (interference effect; see above), with group (alcohol dependence versus normal control group) as between-subjects factor. In the proactive interference analyses, dependent variables were performance in the Brown Peterson task (difference in recall for the first list and the second list in each block, summed across the three blocks) and cued recall tasks (number of items correctly recalled in the one-block trials minus the number of items correctly recalled in the two-block trials) with group (alcohol dependence versus normal control group) as between factor. These analyses were performed using SPSS 20.0 (SPSS, Inc., Ill, USA).

3. Results

3.1. Demographics and current clinical status

Current clinical status was investigated by the years of heavy drinking, the number of prior detoxification treatments, the number of abstinence days, scores on the State-Trait Anxiety Inventory (STAI) and Beck Depression Inventory (BDI).

No group differences in the distribution of male and female participants was found, $\chi^2 = .00$, $p = 1.00$. There were no group difference in age, $t(58) = -.32$, $p = .75$, and scholarship level $t(58) = -.05$, $p = .96$. Compared to the CONT, ALC reported higher levels of state anxiety, $t(58) = 2.72$, $p < 0.01$, trait anxiety, $t(58) = 5.44$, $p < .001$, and depression, $t(58) = 5.34$, $p < .001$.

Importantly, when we carried out ANCOVAS using depression, trait and state anxiety scores as covariates, we found no effect for any of these variables on comparisons between the ALC and CONT groups; therefore we subsequently carried out ANOVAs and *t*-tests.

3.2. Cognitive performances

3.2.1. Updating working memory. Two n-back tasks were considered (n-back1 and n-back3). A two-way ANOVA for repeated measures, with condition (n-back1, n-back3) as within variable, group as between factor, and correct responses as dependent measure revealed no main effect of group, $F(1,58) = .72$, $p = .40$, but a main effect of condition, $F(1,58) = 53.47$, $p < .001$, which shows that participants performed better on n-back1 than on n-back3 trials. The interaction between the factors group and condition did not reach significance, $F(1,58) = .93$, $p = .34$. Another two-way ANOVA for repeated measures, with condition (n-back1, n-back3) as within variable, group as between factor, and reaction time as dependent measure revealed no main effect of group, $F(1,58) = .85$, $p = .36$, but a main effect of condition, $F(1,58) = 37.40$, $p < .001$. The interaction between the factors group and condition did not reach significance, $F(1,58) = .24$, $p = .63$.

3.3. Overcoming competition tasks (see Table 2)

3.3.1. Dominant response inhibition tasks. Antissacade task. A one-way ANOVA revealed that, compared to CONT, ALC participants had a lower score of correct responses on Antisaccade task, $t(58) = -3.67$, $p = .001$.

Hayling test. Reaction times were analyzed by means of a two-way mixed ANOVA with group as between factor and the type of condition (initiation, inhibition) as within-subjects factor. We found a main effect of type of condition, $F(1,58) = 228.04$, $p < .001$, of group, $F(1,58) = 6.90$, $p < .05$, and a group by condition interaction, $F(1,58) = 6.28$, $p < .05$. ALC were significantly slower than CONT to give answer when the task required subjects to complete the sentences with a semantically unrelated word (section B) but not in section A in which the semantically related word was the correct answer. Regarding the responses' quality, ALC made more penalty errors than CONT, $t(58) = 3.68$, $p = .001$.

Stroop test. In ALC, the interference index was higher than in CONT, $t(58) = 2.65$, $p < .01$.

3.3.2. Proactive interference inhibition tasks. Brown-Peterson task. A two-way mixed ANOVA with list (4 lists of 24 trials) as within variable, group as between factor, and correct responses as dependent measure revealed a main effect of group, $F(1,58) = 9.24$, $p < .005$, and a main effect of list, $F(3,56) = 109.47$, $p < .001$. Post hoc analyses showed significant differences between all four lists. Participants performed better at the list 1, followed by list 4, list 2 and list 3. The interaction between the factors group and list did not reach significance, $F(3,56) = .23$, $p = .88$. The difference in recall for the first list and the second list in each block, summed across the three blocks was similar between groups, $t(58) = 0.39$, $p = .21$.

Cued recall. A two-way mixed ANOVA with block as within variable, group as between factor, and correct responses as dependent measure revealed a main effect of group, $F(1,58) = 11.01$, $p < .005$. ALC made significantly fewer correct responses than CONT, indicating a general maintenance deficit. This analysis also revealed a main effect of block, $F(2,57) = 65.40$, $p < .001$, with participants

Table 2
Cognitive performance on updating into working memory, on inhibition to prepotent response and resistance to proactive interference tasks in individuals with alcohol dependence (ALC) and non-alcoholic (CONT) participants.

	ALC (n = 30)		CONT (n = 30)		Significance
	M	SE	M	SE	
Updating into working memory					
N-back					
n-back 1 RT[a]	536.6	27.8	512	19.9	ns
n-back 3 RT	642.3	35.8	602	21.1	ns
n-back 1 CR[b]	14.4	0.1	14.4	0.1	ns
n-back 3 CR	11.9	0.5	12.5	0.3	ns
Prepotent response inhibition					
Antisaccade test					
Mean correct response	51.2	2.1	62.1	2.2	$p < .01$
Hayling test					
Penalty/inhibition score	7.8	0.6	5.1	0.5	$p < .01$
Time part A[c]	9.69	0.9	8.49	0.7	ns
Time part B	72.61	5.20	53.69	4.66	$p < .05$
Stroop test					
Color denomination condition	68.23	15.17	60.37	14.35	$p < .05$
Reading condition	49.43	9.89	42.50	6.01	$p < .01$
Inhibition condition	112.43	26.93	90.30	17.44	$p < .001$
Interference index[d]	0.24	0.06	0.20	0.05	$p < .05$
Proactive interference inhibition					
Brown-Peterson variant					
List 1	12.5	0.5	14.3	0.5	
List 2	7.9	0.5	9.6	0.6	
List 3	6.7	0.5	8.3	2.5	
List 4	11.4	0.7	13.5	0.6	
PI index[e]	4.5	0.5	4.7	0.5	ns
Cued recall					
R1	4.5	0.4	6.0	0.2	
R2	3.5	0.4	4.8	0.4	
PI index[f]	1.0	0.4	1.3	0.4	ns

[a] RT = reaction time (in milliseconds).
[b] CR = correct response.
[c] Time is given in seconds.
[d] The interference index is the time (in sec.) needed to read the third card minus the time needed to read the secondcard, divided by the sum of these two realization times.
[e] PI (proactive interference) index is the difference in recall for the first list and the second list in each block, summed across the three blocks.
[f] PI (proactive interference) index is the number of items correctly recalled in the one-block trials minus the items correctly recalled in the two-block trials.

performing better on block 1, followed by block 2 and block 3. The interaction between group and list did not reach significance, $F(2,57) = 1.51$, $p = .23$. The number of items correctly recalled in the one-block trials minus the items correctly recalled in the two-block trials was similar for the groups, $t(58) = .25$, $p = 82$, suggesting no specific interference control deficit.

4. Discussion

This study aimed to further evaluate the disinhibition hypothesis of alcoholism by distinguishing between the capacity to overcome competition due to responses in procedural memory (i.e., inhibition of prepotent responses) and competition in declarative memory (i.e., inhibition of proactive interference) in ALC and CONT.

Our main finding was that, compared to CONT, ALC performance was impaired in three cognitive tasks requiring the inhibition of prepotent responses. In contrast, ALC performed similarly to CONT on tasks exploring the resistance (inhibition) to proactive interference.

The prepotent response inhibition deficit is consistent with results of numerous studies, which showed that ALC had lower performance on the Stroop task (Tedstone and Coyle, 2004), the Hayling task (e.g., Noël et al., 2001), the go/no-go task (Noël et al., 2007; Goudriaan et al., 2005), the alternate response task (Hildebrandt et al., 2004), the stop-signal task (Goudriaan et al., 2006) and on the Wisconsin Card Sorting task (Goudriaan et al., 2006).

Regarding the resistance (inhibition) to proactive interference, we found that ALC and CONT performed similarly. In the two tasks of the present study (Brown-Peterson variant and cued recall), we did not find greater interference in ALC, suggesting that control of proactive interference was persevered by chronic abuse of alcohol. At first sight, these results seem in discordance with a recent study showing that ALC were impaired in their capacity to suppress no longer relevant information in a directed-forgetting procedure (e.g., Noël et al., 2009). However, the main difference between this procedure and the cued recall and Brown-Peterson Variant could be the degree of intentionality. Intentionality may be higher in the directed-forgetting procedure because participants are explicitly instructed to forget just encoded information. Alternatively, it could be that there are different ways to control irrelevant information in working memory; e.g., by actively suppressing irrelevant information like in a directed-forgetting procedure or by increasing activation thresholds, which would make it harder for information from long-term memory to enter working memory (see the model of Oberauer, 2009).

The present study also showed that updating of verbal working memory was intact in ALC (they were not slower, did not make more commissions, and did not omit more targets than the controls as in Hildebrandt et al., 2004). This is important since inhibitory control and working memory are closely related. For example, performance in the anti-saccade task declines with increasing working memory load (Roberts et al., 1994), possible due to the requirement to maintain task sets (Chikazoe et al., 2007). Similar effects of working memory load have been found in motor response inhibition tasks with a strong rule component (Hester and Garavan, 2005). Thus, our findings suggest that the failure to overcome response competition is not due to a failure to maintain relevant task sets or task rules.

This dissociation between impaired prepotent response inhibition and preserved resistance to proactive interference may mirror another distinction between impaired intentional inhibition and preserved uncontrolled/automatic inhibition in ALC. This distinction is consistent with the finding that intentional response inhibition was more susceptible to the impairing effects of a moderate dose of alcohol than automatic inhibition (Abroms et al., 2006). Indeed, the ability of a subject to execute a saccade in the presence of an irrelevant, interfering stimulus (distractor), which required its reflexive suppression (e.g., Reingold and Stampe, 2002) appears to be uncompromised by moderate dose of alcohol (Abroms et al., 2006). Also, adult children of people with alcoholism did not differ from controls on a reaction-time based negative priming task (Ferraro et al., 2007), which supposedly measures automatic response inhibition (Nigg, 2000; but see e.g. MacLeod and Dodd, 2003). Taken together, these findings suggest that alcohol dependence is not associated with impairments in automatic response inhibition whereas the capacity to intentionally suppress prepotent response does allow discriminating between individuals at risk or not to become dependent to alcohol (Ferraro et al., 2007), between people under influence of alcohol or not (Abroms et al., 2006), and between alcohol-dependent and non-alcohol dependent individuals.

The inhibition of prepotent responses could be critical to control drinking behavior (Noël et al., 2002). Indeed, alcohol-drinking practice in individuals suffering from alcohol dependence can be viewed as encompassing stimulus-driven automatic behaviors (Tiffany, 1990), which can be stronger because of an effect of the behavioral sensitization phenomenon (Robinson and Berridge, 1993, 2003). Overcoming such prepotent responses is required to interrupt these behaviors. For these reasons, psychopharmacological (see the Moallem and Ray's study, 2012, which reports that Quetiapine improves response inhibition in alcohol dependent patients) and psychological strategies consisting to improve the prepotent response inhibition capacities (see the article by Houben et al., 2011, in which training response inhibition decreases craving and subsequent drinking behavior in heavy drinking students) would be fruitful for attenuating the severity of alcoholism and to prevent alcohol relapse.

The present study has some limitations. First, our sample was too small to allow latent-variable analysis, which could confirm the existence of two separate types of inhibition in both healthy and alcohol-dependent participants. Indeed, the discussion of our results was essentially based on the theoretical proposal of Friedman and Miyake (2004) and would deserve further confirmatory analyses in alcohol-dependent participants. Second, it would be useful to investigate whether co-morbid personality disorders could account for poor intentional prepotent response inhibition (for the influence of borderline personality disorder on the number of commissions made on the go/no-go task, see Rentrop et al., 2008). Third, one robust way to overcome the fact that an entire task does not tap into one single psychological construct may be to perform analyses within a single task to extract the relative contribution of automatic versus intentional inhibition to the interruption of an action (see Verbruggen and Logan, 2008). This would allow a more straightforward group comparison with dependent variables assessing either automatic or intentional response inhibition.

In sum, we found dissociation between overcoming competition due to responses versus competition in memory in individuals with alcoholism. Our results support the intentional disinhibition hypothesis of alcoholism in emphasizing the presence of impairments in intentional prepotent response inhibition in recently detoxified alcohol dependent individuals, but with preserved resistance (inhibition) to proactive interference.

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Nothing declared.

Contributors

Xavier Noël, Martial Van der Linden and Frederick Verbruggen were responsible for the study concept and design. Damien Brevers contributed to the acquisition of data and assisted with data analysis and interpretation of findings. Xavier Noël drafted the manuscript and Martial Van der Linden, Paul Verbanck, Charles Kornreich, Catherine Hanak and Frederick Verbruggen provided critical revision of the manuscript for important intellectual content. All authors critically reviewed content and approved final version for publication.

Conflict of interest

No conflict declared.

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