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Disease recognition is related to specific autobiographical memory deficits in alcohol-dependence

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ABSTRACT

The particularly high treatment gap in alcohol-dependence suggests the existence of important barriers to treatment decision and in particular difficulties in problem recognition. This study tested the relation between problem recognition and self-related memories. Forty-one recently detoxified alcohol-dependent individuals (AD) were compared to twenty alcoholic subjects that were abstinent for 6 months or more (recruited among alcoholics-anonymous (AA)), and to twenty controls on autobiographical memories elicited by pictures depicting or not alcohol using the autobiographical memory test. Autonoetic consciousness was measured with the Remember/Know paradigm. We tested whether memories performances were related with data obtained on the readiness to change questionnaire (RCQ) or with consciousness of the severity of drinking. AD subjects provided less specific memories than control and AA subjects, and fewer Remember responses than controls. The deficits in AD subjects were not specific for memories elicited by pictures depicting alcohol, suggesting a global deficit. Autobiographical memories specificity was negatively correlated to scores of consciousness of the severity of drinking but not to RCQ. Our results support potential recovery of autobiographical memory with abstinence. AD's deficits in autobiographical memory were related to capacities to recognize the severity and therefore may be a barrier to treatment decision.

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1. Introduction

Alcohol-dependence is the third cause of death worldwide (Hall, 2012). However, curing alcohol-dependent subjects remains an important challenge for clinicians. The first difficulty in the treatment of these patients is their access to treatment. The treatment gap for this pathology that has been estimated between 80 and 92% (Kessler et al., 2005; Kohn et al., 2004) is the largest among psychiatric disorders (Kohn et al., 2004). Furthermore, the period between the beginning of problematic drinking and first primary cares often exceeds ten years (Saunders et al., 2006). Saunders et al. (2006) have identified four different steps before a treatment is effectively sought by alcohol-dependent (AD) subjects: (1) Problem recognition; (2) decision that change is needed; (3) decision that professional help is needed; and (4) Actual

professional help seeking. At each step, barriers may hinder progression in the decision to seek treatment. Among these barriers, problem recognition induces the most important delay and is highly related to poor opinion towards the self (Self-Stigma) (Saunders et al., 2006). However, the identity of the processes that are involved in recognition deficits has not been investigated thoroughly. Prochaska and DiClemente (1983) also insisted on the importance of disease recognition and developed the concept of readiness for change to describe the ability of individuals to change their habits. This concept has been extensively used both in clinical and research contexts in the domain of alcohol dependence (Heather et al., 1993; Rollnick et al., 1992). Prochaska and DiClemente (1983) described four steps in the evolution of an individual towards a change in habit. The two initial steps, precontemplation and contemplation, precisely refer to the difficulty of the individual to recognize his drinking problem.

Le Berre et al. (2012) have recently tested the relation between readiness for change and cognition in AD subjects and found that subjects at precontemplation and contemplation stages of change presented with deficits in executive functions and episodic

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memory. The proposal of Saunders that Self-Stigma interferes with the recognition of the disease suggests that the latter could be related to specific cognitive processes involving the Self, and in particular autobiographical memory. This is congruent with Conway's model of autobiographical memory in which accessibility to autobiographical knowledge might be limited to protect the Self from painful emotions and threatening information (Conway, 2001, 2005), which in turn might lead to a tendency for less specific memories, yielding an overgenerality bias. In AD individuals, deficits in autobiographic memories have been described and have been shown to improve after prolonged abstinence (D'Argembeau et al., 2006; Pitel et al., 2009).

In addition, the recollection is attended by a subjective state of consciousness, namely auto-noetic and noetic consciousness (Tulving, 1985). Auto-noetic consciousness describes a state where people can mentally place themselves in the past with their thoughts and feelings of the original event. This differs from noetic consciousness that is based on feelings of familiarity and the activation of the general knowledge about a situation (Tulving, 1985; Luminet et al., 2006). Auto-noetic consciousness is related to introspection abilities, which allow thinking about one's own thoughts, feelings, actions, and social relations. Such conscious recollection offers a rich source of information to decide for appropriate behaviors in self-engaging situations (Neumann, 2014) and hence facilitates self-regulation of emotion and behavior necessary for the achievement of personally relevant goals (Levine, 2000). Impairments of auto-noetic consciousness have been observed in AD subjects with the Remember/Know/Guess paradigm (Pitel et al., 2007).

Because deficits in auto-noetic consciousness and autobiographical memory might impair realistic Self-appraisal (Conway, 2001, 2005; Neumann, 2014), we hypothesize that such deficits predict difficulties in recognizing the severity of problems related to drinking in AD subjects. We first assessed readiness to change using the RCQ Questionnaire (Prochaska and DiClemente, 1983, 1986) as well as how AD subjects evaluate the importance and the consequences of their drinking problem with nine specific questions. To assess the coherence of these evaluations, these were compared with objective markers of alcohol dependence severity (severity of liver disease, duration of dependence).

Autobiographical memory was tested by the recall of events evoked by pictures that were presented twice at a 48 h interval and auto-noetic consciousness with the remember-know-guess procedure. Because autobiographical memory abilities may improve after a period of abstinence (Pitel et al., 2009), we tested whether these deficits were also observed in long term abstinent AD subjects recruited among a self-help group of alcoholic-anonymous (AA).

Our first hypothesis was that AD subjects present deficits in autobiographical memory and auto-noetic consciousness and that these impairments are reduced after abstinence (AA group). Our second hypothesis was that AD subjects would evidence more impairment for autobiographical memories of events directly related to alcohol experiences. To test this second hypothesis, subjects were asked to describe and recall experiences evoked by alcohol-related pictures. Our third and main hypothesis was that AD subjects with impairment in autobiographical memory and auto-noetic awareness also present with a decrease in readiness to change and with a tendency to describe their alcohol drinking problem and consequences as less important.

2. Method

2.1. Participants

Three groups of participants took part in this study (81 in total). The first group was composed of 41 inpatients (28 men) presenting an Axis-1 diagnosis of alcohol-dependence (DSM-IV), and recruited during detoxification process at the Unité Intégrée d'Hépatologie, Department of Adult Psychiatry and Gastroenterology at the Academic Hospital Saint-Luc for which admission is totally voluntary. Exclusion criteria were the existence of other types of substance dependence (excepted tobacco) or any other DSM-IV Axis-1 disorder, as evaluated by a psychiatrist (PdT). All consecutive inpatients that responded to the criteria were proposed to enter the study on the day 14 of abstinence. Only four patients (10%) refused to enter the study. First testing of AD subjects occurred after 15 days of abstinence. The second group was composed of 20 subjects (13 men) recruited among groups of AA in Brussels, following a direct contact with organizers of the AA group of Academic Hospital Saint-Luc and communication of this information to other groups in Brussels. All of them had been abstinent for six months or more ($M = 129.1$ months, $SD = 129.9$) at time of testing. A group of 20 controls [C] (12 men) was selected to observe WHO criteria for normal alcohol drinking (less than 14 units/week for women and less than 21 units/week for men) (World Health Organization, 2000). All participants were provided explanations concerning study's aims and procedure and gave written informed consent. The protocol was approved by the hospital's Ethical Committee.

2.2. Procedure

Participants were tested twice within a 48 h interval.

During the first session, after collecting socio-demographic data, a first set of 30 pictures was presented. The series were presented in two different orders (A and B). For each photo, the participants realized three tasks: 1- to briefly describe the picture; 2- to express their emotional reaction to the picture on a 7-point Likert scale (unpleasantness (1) to pleasantness (7)); 3- to recall a specific autobiographical memory evoked by the photo. This memory retrieval task was based on the Autobiographical Memory Test of Williams and Broadbent (1986). Autobiographical memories were categorized into four types of recalling: 1- specific (personally experienced event that lasted a maximum of one day and had occurred at a particular time), 2- categorical (repeated events), 3-extended (event that lasted more than 24 h), 4-omission (no personal memories). Participants were asked to retrieve specific autobiographical memories. The experimenter hence explained the definition of specific memories and gave several examples. This first session lasted approximately 1 h.

During the second session, we used the Remember/Know procedure to operationally define auto-noetic (Remembering) and noetic (Knowing) consciousness during retrieval. Participants were presented with a second series of pictures that comprised the 30 pictures of the first series mixed with 58 distractors. Participants had to report whether they recognized or not the picture. When the picture was recognized, they had to indicate one of three subjective state of consciousness associated with the recognition of the photo and to recall the memory associated to the picture: 1-Remember (conscious recollection of the memory associated with the picture), 2-Know (feelings of familiarity), 3-Guess (uncertain assumption). The whole task lasted approximately 30 min.

2.3. Materials

The first series of 30 pictures was constructed for testing at

Time-1. It was composed of 22 pictures presenting human beings, animals and objects selected from the International Affective Picture System [IAPS] (Lang et al., 1993). The IAPS pictures were classified according to affective valence (ranging from unpleasant (1) to pleasant (9)). The items of this study included 6 positive ($M=7.54$, $SD=0.35$), 6 negative ($M=2.79$, $SD=0.57$) and 10 neutral pictures ($M=5.32$, $SD=0.64$). Eight pictures ($M=4.67$, $SD=1.31$) were selected from the Geneva Appetitive Alcohol Pictures [GAAP] which are classified according to affective valence ranging from (1) unpleasant to (9) pleasant (Billieux et al., 2011). They all depicted alcohol drinks and could be divided into 4 categories: wine, beer, cocktails and spirits.

The second series of 88 pictures was composed from the first series of 30 pictures as well as of 58 “distractor” pictures from the GAAP and from the IAPS selected to be of positive, negative or neutral valence with similar proportion as the first series.

2.4. Measures

2.4.1. Mini-mental state examination (MMSE)

The MMSE that assesses global cognitive functions briefly measures various mental abilities including attention, memory and language (Derouesne et al., 1999) and was used to exclude the existence of a diagnosis of dementia.

2.4.2. Readiness to change questionnaire (RCQ)

We used the RCQ self-report questionnaire to assess readiness to change alcohol abuse behavior (Rollnick et al., 1992). It consists in 12 items divided into 3 subscales that correspond to the 3 stages of change (i.e., precontemplation, contemplation and action). Each item is rated on a 5-point Likert scale (strongly disagree (-2) to strongly agree (+2)). For each subscale, the subject receives a score [-8 to 8]. The subscale with the highest score indicated subjects' motivation stage (Heather et al., 1993).

2.4.3. Evaluation of consciousness of the severity and consequences of alcohol dependence

In order to evaluate the consciousness of the severity and consequences of alcohol dependence, we built a 9 items questionnaire that addressed specifically the perception by patients of the reality of the alcohol-dependence and how this impacts on different dimensions of their life. These sentences are described in supplemental material. Subjects had to answer on a 8-point likert scale ((1) strongly agree to (8) strongly disagree). To obtain a global score of consciousness of alcohol-dependence severity and consequences, the scores of different items were added. The global score ranged from 9 to 72. We obtained a good degree of face validity when questioning professionals working with this population, patients and individuals that were not concerned by the field according to the procedure proposed by Nevo (1985). It presented a single factor dimension and the internal consistency of the questionnaire was good (Cronbach's $\alpha=0.82$). Details of validation are presented in supplemental material.

2.4.4. Objective criteria for the severity of alcohol-dependence

Two objective markers were chosen: 1- the duration of the period of loss of control of alcohol drinking determined by participants with researcher to guide patients to evaluate it by asking questions about impacts of alcohol consumption; 2.- the extent of liver disease (liver disease being the most frequent consequence of alcohol-dependence) assessed with a single dimension: the degree of stiffness measured on the day of admission by transient liver elastography (Fibroscan) that correlates with fibrosis rates according to the Metavir classification system (ranges between 0 (no fibrosis) and 4 (severe fibrosis) (Bedossa and Poynard, 1996).

2.5. Statistical analyzes

We conducted preliminary analysis to determine subjects' stage of change and the score of consciousness of the severity and consequences of alcohol-dependence. Group differences of specific autobiographical memory were assessed using ANCOVAs controlling participants' age (age-memory specificity: $r=-0.27$, $p<0.05$). As auto-noetic consciousness did not correlated with age (age-remember: $r=-0.13$, NS; age-know: $r=0.11$, NS), ANOVAs were used to examine group differences. Other ANCOVAs were then performed to analyze group differences in abilities of autobiographical memory with event directly related to alcohol experiences. To examine the influence of abilities in autobiographical memory on the consciousness of the alcohol-dependence and consequences, regression analyses were computed with autobiographical memories as predictors and score of the consciousness of the severity and consequences of addiction as dependent variable. Differences regarding the stages of change in autobiographical memories were assessed using ANOVA.

3. Results

3.1. Description of subject population

There was no differences between the three groups of participants concerning level of education [$\chi^2(8, N=81)=6.41$, NS], the age or their first alcohol drink [$F(2)=1.254$, NS] and between the AD and the AA groups concerning the duration of alcohol-dependence period [$t(58)=0.58$, NS]. All participants presented normal scores at the MMSE (Table 1).

Concerning the age of participants, AA subjects were older than AD and C subjects [$F(2)=4.32$, $p<0.05$, $\eta^2=0.10$, [51.4–56.65]]. Therefore, the potential influence of age differences will be examined.

Table 1
Socio-demographic characteristics.

	Alcohol-dependant[AD]	Alcoholic Anonymous [AA]	Control [C]
N	41 (28 men)	20 (13 men)	20 (12 men)
Age	$M=51.27$ ($SD=11.02$)	$M=59.7$ ($SD=10.4$)	$M=51.1$ ($SD=12.3$)
Education	Elementary: 2.4% Junior high school: 9.8% Senior high school: 19.5% Undergraduate: 36.6% Postgraduate: 31.7%	Elementary: 0% Junior high school: 20% Senior high school: 35% Undergraduate: 25% Postgraduate: 20%	Elementary: 0% Junior high school: 10% Senior high school: 30% Undergraduate: 20% Postgraduate: 40%
Living environment	Alone=41.5% In couple=31.7% In family=24.4% Housing=2.4%	Alone=50% In couple=30% In family=20% Housing=0%	Alone=30% In couple=40% In family=25% Housing=5%
MMSE	$M=28.3$ ($SD=1.34$)	$M=29.4$ ($SD=0.75$)	$M=29.2$ ($SD=0.80$)
Alcohol-dependence period (years)	$M=14.58$ ($SD=11.28$)	$M=12.89$ ($SD=9.14$)	–
Age at first drink (years)	$M=15.59$ ($SD=6.30$)	$M=15.65$ ($SD=3.31$)	$M=13.5$ ($SD=3.44$)

M: mean, SD: Standard Deviation

Table 2
Details of 9 items questionnaire on consciousness of the disease.

	Mean	Std. deviation
1. Alcohol drinking problematic	5.9	2.62
2. Health consequences	6.27	2.27
3. Family consequences	6.13	2.12
4. Professional consequences	4.49	2.78
5. Social interaction consequences	4.74	2.55
6. Family and friends expectations	6.63	1.58
7. Professional expectations	2.79	2.51
8. General practitioner expectations	5.84	2.61
9. Social expectations	4.74	2.64
10. Global score	48.17	14.18

3.2. Stages of change and consciousness of severity and consequences of alcohol-dependence

Concerning the stages of change, a frequency analysis showed that 0%, 28.9% and 71.1% of AD subjects were in precontemplation, contemplation and action stages respectively and 100% of AA subjects in the action stage.

The scores of consciousness ranged in AD subjects between 9 and 72. Subjects rated the consequences of their alcohol consumption on health and on family as more important than those on professional [$t(40) = -4.10$, $p < 0.001$, $\eta^2 = 0.30$, [0.85;2.71] $t(40) = -3.78$, $p < 0.01$, $\eta^2 = 0.26$, [0.62;2.42] respectively] or social links [$t(40) = -3.84$, $p < 0.001$, $\eta^2 = 0.27$, [0.62;2.42], $t(40) = -3.48$, $p < 0.01$, $\eta^2 = 0.23$, [0.73;2.05], respectively]. Concerning expectations from others of a change in drinking habits, subjects rated the expectations from family-friends and from the general practitioner higher than the expectations from social [$t(39) = -4.53$, $p < 0.001$, $\eta^2 = 0.34$, [1.20;2.73], $t(39) = -2.63$, $p < 0.05$, $\eta^2 = 0.15$, [0.26;1.94] respectively] or professional acquaintances [$t(38) = -9.56$, $p < 0.001$, $\eta^2 = 0.69$, [2.86;4.83], $t(38) = -7.59$, $p < 0.001$, $\eta^2 = 0.59$, [2.06;3.92] respectively] (Table 2).

3.3. Relation between actual severity criteria and stages of change or consciousness of the disease

The stages of changes were not related to the objective severity criteria of alcohol dependence (neither the duration of the loss of control of drinking [$t(35) = 0.43$, NS], nor to the importance of the liver damage [$t(20.75) = -1.63$, NS]). There was a trend for a negative correlation between scores of recognition of the alcohol dependence as being problematic (item 1) and the duration of the loss of control of drinking ($r = -0.27$, $p = 0.09$, [-0.34;0.29]) and the importance of the liver damage assessed by F index of liver stiffness ($r = -0.32$, $p = 0.07$, [-0.60; -0.29]). All other correlations were not significant.

Overall, the degree of recognition of severity of alcohol-dependence and consequences were most often negatively correlated with objective markers of severity.

3.4. Autobiographical memory specificity

Concerning the pictures, control perceived alcohol pictures as slightly more pleasant than the other groups (see supplemental for details). In order to compare the proportions of specific memories elicited by all 30 pictures, a 3 (AD vs AA vs C) \times 2 (alcohol-pictures vs no alcohol-pictures) ANCOVA, with age as a covariate, was performed. There was a significant group effect [$F(2,77) = 6.58$, $p < 0.01$, $\eta^2 = 0.15$, [0.59; 0.67]]. AD subjects significantly provided a lower proportion of specific memories than C and AA subjects [AD-AA: $t(77) = -2.86$, $p < 0.01$, $\eta^2 = 0.12$, [-0.27; -0.02]; AD-C: $t(77) = -2.98$, $p < 0.01$, $\eta^2 = 0.13$, [-0.27; -0.03]; AA-C: $t(77) =$

-0.01 , NS] (Table 2). No interaction was noted with the types of pictures [$F(2,77) = 0.47$, NS].

3.5. Recognition of pictures

A preliminary ANOVA examined group differences in picture recognition performance. There was no difference between groups regarding the number pictures that were not recognized (alcohol-pictures [$F(2,78) = 0.66$, NS], no alcohol-pictures [$F(2,78) = 1.35$, NS]) and the number of false-recognitions (alcohol-pictures [$F(2,78) = 0.24$, NS], no alcohol-pictures [$F(2,78) = 0.09$, NS]).

3.6. Abilities in autozoetic consciousness

Two 1-way ANOVAs comparing the proportions of Remember responses and comparing the proportion of Know responses between the 3 groups (AD vs AA vs C) were performed. There was a significant effect of groups (Remember: [$F(2,78) = 7.58$, $p < 0.001$, $\eta^2 = 0.16$, [0.80;0.85]]; Know: [$F(2,78) = 5.46$, $p < 0.01$, $\eta^2 = 0.12$, [0.13; 0.18]]). AD subjects significantly provided fewer Remember and more Know responses than the C subjects [Remember AD-AA: $t(77) = -1.49$, NS; AD-C: $t(77) = -4.07$, $p < 0.001$, $\eta^2 = 0.22$, [-0.12;0.03]; AA-C: $t(77) = -2.06$, NS; Know AD-AA: $t(77) = 1.3$, NS; AD-C: $t(77) = 3.30$, $p < 0.01$, $\eta^2 = 0.16$, [0.03;0.17]; AA-C: $t(57) = 1.72$, NS] (Table 3).

Finally, in order to test difficulties of autozoetic consciousness directly related to alcohol experiences, we performed a 3 (AD vs AA vs C) \times 2 (alcohol-pictures vs no alcohol-pictures) ANOVA on the proportion of Remember responses among good responses. Results revealed a significant effect of types of pictures [$F(1,78) = 32.003$, $p < 0.001$, $\eta^2 = 0.29$, [0.77;0.83]]. All participants provided more Remember responses for the no alcohol pictures.

Another significant effect was noted between types of pictures and groups [$F(2,78) = 3.13$, $p < 0.05$, $\eta^2 = 0.07$]. AD subjects provided fewer Remember responses than C subjects for both alcohol-pictures [AD-C: $t(77) = -3.66$, $p < 0.001$, $\eta^2 = 0.18$, [0.68;0.78]; AD-AA: $t(77) = -0.49$, NS] and no alcohol-pictures [AD-C: $t(77) = -3.16$, $p < 0.01$, $\eta^2 = 0.14$, [0.81;0.87]; AD-AA: $t(77) = -1.80$, NS]. Moreover, AA subjects provided fewer Remember responses than C subjects for alcohol-pictures only [AA-C: $t(77) = -2.74$, $p < 0.01$, $\eta^2 = 0.16$, [0.71;0.84]], not for no alcohol-pictures [AA-C: $t(77) = -1.40$, NS] (Table 4).

3.7. Relation between the stages of change or the scores of consciousness of the severity and consequences of the alcohol-dependence and autobiographical memories

Three ANOVAs were performed separately between specific memories, Remember or Know response and stages of change (and failed to show any relation [$F(1,36) = 0.13$, NS; $F(1,36) = 0.44$, NS; $F(1,36) = 0.49$, NS, respectively]).

Table 3

Proportions of specific memories, Remember and Know responses between Alcohol-dependent (AD), Alcoholic anonymous (AA) and Control (C) subjects.

	AD	AA	C
Specific memories	0.53 ^a (0.03)	0.68 ^b (0.04)	0.68 ^b (0.04)
Remember response	0.77 ^a (0.02)	0.83 ^{ab} (0.03)	0.89 ^b (0.03)
Know response	0.21 ^a (0.02)	0.16 ^{ab} (0.02)	0.11 ^b (0.01)

Standard deviations appear in parentheses below means. Means with differing superscripts within rows are significantly different at the $p < 0.05$ based on Bonferroni post hoc paired comparisons.

Table 4

Proportions of Remember responses related to pictures depicting or not alcohol between Alcohol-dependent (AD), Alcoholic anonymous (AA) and Control (C) subjects.

	AD	AA	C
Alcohol pictures	0.67 ^a (0.20)	0.69 ^a (0.22)	0.86 ^b (0.15)
No alcohol pictures	0.80 ^a (0.13)	0.86 ^{ab} (0.09)	0.90 ^b (0.07)

Standard deviations appear in parentheses below means. Means with differing superscripts within rows are significantly different at the $p < 0.01$ based on Bonferroni post hoc paired comparisons.

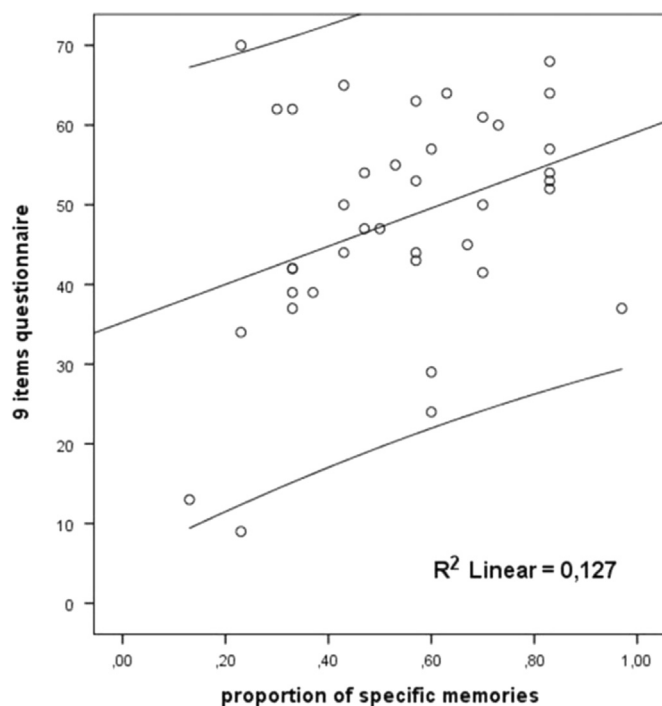


Fig. 1. Relation between consciousness of the severity of alcohol-dependence and proportion of specific autobiographical memories in alcohol-dependent subjects.

Regression analyses were computed with specific autobiographical memory as predictor and consciousness of the disease as dependent variable in AD population. The predictor explained 12.7% of the variance ($R^2=0.13$, $F(1,36)=5.24$, $p < 0.05$) (Fig. 1). The proportion of specific memories significantly negatively correlated to score of consciousness of the severity ($\beta = -0.36$, $p < 0.05$, [2.73;45.09]) and especially the proportion of specific memories not related to alcohol experiences ($\beta = -0.41$, $R^2=0.17$, $F(1,36)=7.22$, $p < 0.05$, [6.81;48.79]). In other words, the results showed that a higher proportion of specific memories was related to lower scores on consciousness of the severity.

Finally, we failed to observe any relation between the score of consciousness of severity of addiction and the Remember ($F(1,36)=0.13$, NS) or Know ($F(1,36)=0.12$, NS) responses.

4. Discussion

A previous study has shown the existence of a relation between cognitive processes and RCQ measured stages of changes in alcohol-dependence (Le Berre et al., 2012). However, it did not investigate specifically the issues of the alcohol dependence recognition and the relation to the self. The difficulty of the recognition of the disease is the first and most important difficulty in

treatment seeking observed in AD subjects (Saunders et al., 2006) and hence of major importance to explain the important treatment gap in this population (Kohn et al., 2004). Saunders et al. (2006) ascribed the difficulty to recognize disease severity to a denial process. The definition of denial is the conscious or unconscious repudiation of part or all parts of the meanings of an event to allay painful affects (Dorpat, 1983) and to avoid difficult specificities of self (Stoddard Dare and Derigne, 2010). In AD subjects, it could describe the repudiation of the reality of alcohol dependence as a mechanism to protect the self from the negative image associated to alcohol-dependence (Schomerus et al., 2010). Self-protective attitudes have already been suggested in this population that present with particularly high self-beliefs and standards (Maurage et al., 2013). The use of alcohol drinks for instance may serve as a way to escape self-threatening situations (Hull, 1981; de Timary et al., 2013). Clinicians working with AD subjects are familiar with the impression that they tend to minimize their disorder. However, the difficulty to recognize the disease is not necessarily related to a motivation to protect the self but could be due to cognitive deficits elicited by alcohol consumption. Neurologists use the word anosognosia to describe a difficulty to recognize a disease due to cognitive deficits elicited by the disease itself (Orfei et al., 2007; Breggin, 2007). Determining whether problem recognition of alcohol-dependence is due to denial or anosognosia is important for clinicians as it may influence the strategy to overcome this difficulty. In a methodological standpoint however, measuring denial or anosognosia is extremely difficult as it would necessitate to assess the gap that may exist between the consciousness of the disease by the subject on the one side and the reality of the disease and its consequences on the other side. What is difficult to assess is the relation between the disease and its consequences. An individual may present a drinking problem and may have difficulties in his life. However, it is impossible to ascertain scientifically that his difficulties are due to drinking. The ambitions of this study was therefore not to test the question of denial or anosognosia in alcohol-dependence but to examine how AD subjects' drinking problem recognition may be related to disturbance in specificity of autobiographical memory recall and autonotic consciousness and to try to evaluate whether the difficulty in problem recognition are related to deficits or to motivational dimensions.

4.1. Readiness to change and consciousness of severity and consequences of alcohol dependence

The vast majority of AD subjects were at the action stage of change (i.e., they were in the explicit process of stopping excessive consumption). Subjects however still presented a large variance in the scores of consciousness of severity and consequences of the addiction. This consciousness score hence provided additional information to that obtained by the RCQ. Whether low scores on this nine items questionnaire of consciousness of the severity and consequences of alcohol-dependence are related to actual difficulties could only be tested for two dimensions: the duration of the loss of control and the liver status, an obvious consequence of drinking. Only the first general item of the questionnaire that assessed the issue of alcohol drinking as being still problematic correlated negatively with the duration of the alcohol-dependence and with the severity of the liver damage, suggesting in some patients a real difficulty to recognize their disease. This is in keeping with difficulties in self-perception and metacognition described in this population (Le Berre et al., 2010; Spada and Wells, 2005). Kim et al. (2007) that investigated the relation between the readiness to change and insight measured with the Hanil alcohol insight scale (Kim et al., 1998) in alcohol-dependence had observed that AD patients in contemplation or action stage

had higher score of insight than those in precontemplation. We suspect that AD subjects that are at the action stage but who still present difficulties to fully recognize their dependence may be more likely to relapse, because they are more likely to lose their motivation for abstinence.

4.2. Autobiographical memory and auto-noetic awareness

As shown in previous studies, AD subjects presented with reduced access to specific autobiographical memories (D'Argembeau et al., 2006; Pitel et al., 2009). Conversely, the access to autobiographical memory specificity was better in AA subjects who had all been abstinent for more than 6 months, than in AD subjects and equivalent to that of C subjects. These observations support the possibility of a recovery of episodic memory capacities with abstinence as previously observed by Pitel et al. (2009).

Concerning the level of consciousness of the recollection, AD subjects presented impairments of auto-noetic but not of noetic consciousness, as previously observed by Pitel et al. (2007) and Le Berre et al. (2010). Two alternative, non-exclusive hypotheses may be suggested to explain the reduced access to memories and the reduced levels of auto-noetic consciousness of AD subjects. A first hypothesis would be that it results from a cognitive impairment that has often been observed in this population, possibly the neurotoxic consequence of alcohol consumption (Pitel et al., 2009) causing brain damages (Knight and Longmore, 1994; Oscar-Berman and Marinkovic, 2003). A second hypothesis would be related to Conway's Self-Memory System (Conway, 2005; Conway and Pleydell-Pearce, 2000) where the Working Self coordinates and regulates the construction of memories as a function of personal goals, to protect the Self from painful emotions and threatening information. To test this hypothesis, we compared the results for memories related to alcohol pictures to the other memories, as alcohol related events are expected to induce emotional avoidance in this population (Conway, 2005; Lemogne et al., 2009). If the hypothesis was true, we would have expected less specific memories and a decreased level of auto-noetic awareness, for memories evoked by alcohol pictures.

However, our data did not allow to decide which hypothesis can be supported. Indeed, we observed no differences in memories, whether they were elicited or not by Alcohol pictures, both in the AA and AD groups. Similarly, in the AD group, the levels of auto-noetic awareness were not different for memories elicited by alcohol pictures or by non-alcohol pictures. The only situation where a difference was observed was for auto-noetic awareness in the AA group which was altered for memories related to alcohol pictures only. This observation is the only one supporting a possible motivational aspect that would limit access to contextual information concerning past personal alcohol experiences, where the Self is likely threatened (Neumann, 2014). Another possible explanation for this decrease in auto-noetic awareness of alcohol related events in the AA group is that the event recalled were not recent as they had been abstinent for a long time. Altogether, our study was not conclusive regarding departing between the two hypotheses.

The deficits in auto-noetic awareness were present in the AD group, irrespective of the type of pictures (depicting or not alcohol). Conversely, in the AA group, auto-noetic consciousness was normal for the no alcohol-pictures, which is consistent with a recovery during abstinence (Pitel et al., 2009). However, in the AA population, deficits still persisted for alcohol pictures.

Overall, our observations of memory and auto-noetic awareness deficits in AD subjects do not allow to conclude whether these impairments are related to a cognitive deficit or to motivational dimensions. However, these impairments may play a role in a form of anosognosia of the disorder that has been related to self-related

memories (Heilman et al., 1998).

4.3. Relation between deficits in specific autobiographical memories or auto-noetic consciousness capacities and the difficulty to recognize the drinking problem in the AD population

We failed to observe a relation between auto-noetic consciousness or autobiographical memory and AD subjects' stage of change. This contrasts with Le Berre et al. (2012)'s observation of a relation between cognitive abilities, including episodic memory and motivation for changes, but in our population, most patients were at the action stage of change, which was not the case in the Le Berre's paper. Conversely, we observed that reduced access to autobiographical memories was related to the global score of consciousness of the severity and consequences of alcohol-dependence. Autobiographical memories have a self-related content and are particularly important to establish and maintain a coherent sense of self (Prebble et al., 2013). The observation of a relation between autobiographical memory and consciousness of the severity of dependence, altogether with that of an improvement in autobiographical memory in abstinent AD subjects, suggests that the duration of abstinence may favor disease recognition due to a better self-perception. This is consistent with examples of patients where we have observed an improvement in disease recognition after a prolonged period of abstinence.

4.4. Limitations

This study is among the first to evaluate the consciousness of the disease in relation with capacities of autobiographical memory in this population. One important limitation of this study is the use of a questionnaire on the degree of recognition of the severity and consequences of alcohol-dependence, that is still under validation. The first psychometric evidences are however supportive as the questionnaire presented a high degree of face validity and a high level of internal consistency (Cronbach's $\alpha=0.82$). The questionnaire still lacks evidences regarding convergent validity, with appropriate validated tool, such as for instance the Hanil Alcohol Insight Scale (Kim et al., 1998). At the time when we developed this study, we were not aware of the existence of this scale. The use of this questionnaire would have greatly improved the conclusions of our study and we plan to use it in future studies. Furthermore, studies should also be conducted to evaluate the discrepancy between consciousness and reality of the disease, for instance by comparing self-rated consequences by patients with answers by relatives on how they would describe the consequences, in particular at the social or familial level. The study could be repeated on a larger sample and with subjects that are not essentially at the action stage of change. Finally, it would also be interesting to repeat this study integrating measures of cognitive functions, in order to assert which part of autobiographical memory deficits is caused by general cognitive deficits (e.g., anosognosia) or motivational aspects (e.g., denial).

4.5. Conclusion and clinical perspectives

Altogether, this study support the hypothesis of a deficit in autobiographic memory and auto-noetic consciousness in AD subjects that are not specific for alcohol related memories and that the capacities to recognize the importance and severity of the disease is related to the deficit in autobiographical memory. This supports the view that the difficulty of AD subjects to engage into a treatment, mostly due to their difficulties to recognize their disease is related to their cognitive deficit, as previously suggested (Le Berre et al., 2012). However, these cognitive deficits may decrease with an abstinence period, which may lead to an increase of

consciousness of the severity and consequences of the disease. This suggests that a prolonged period of detoxification could be interesting to facilitate therapeutic process and increase disease recognition. Moreover, clinicians exposed to this type of population should compensate the lack of specificity of patients' memories by being more specific in designating aspects of the reality of their disorder. Furthermore, approaches such as mindfulness-based cognitive therapy that increases capacities of autobiographical memory specificity (Heeren et al., 2009; Williams et al., 2000), might be favorable, as previously described in this population (Chiesa and Serretti, 2014; Witkiewitz et al., 2013).

Contributors

Marie Poncin performed the statistical analysis and wrote the original paper. Aurore Neumann contributed actively to the design and implementation of the study and oversaw the writing of the paper. Olivier Luminet contributed to the project implementation and gave suggestions for the writing of the paper. Noémie Vande Weghe contributed to the data collection and implementation of the design. Pierre Philippot contributed to the project implementation and gave suggestions for the writing of the paper. Philippe de Timary oversaw the design, the implementation of the study and the writing of the paper. All authors contributed to and have approved the final version of the manuscript.

Conflict of interest

All authors report no competing financial interests or potential conflict of interests, and no connection with tobacco, alcohol, pharmaceutical, or gaming industries. Philippe de Timary is Clinical Research Associate and from Fonds de Recherche Clinique of UCL, and clinical Full Professor at UCL, Pierre Philippot is a Full Professor at UCL and Olivier Luminet (Research Director) are funded by the Belgian Fund for Scientific Research (F.R.S.-FNRS, Belgium), but this fund did not exert any editorial direction or censorship on any part of this article.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.psychres.2015.08.031>.

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