UNIVERSITY OF TWENTE.

**Faculty of Behavioral,
Management and Social Sciences**

The Association Between Alcohol Dependence and Craving in Response to Stress and Alcohol Cues: The Moderating Role of Biopsychosocial Factors

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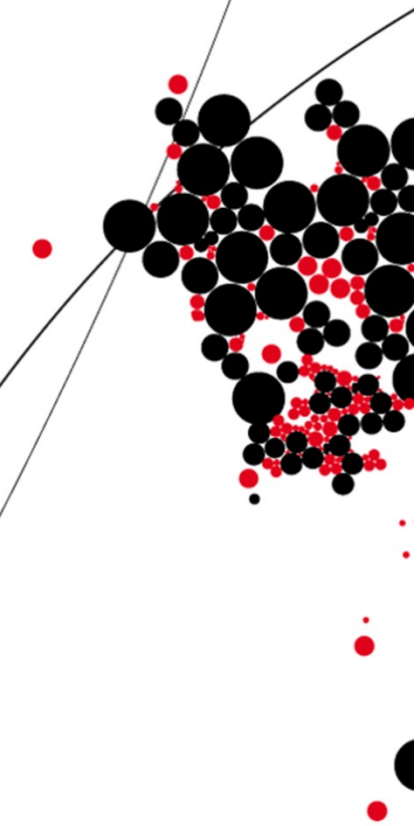

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Abstract

Craving is a prominent feature of alcohol dependence, therefore getting a deeper understanding of craving is crucial to subsequently provide better treatment for alcoholics. Stress and alcohol cues are considerably increasing the risk of craving, however craving remains a complex and multifactorial phenomenon. To get more insight in the concept, this study investigated the effect of the biopsychosocial factors sex, age, educational level, drinks per week, years of problematic alcohol use and lifetime tobacco use on the relationship between alcohol dependence and stress and alcohol cue induced craving.

The moderator analyses to do so were based on a stress and an alcohol cue induced craving scale generated from a craving questionnaire by several psychometric tests. The questionnaire contained data of 228 participants aged 21 to 75 years who took part in an online treatment programme for alcoholics based on own initiative who self-administered the craving questionnaire in an early programme phase.

The moderator analyses revealed no significant results. Although this is not in line with previous research the uniqueness of the sample including alcohol dependent subjects who self-administered the questionnaire based on own initiative might have contributed to the discrepancy between the current study's findings and past research. The results of the psychometric tests showed that stress induced craving was consistently mirrored in another dimension than alcohol cue induced craving, showing that they are distinct dimensions of the questionnaire. However, also latent constructs were disclosed, indicating that the scales may not be unidimensional.

Regarding future research on stress and alcohol cue induced craving it is highly suggested to further examine biopsychosocial factors by applying similar, realistic samples to ultimately provide more tailored treatment for alcohol dependent individuals more susceptible for stress or alcohol cues.

Key words: alcohol dependence, craving, stress, alcohol cue, biopsychosocial factors

Introduction

Alcohol consumption leads to several negative health outcomes with tremendous consequences regarding morbidity and mortality as it is involved in more than two million deaths every year. Moreover about 76 million people across the globe are heavy drinkers, which makes excessive drinking a highly prevalent health issue as well as an economic and social problem (Pinel & Barnes, 2013).

Thus, the question arises why so many people maintain in the highly risky behavior of heavy drinking and how to counteract the problem. First of all, treatment is considerably important to address problem drinking and a wide range of treatment options is available today, from brief alcohol interventions to extensive psychological or even pharmacological treatment (World Health Organization, 2011). Also online intervention programs became increasingly important in the recent years as they reach a larger amount of problem drinkers with diverse characteristics while providing high levels of accessibility and low levels of barriers to treatment facilities compared to face-to-face interventions (Postel, 2011). Hence, there is a broad spectrum of treatment options, but although many treatment approaches for problematic alcohol consumption have been demonstrated to be effective, Miller and colleagues (as cited in Bottlender and Soyka, 2004) claim that relapse remains a serious and multi-factored problem and up to two in three alcoholics start drinking again after treatment (Breese et al., 2005).

When it comes to acquisition and maintenance of alcohol dependence the concept craving plays a central role as it is considered to be obstacle to recovery and is believed to strongly contribute to the persistence of dependence (Tiffany & Conklin, 2000). Further, Robinson and Berridge (1993) state that addiction can be understood in terms of the development of obsessive craving thoughts which become so strong that drug seeking and taking is almost guaranteed. Before the role of craving in alcohol dependence can further be examined it is essential to get a deeper understanding of the concept craving. Despite the fact that craving can be considered a key factor for relapse in alcoholics, there are definitional issues meaning that a common and valid definition of the concept is not available (Lowman et al., 2000). However, craving has been defined in various ways, but is most basically understood as a desire or drug-seeking state which motivates the use of a drug (Sayette et al., 2000). Thus, with craving as prominent feature of addiction, even considered as lying at the heart of addiction and described as the reason for relapse, it can be acknowledged as important factor that needs to decrease to subsequently diminish the risk of relapse (Skinner

& Aubin, 2010). Therefore a profound insight in cues that evoke craving is necessitated to better understand and minimize craving thoughts in alcoholics.

Previous research on cues that evoke craving found that although craving is a multi-faceted phenomenon, the following two factors considerably increase the risk of craving and relapse: exposure to *Stress* and *Alcohol cues* (Fox et al., 2007). The field of craving research has investigated both stress induced craving and alcohol cue induced craving separately, but also both factors have been examined together. For instance, Fox and colleagues (2007) examined stress and alcohol cue induced craving and found that both exposure to stress and to alcohol cues each produced significant increases in alcohol craving. Furthermore, Cooney and his colleagues (1997) found in their study that alcohol cue exposure led to increased desire to drink in treated alcohol dependent men. Another study indicated similar results as alcohol cue-exposure evoked a greater craving response in alcoholics compared to social drinkers (Grüsser, Mörsen & Flor, 2006). Thus, in the field of craving research it is well-known that exposure to stress and alcohol cues increase alcohol craving and the risk for relapse (Sinha et al., 2009), with non-dependent subjects showing less craving than dependent subjects (Grüsser, Mörsen & Flor, 2006).

However, although research has demonstrated the positive association between alcohol craving and alcohol use (Tiffany & Conklin, 2000) with stress and alcohol cues increasing the risk of craving substantially (Fox et al., 2007) it should not recede into the background that craving remains a complex, multi-faceted phenomenon. Therefore, diverse factors have to be taken into account to actual get a deeper understanding of the concept and its relationship with alcohol dependence. Previous research has already examined various factors associated with craving and in accordance with the *Biopsychosocial model*, a discrimination between *Biological factors*, *Psychological factors* and *Social factors* could be made. The biopsychosocial model, which is commonly used for treatment of psychiatric disorders, can also be used in the context of alcohol dependence and therefore alcohol craving (Chakravorty et al., 2010). For the purpose of this study the possibly moderating effect of six factors on the relationship between dependence and stress induced craving and dependence and alcohol cue induced craving was examined in more detail, whereby the factors were as follows: *Sex* and *Age* as biological factors, *Educational level* as social factor and *Drinks per week*, *Years of problematic alcohol use* and *Lifetime tobacco use* as psychological factors.

Biological factors. The biological factor sex plays an important role in alcohol craving and alcohol consumption, with male subjects showing greater stress than female

subjects (Lindquist et al., 1997). In contrast Kraus and colleagues (2004) indicated that women show higher craving for alcohol in response to negative mood states like stress than men, subsequently putting them on a higher relapse risk in negative mood situations than men. Although craving has been associated with female subjects in some studies and with male subjects in others, there has certainly been found a relationship between alcohol craving and sex by many studies (Chakravorty et al., 2010). Furthermore, the biological factor age has shown to be indirectly associated with craving. For instance, a study by Heinz and colleagues (2005) indicated that dopamine levels decrease with age, which increases alcohol craving and the risk of relapse as alcohol stimulates the release of dopamine and has a rewarding effect. Contrary, other studies investigated whether there is a decrease of craving with increasing age. For instance, Hintzen and colleagues (2011) hypothesized a decrease of alcohol craving with age as they linked craving with obsessive compulsive behavior, which decreases with age.

Social factors. The social factor educational level has a major influence on drinking habits, whereby those with the lowest educational level are most frequently heavy drinkers (Schnohr et al., 2004). Although research examining the direct relationship between level of education and alcohol craving remains meagre, it is assumed that low educational level leads to increased craving as alcohol dependent subjects show higher craving than subjects who are not alcohol dependent (Grüsser, Mörsen & Flor, 2006). Thus, based on the fact that many research has demonstrated the positive association between alcohol craving and alcohol use (Tiffany & Conklin, 2000), the social factor educational level is taken into account in this study to get a deeper understanding of craving and its relationship with alcohol dependence.

Psychological factors. Drinking behavior is a psychological factor that comes into focus when examining the relationship between alcohol craving and alcohol dependence. Although previous research indicating an association between the factors drinks per week and number of years of problematic alcohol use has not been conducted, it is assumed that especially the factors drinks per week and years of problematic alcohol use are linked to craving. Hereby, drinks per week can be referred to as a more current behavioral factor, whereas the factor years of problematic alcohol use refers more to past behavior. Finally, the factor lifetime tobacco use is a psychological factor that should be considered in the context with alcohol craving. For instance, as indicated by Hillemacher and colleagues (2006) there is an association between alcohol dependence nicotine and a comorbidity between the two has been demonstrated in multiple studies.

Thus, to move beyond the relationship between alcohol dependence and stress and

alcohol cue induced craving it is essential to examine factors that possibly moderate the relationships. Therefore, it is hypothesized that there is a potentially moderating effect of the biological factors sex (1) and age (2), the social factor educational level (3) and the psychological factors drinking behavior with regard to drinks per week (4) and years of problematic alcohol use (5) as well as the psychological factor lifetime tobacco use (6).

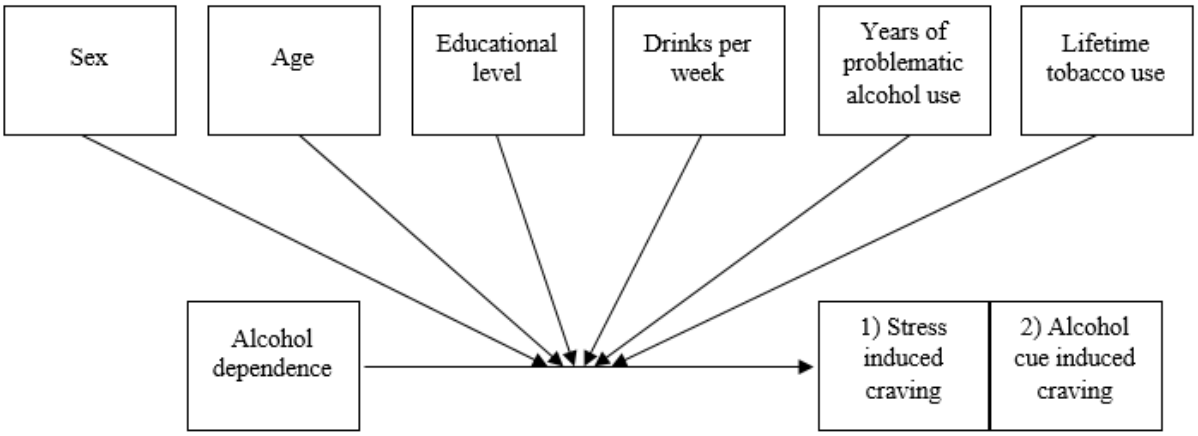

Figure 1. Moderation model with sex, age, educational level, drinks per week, number of years of problematic alcohol use and lifetime tobacco use functioning as moderators on dependence and stress induced craving (1) or alcohol cue induced craving (2)

Methods

Design

This observational study analysed longitudinal data, which was collected in multiple waves.

Participants

Participants subscribed via the website of the *Alcohol de Baas* online treatment programme for alcoholics, which is described in the *Measures* section in more detail. They participated based on own initiative, thus a self-selecting sample was employed. As part of the programme participants were asked to fill in an alcohol craving questionnaire named *Drinkwijzer,* also described in the Measures section more precisely. The Drinkwijzer was completed by 228 participants, 111 participants were female (48.7%) and 117 participants were male (51.3%) with an average age of 47.36 years (Min 21, Max 75, SD = 10.98). Furthermore, it was assessed whether the participants fulfilled the DSM-IV alcohol dependence criteria by evaluating their *CIDI-score* (Composite International Diagnostic Interview). Participants meeting three or more of the DSM-IV dependence criteria (see

Appendix 1) during a 12-month period received the diagnosis alcohol dependent (coded 1), whereas participants meeting less than three DSM-IV dependence criteria received the diagnosis not alcohol dependent (coded 2). 192 participants were assigned to the alcohol dependent group (84.2%) and 36 participants were assigned to the non-dependent group (15.8%).

Measures

The alcohol craving questionnaire of the Alcohol de Baas online treatment programme for alcoholics, which is part of the addiction treatment organization *Tactus*, was utilized for this study. The craving questionnaire named Drinkwijzer contained fifty items, whereas sixteen items referred to the dimension feelings, three items refer to thoughts and thirty one items to situations. Participants needed to indicate the intensity of their craving by choosing on a three-point scale between the answer options low/absent (1), moderate (2) or high (3) for all items. The original version of the Drinkwijzer, which was also presented to the participants, was in Dutch language (see Appendix 2), however, it was later translated to English language for the purpose of this paper (see Appendix 3).

Furthermore, this study utilized the *Intake questionnaire*, which was also part of the online treatment programme. The intake questionnaire provided baseline data of the participants of the Alcohol de Baas online treatment programme including demographic information, various information about participant's health and drinking behaviour. However, this study focused on intake questionnaire information about DSM-IV alcohol dependence criteria as well as information about sex, age, educational level, drinks per week, number of years of problematic alcohol use and lifetime tobacco use.

Sex and Age. Sex and age were assessed by asking participants whether they are male (coded 1) or female (coded 2), subsequently participants were asked to indicate their age. For the purpose of this study median split was used in order to transform the continuous variable age into a binary variable (Mdn = 47.5) resulting in the categories younger participants, n = 114 (coded 2) and older participants, n=114 (coded 1).

Educational level. Educational level was subdivided in seven categories of Dutch educational levels, which were as follows: primary school (1), LBO/MAVO/VMBO (2), HAVO/VWO (3), MBO (4), HBO (5), WO (6) and others (7). For the purpose of this study higher educational level and lower educational level were examined with primary school (1), LBO/MAVO/VMBO (2), HAVO/VWO (3), MBO (4), HBO (5) being assigned to the category of lower educational level (coded 1) and HBO (5), WO (6) and others (7) being assigned to the category of higher educational level (coded 2). Based on that 95 participants

(41.7%) were assigned to the group lower educational level and 133 participants (58.3%) were assigned to the group higher educational level.

Drinks per week. Drinks per week were assessed by *Alcohol Timeline Follow Back* (TLFB) by asking participants to indicate the number of drinks consumed per day during the last week, thus the 7 days before completing the intake questionnaire. The mean of standard drinks per week for all 228 participants was 34.88 (Min 0, Max 153, SD=21.69). Subsequently participants were assigned to the groups consuming more drinks per week, n = 115 (coded 1) and less drinks per week, n = 113 (coded 2), also by means of median split (Mdn = 32).

Years of problematic alcohol use. The number of years of problematic alcohol use was evaluated by the question *How long is your alcohol use already problematic?*. Median split was performed (Mdn = 6) in order to obtain the two categories more years of problematic alcohol use, n = 117 (coded 1) and less years of problematic alcohol use, n = 111 (coded 2).

Lifetime tobacco use. Lifetime tobacco use was assessed by the question *Did you ever consumed* tobacco?, which could be answered with no, n = 37 (coded 0) or yes, n = 190 (coded 1).

Procedure

The Drinkwijzer was available from January 2012 until January 2015 as part of the Alcohol de Baas online treatment programme. The programme contained fifteen phases, starting with the completion of the intake questionnaire in phase one to obtain baseline data, demographic information, information about drinking behavior and participant's health. Phase two, three and four comprised assignments, for instance to make participants become more aware of advantages and disadvantages of drinking alcohol. Completing the Drinkwijzer was part of phase five named Drinkwijzer in accordance with the name of the craving questionnaire. Participants were informed about the purpose of the questionnaire to gain a deeper insight in their craving thoughts to subsequently summarize individual drinking habits more precisely. Thus, the craving data was derived from an early phase of the programme. The last ten phases were comprised of between measurements and diverse assignments, however, these phases were not relevant for this study and were therefore not described in more detail (see Appendix 4).

Analyses

The data retrieved was analysed with the statistic software *Statistical Package for the Social Sciences* (SPSS). An alpha value 0.05 indicated statistical significant results for all statistical

analyses performed.

First of all, exploratory factor analyses were conducted with the original 50-item craving questionnaire in order to examine whether the three original dimensions feelings, thoughts and situations can be disclosed or excluded as possible confounders for the stress-alcohol cue factor structure which was expected to be found. The first exploratory factor analysis was conducted without fixed number of factors to examine all possible factors, whereas the second exploratory factor analysis was conducted with fixed number of three factors to examine whether the three dimensions feelings, thoughts and situations fit with the three factors found in the exploratory factor analysis. Coefficients with an absolute factor loading below 0.4 were suppressed in all exploratory factory analyses conducted and extraction was based on eigenvalues greater than 1.0.

Secondly, the items of the original craving questionnaire were assigned to the two scales stress induced craving and alcohol cue induced craving based on content (face validity). All items associated with stress were assigned to the stress induced craving scale, all items that could involve exposure to alcohol were assigned to the alcohol cue induced craving scale. If items could not be assigned to one of these two categories, because the content did not match, the items were excluded. To avoid subjectivity regarding the item assignment to the scales, inter-rater reliability was assessed by determining Cohen's Kappa after a second rater assigned the items to the two scales by face validity. Cohen's Kappa (κ) between 0.61 and 0.8 was evaluated as substantial agreement, Cohen's Kappa between 0.81 and 1.0 as almost perfect (Landis and Koch, 1977). Then the new scales were tested for internal consistency measured by Cronbach's alpha (α), with Cronbach's alpha between 0.7 and 0.8 indicating acceptable reliability and Cronbach's alpha higher than 0.9 indicating excellent reliability (George as cited in Gliem & Gliem, 2003).

Subsequently, exploratory factor analyses were conducted with the items resulting from previous assignment to examine whether stress induced craving and alcohol cue induced craving are separate underlying factors of the questionnaire. Firstly, exploratory factor analysis without fixed number of factors was conducted to examine all possible factors, secondly, it was conducted with fixed number of two factors to examine whether the two dimensions stress and alcohol cue induced craving match the two factors found.

Furthermore, one-way ANOVA was performed to determine whether there are significant differences between the means of stress induced craving and alcohol cue induced craving in dependent and non-dependent subjects. Pearson's r was assessed to indicate whether there are significant correlations between all constructs.

Finally, moderator analyses were performed as described by Baron and Kenny (1986) to examine whether sex, age, level of education, drinks per week, number of years of problematic alcohol use and lifetime tobacco use moderate the effect of alcohol dependence on stress induced craving and alcohol cue induced craving by using univariate analyses. Median splits were performed with all continuous variables (age, drinks per week, years of problematic alcohol use and lifetime tobacco use) to transform them into binary variables.

Results

Exploratory Factor Analysis: Original Questionnaire

First, exploratory factor analysis without fixed number of factors was conducted with the original questionnaire to test which dimensions can be found. Eleven factors were revealed, but only nine factors retained having an eigenvalue of minimal 1.0 (see Figure 2).

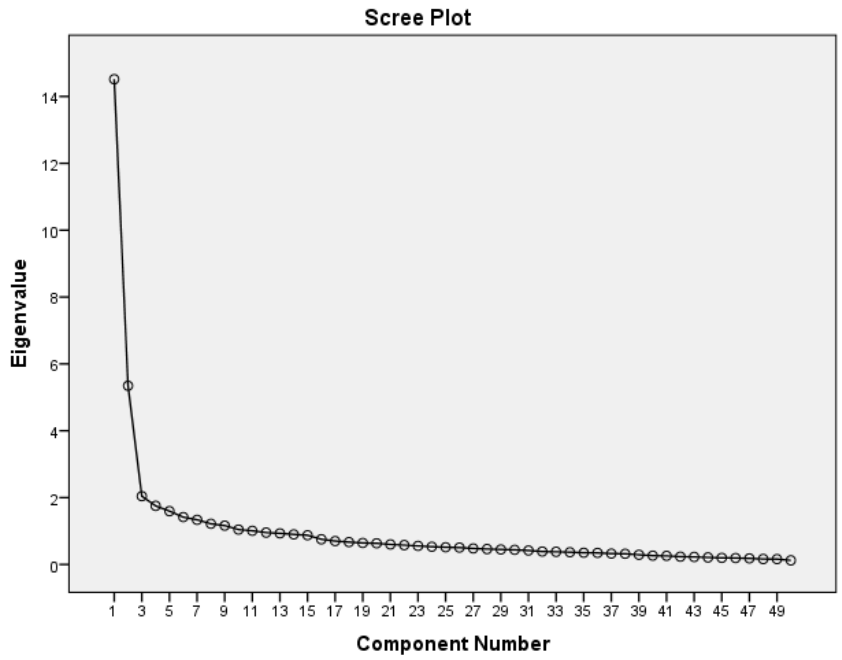

Figure 2. Scree plot with eigenvalues for each component

Consequently, based on content of the items the remaining factors were labelled as follows: *Negative affect* (1), *Social situations* (2), *Positive affect* (3) and *Situations involving food* (5). *Physical reactions* (4) was considered an appropriate label for factor 4 as although item 41 did not fit in this category its factor loading was 0.41, which is close to the extraction value. The remaining four factors could not be labelled based on content of the items. Pertaining the total variance the results showed that 23.86% of the total variance was explained by negative

affect (1), 9.49% by social situations (2), 5.54% by positive affect (3) and by less than 5% by the remaining factors (see Appendix 6).

Secondly, exploratory factor analysis was performed with fixed number of three factors to examine whether the three dimensions feelings, thoughts and situations can be found. The dimensions were labelled negative affect (1) and social situations (2), factor 3 could not be labelled. Furthermore, the results revealed that negative Affect (1) explained 25.19% of the total variance, social Situations (2) 10.61% and factor 3 8.01% (see Appendix 7).

Thus, the dimensions feelings, thoughts and situations were not found by exploratory factor analyses, therefore, it was ensured that they do not constitute confounders for a stress-alcohol cue factor structure.

Inter-Rater Reliability

Based on face validity the scales stress and alcohol cue induced craving were developed from the original Drinkwijzer questionnaire by rater 1. 25 items were assigned to the scale stress induced craving, 10 items to the scale alcohol cue induced craving and 15 items could not be assigned to one of the scales as content did not match, subsequently leading to a new 35-item questionnaire (see Appendix 2). Cohen's Kappa analysis indicated an almost perfect agreement between rater 1 and rater 2 ($\kappa = 0.82$) leading to the confident assumption of little subjectivity pertaining the item assignment to the two dimensions.

Internal Consistency

Subsequently, the two new scales were tested for internal consistency measured by Cronbach's alpha (α). Cronbach's alpha of the stress induced craving scale was $\alpha = 0.95$, indicating an excellent internal consistency and therefore high reliability. Cronbach's alpha of the alcohol cue induced craving scale was $\alpha = 0.78$ indicating acceptable reliability. Cronbach's alpha would rise if item 42 and item 48 deleted, however no item was deleted as the discrepancy was marginal.

Exploratory Factor Analysis: 35-Item Questionnaire

Exploratory factor analyses were conducted with the items resulting from previous assignment to examine whether stress induced craving and alcohol cue induced craving are separate latent factors of the questionnaire.

Firstly, exploratory factor analysis without fixed number of factors was conducted to

examine all possible factors. The results revealed six factors with an eigenvalue of minimal 1.0, so all six factors were retained (see figure 3).

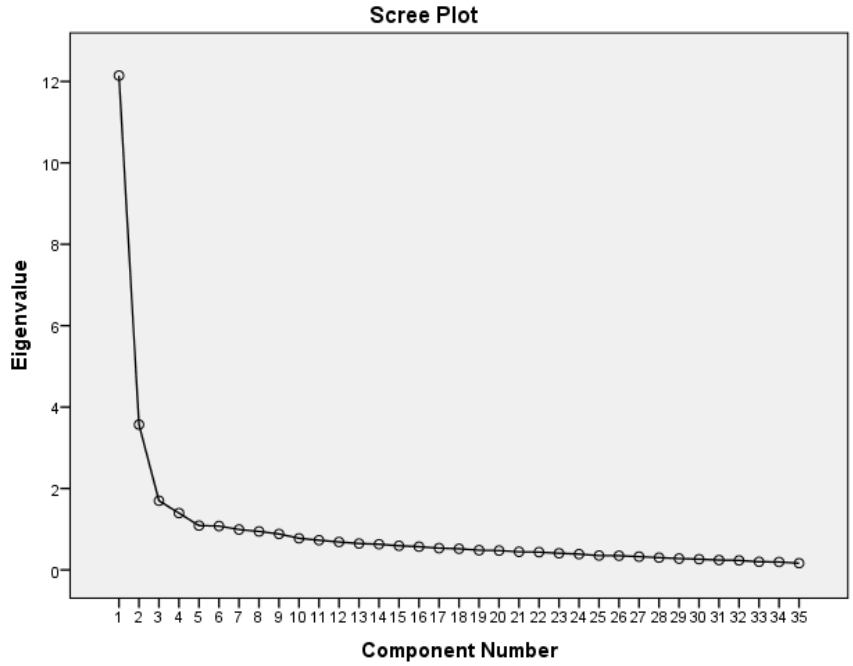

Figure 3. Scree Plot with Eigenvalues for Each Component

Table 1 shows the factors revealed, which were labelled *Negative affect* (1), *Social situations* (2) and *Situations involving food* (4), factor 6 could not be labelled. Factor 3 was labelled *Physical reactions* (3), as although the label did not fit item 24 and item 42 their factor loadings were low. Thus, firstly the 35-item questionnaire contained more dimensions than the dimensions stress and alcohol cue induced craving, secondly the two dimensions stress and alcohol cues cannot be directly found as two single factors.

However, the results also showed that negative affect (1) and physical reactions (3) exclusively contained items of the scale stress induced craving (s), whereas social situations (2) and situations involving food (4) exclusively contained items of the scale alcohol cue induced craving (C). Thus, both scales appear to contain at least two latent variables, which are negative affect (1) and physical reactions (3) for stress induced craving and social situations (2) and situations involving food (4) for alcohol cue induced craving. Furthermore, the results indicated that negative affect (1) accounts for 30.72% of the total variability, social situations (2) for 10.63% physical reactions (3) for 6.14% and the other three factors for less than 5.0%.

Table 1. *Exploratory Factor Analysis: 35-Item Questionnaire*

	Factor number					
	1	2	3	4	5	6
Total variance explained (%)	30.72	10.63	6.14	4.97	3.97	3.49
Item 32 Not self-satisfied (S)	0.81					
Item 18 Cheerless (S)	0.77					
Item 36 Lonely (S)	0.74					
Item 11 Criticised (S)	0.74					
Item 31 Tense atmosphere (S)	0.74					
Item 20 Disappointed (S)	0.74					
Item 17 Insecure (S)	0.73					
Item 12 Restless (S)	0.73					
Item 10 Mad or angry (S)	0.73					
Item 47 Panic (S)	0.72					
Item 6 Stressed (S)	0.72					
Item 38 Guilty (S)	0.72					
Item 46 Treated disingenuous (S)	0.72					
Item 23 Nervous (S)	0.71					
Item 15 Ruminate about past (S)	0.66					
Item 50 Mistake (S)	0.66					
Item 35 No future perspective (S)	0.65					
Item 40 Family problems (S)	0.64					
Item 24 Argument with partner (S)	0.58		0.4			
Item 14 Something goes not well (S)	0.55					
Item 1C Party (C)		0.79				
Item 22 At café or restaurant (C)		0.8				
Item 28 With friends (C)		0.74				
Item 13 Festive days (C)		0.67				
Item 9 Alcohol is offered (C)		0.66				
Item 27 Drink for socializing (C)		0.63				
Item 16 Others drink (C)		0.61				
Item 19 Sweating (S)			0.75			
Item 43 Shaking hands (S)			0.74			
Item 41 Plan does not go through (S)			0.55			
Item 7 Cooking (C)				0.84		
Item 42 Mealtime (C)				0.83		
Item 48 Grocery shopping (C)					0.84	
Item 4 Pain (S)	0.45				0.51	
Item 34 Work problems (S)	0.49					0.49

Secondly, exploratory factor analysis was conducted with fixed number of two factors to examine whether the two dimensions stress and alcohol cue induced craving match the two factors found. The results showed that based on content the factors could be labelled as previously: negative affect (1) and social situations (2). Also the results revealed that all items assigned to the factor negative affect (1) were stress induced craving items (S) and all items assigned to the factor social situations (2) were alcohol cue induced items (C). However, item 43 (shaking hands), item 42 (mealtime), item 48 (grocery shopping), item 19 (sweating) and item 7 (cooking) could not be assigned to the two factors, indicating the latent constructs situations involving food and physical reactions. Furthermore, the results showed that negative affect (1) accounts for 33.09% of the total variability and social situations (2) for 11.81% (see table 2).

Table 2. *Exploratory Factor Analysis with Fixed Number of Two Factors: 35-Item Questionnaire*

	Factor number	
	1	2
Total variance explained (%)	33.09	11.81
Item 32 Not Self-satisfied (S)	0.81	
Item 11 Criticised (S)	0.78	
Item 10 Mad or angry (S)	0.77	
Item 38 Guilty (S)	0.75	
Item 31 Tense atmosphere (S)	0.74	
Item 36 Lonely (S)	0.74	
Item 18 Cheerless (S)	0.73	
Item 46 Treated disingenuous (S)	0.73	
Item 20 Disappointed (S)	0.72	
Item 17 Insecure (S)	0.72	
Item 47 Panic (S)	0.71	
Item 23 Nervous (S)	0.71	
Item 12 Restless (S)	0.7	
Item 35 No future perspective (S)	0.69	
Item 50 Mistake (S)	0.69	
Item 14 Something goes not well (S)	0.67	
Item 40 Family problems (S)	0.67	
Item 6 Stressed (S)	0.67	
Item 15 Ruminate about past (S)	0.66	

Item 24 Argument with partner (S)	0.64	
Item 34 Work problems (S)	0.58	
Item 4 Pain (S)	0.56	
Item 41 Plan does not go through (S)	0.56	
Item 43 Shaking hands (S)		
Item 42 Mealtime (C)		
Item 48 Grocery shopping (C)		
Item 19 Sweating (S)		
Item 7 Cooking (C)		
Item 22 At café or restaurant (C)		0.74
Item 28 With friends (C)		0.74
Item 1 Party (C)		0.73
Item 13 Festive days (C)		0.66
Item 27 Drink for socializing (C)		0.62
Item 9 Alcohol is offered (C)		0.57
Item 16 Others drink (C)		0.57

As the factor situations involving food (4) was constituted by item 7 (cooking) and item 42 (mealtime) in the factor analysis without fixed number of factors and as the two items could not be assigned to one of the two factors in the factor analysis with fixed number of two factors the alcohol cue induced craving scale was tested for inter-item correlation by Pearson's r. The results showed that although item 7 (cooking) and item 42 (mealtime) have a positive correlation ($r = 0.59$), they only have weak correlations with all other items. Therefore, it can be assumed that the items do not fit well in the alcohol cue induced craving scale and could be excluded from the scale (see Appendix 8). However, referring to high inter-rater reliability and inter-item reliability it was decided to retain the items in the alcohol cue induced craving scale.

One-Way ANOVA

One-way ANOVA was performed to determine whether there are significant differences between stress induced craving and alcohol cue induced craving in dependent and non-dependent subjects. The results showed that there was no significant difference between the scores of alcohol dependent and non-dependent subjects on stress induced craving items or alcohol cue induced craving items (see table 3).

Table 3. *One-Way ANOVA: Difference between Dependent and Non-Dependent Subjects on Stress Induced Craving and Alcohol Cue Induced Craving*

	Mean (SD)		F	p	n
	Dependent	Non-Dependent			
Stress induced craving	1.74 (0.5)	1.56 (0.43)	2.86	0.09	228
Alcohol cue induced craving	2.01 (0.4)	1.88 (0.41)	3.21	0.08	228

Correlational Analysis

Correlational analysis was used to test whether there are correlations between all constructs. Pearson's r showed that there were significant positive correlations between dependence and drinks per week ($r = 0.17$, $n = 228$; $p<0.05$), stress induced craving and alcohol cue induced craving ($r = 0.33$, $n = 228$; $p<0.05$) and between number of years of problematic alcohol use and age ($r = 0.18$, $n = 228$; $p<0.05$). All other variables and constructs did not significantly correlate with each other (see table 4). As all analyses were performed with binary coded variables, correlational analysis was also performed with continuous variables (age, educational level, drinks per week and years of problematic alcohol use), which revealed similar results (see Appendix 9).

Table 4. *Correlations between all Binary coded Variables and Constructs (n = 228)*

	1	2	3	4	5	6	7	8	9
1 Dependence									
2 Stress induced craving	-0.11								
3 Alcohol cue induced craving	-0.12	0.33*							
4 Sex [a]	0.04	-0.04	-0.003						
5 Age [b]	0.05	-0.05	-0.09	-0.02					
6 Educational level [c]	0.07	-0.006	0.01	0.08	-.044				
7 Drinks per week [d]	0.17*	-0.11	0.07	0.09	-.009	0.07			
8 Years problematic alcohol use [e]	0.09	0.005	-0.04	-0.05	0.18*	-0.1	0.12		
9 Lifetime tobacco use [f]	0.1	-0.01	.032	.025	0.07	0.04	0.02	-0.1	

[a] male = 1; female = 2

[b]. 47.5 - 75 years = 1; 21 - 47.5 years = 2

[c.] primary school, LBO/MAVO/VMBO, HAVO/VWO, MBO, HBO = 1; HBO, WO, others = 2

[d.] 32 – 153 drinks per week = 1; 0 - 32 drinks per week = 2
[e] 6 – 41 years of problematic alcohol use = 1; 0 - 6 years of problematic alcohol use = 2
[f.] lifetime tobacco use = 1; no lifetime tobacco use = 0
*. Correlation is significant at the 0.01 level

Moderator Analyses

Univariate analyses were performed in order to examine whether the factors sex, age, educational level, drinks per week, number of years of problematic alcohol use and lifetime tobacco use moderate the relationship between dependence and stress induced craving and dependence and alcohol cue induced craving. Thus, for all possible moderators two univariate analyses were performed, firstly, with stress induced craving as dependent variable and secondly, with alcohol cue induced craving as dependent variable.

Table 5 shows that none of the six hypothesized factors had a moderating effect on the relationship between alcohol dependence and stress induced craving, sex ($p = 0.87$), age ($p = 0.62$), educational level ($p = 0.68$), drinks per week ($p = 0.91$), years of problematic alcohol use ($p = 0.16$) and lifetime tobacco use ($p = 0.72$). Similar applies for alcohol cue induced craving as dependent variable as no significant results were revealed, sex ($p = 0.31$), age ($p = 0.94$), educational level ($p = 0.49$), drinks per week ($p = 0.98$), years of problematic alcohol use ($p = 0.13$) and lifetime tobacco use ($p = 0.82$), subsequently leading to the rejection of the hypothesis. Also when tested with continuous variables no significant results were found (see Appendix 10).

Table 5. *Moderating Effect of Sex, Age, Educational Level, Drinks per Week, Years of Problematic Alcohol Use and Lifetime Tobacco Consumption on the Relationship between Dependence and Stress Induced Craving and Alcohol Cue Induced Craving*

Moderator	Dependent Variable	Corrected Model		Moderator	
		F	p	F	p
Sex	S [a]	1.06	0.37	0.3	0.87
	AC [b]	1.41	0.24	1.1	0.31
Age	S [a]	1.15	0.33	0.25	0.62
	AC [b]	1.65	0.18	0.01	0.94

Educational level	S [a]	1.0	0.39	0.17	0.68
	AC [b]	1.25	0.29	0.49	0.49
Drinks per week	S [a]	1.54	0.21	0.01	0.91
	AC [b]	1.67	0.18	0.001	0.98
Years problematic alcohol	S [a]	1.65	0.18	2.03	0.16
use	AC [b]	1.91	0.13	2.3	0.13
Lifetime tobacco	S [a]	1.27	0.28	0.13	0.72
consumption	AC [b]	0.97	0.43	0.53	0.82

[a]. Stress induced craving

[b]. Alcohol cue induced craving

Discussion

The aim of the current study was to examine whether different biopsychosocial factors have a moderating effect on the relationship between alcohol dependence and stress induced craving and alcohol cue induced craving. Results indicated that no moderating effect could be found, however, multiple interesting findings have been revealed by this study. Firstly, psychometric tests were performed to develop a questionnaire measuring the dimensions stress induced craving and alcohol cue induced craving from a craving questionnaire, which was part of an online intervention programme for alcoholics. Secondly, the relationship between alcohol dependence and stress induced craving and alcohol dependence and alcohol cue induced craving was investigated by performing several tests including moderation analyses.

First of all, the results of the moderator analyses will be discussed. It can be concluded that no significant moderation effect for any of the biological factors sex and age, the social factor educational level and the psychological factors drinking behavior with regard to drinks per week and years of problematic alcohol use as well as the psychological factor lifetime tobacco use was revealed. Furthermore, no correlations between the factors and alcohol dependence could be revealed by this study with the expectation of a weak positive correlation between alcohol dependence and drinks per week. However, this might be explained by the fact that the factor drinks per week overlaps with alcohol dependence. With regard to the findings of the moderator analyses it can be concluded that they are not in line with previous research, which indicated that the hypothesized factors are associated with craving. Especially the biological factor sex was associated with craving in previous craving studies (Chakravorty et al., 2010), but also tobacco use was mentioned as important factor

(Hillemacher et al., 2006). Moreover, the other factors examined by this study were associated with craving, for example age (Heinz et al., 2005; Hintzen et al., 2011) or educational level (Schnohr et al., 2004). Therefore, it would be expected to find a moderating effect of the factors, which was not the case. However, the consistency of non-significant results was striking, whereby the dichotomization of continuous variables can be precluded as possible explanation as the analyses were also conducted with continuous variables, which revealed no significant results. This in turn leads to the question of possible explanations, which might lie in the distinctiveness of the study's sample.

Secondly, the results of the psychometric tests the main analyses were based on will be discussed. It can be concluded that both exploratory factor analyses (without and with fixed number of two factors) showed that stress induced craving was consistently mirrored in the dimension *Negative affect*, whereas alcohol cue induced craving was consistently mirrored in the dimension *Social situations*, providing evidence that stress induced craving and alcohol cue induced craving are distinct dimensions of the craving questionnaire. However, the exploratory factor analysis without fixed number of factors disclosed more dimensions than the two. The stress induced craving scale comprised the latent construct *Physical reactions* and the alcohol cue induced craving scale comprised the latent construct *Situations involving food*. This is in accordance with the exploratory factor analysis with fixed number of two factors as all items previously assigned to the dimensions situations involving food and physical reactions could not be assigned to the dimension negative affect, comprising stress induced craving items, nor to the dimension social situations, comprising alcohol cue induced craving items. Thus, the disclosure of latent constructs indicates that the scales may not be unidimensional.

When it comes to strengths and limitations, the study's sample constituted a major strength as it entailed alcohol dependent subjects taking part in a treatment programme for alcoholics based on own initiative and motivation who self-administered the craving questionnaire in a treatment phase. Thus, participants were not approached by researchers increasing the probability of higher commitment and willingness pertaining the completion of the craving questionnaire. Although it is assumed that they gave honest insights in their craving to receive good and individually tailored treatment, it needs to be taken into account that also in online-environments therapeutic alliance is present and that there is a relationship between therapeutic alliance and e-therapy outcome (Sucala et al., 2012). Therefore, loyalty towards the counsellor may still have caused bias in this study. However, it is still important to highlight that the current study's sample is a quiet unique sample as most research on

craving has been conducted with alcohol dependent subjects being actively approached, for instance via advertisements (Fox, 2007; Grüsser & Möhrsen, 2006; Sinha, 2009). This allows the assumption that the current study's results were not in line with previous research based on sample difference, presuming that the current study's participants mirror the true sample to be measured. Although this leads to some controversy as it would be expected to reveal correlations between craving, dependence and the possible moderators, the explanation for this might partially lie in some of the current study's limitations with special regard to the following, first limitation.

The first limitation to be mentioned is that participants were in an early treatment phase and not abstinent when craving was measured. Therefore, craving might not have been experienced as a withdrawal symptom when measured and would consequently have been rated different and more severe at a later point in treatment or in a post-treatment stage. As stated by Ludwig and Wikler (1974), alcohol craving correlates with alcohol withdrawal and the more severe withdrawal, the greater the craving. Thus, as alcohol withdrawal was absent or at least not severe when the questionnaire was completed it can be assumed that craving was relatively low. Therefore, it would be recommended to let participants additionally complete the craving questionnaire at a later treatment stage.

Another limitation that needs to be taken into account is that subjects had to report their craving from a retrospective point of view, enhancing the risk of recall bias. The subsequent craving data might therefore be partially unreliable. This is also acknowledged by Hassan (2005) as he states that people encounter difficulties remembering past incidents since human memory is only a poor vision of original precepts. However, other studies encountered recall issues as well, for instance Shiffman and colleagues (1997) reported biased recall of craving compared to real-time measures, showing that recall bias in craving studies is a more general issue rather than a limitation of this study in particular. Further research could address this problem by implementing a diary function in the online intervention, for instance participants could write down their craving on a daily basis and distorted memory recall could be prevented by reducing the likelihood of retrospection by minimizing the amount of time between occurrence and record of craving (Bolger, Davis & Rafaeli, 2003).

In addition, the construction of the Alcohol de Baas questionnaire might be disputable from a research point of view since content of the items and their compilation was based on experience rather than evidence, resulting in a call for validation. Therefore, future research should address the validity of the questionnaire as it is essential to accurately measure craving

to subsequently guarantee the collection of comparable, generalizable and credible data.

There might also be some controversy pertaining the weight of the factors examined in the exploratory factor analyses. In the analyses of the 35-item questionnaire the factor negative affect explained about 30% of the total variance and the factor social situations about 10%, making them the two factors explaining most of the variance. Thus, the factor negative affect, which contained stress induced craving items weights three times more than the factor social situations, which contained alcohol cue induced craving items. This could be related to the unequal distribution of items to the stress induced craving scale (25 items) and the alcohol cue induced craving scale (10 items).

Another limitation of the current study might be the selection of the factors drinks per week and years of problematic alcohol use. As already mentioned before, the results revealed a correlation between drinks per week and alcohol dependence, which lead to the assumption of overlap between the two. This overlap becomes considerably apparent when investigating the DSM-IV alcohol dependence criteria in more detail, as the criterion alcohol tolerance seems to be in accordance with the factor drinks per week. Although no correlation was revealed between the factor years of problematic alcohol use and dependence it can be assumed that also this factor overlaps with alcohol dependence as it seems to be in accordance with the DSM-IV criterion of alcohol habituation (see Appendix 1). Moreover, the factor educational level might be a point of criticism as it is a more distal and indirect rather than direct factor (Considine & Zappala, 2002). Therefore, the factor educational level may be subject to confounding variable.

Finally, it needs to be considered that the alcohol dependence cut-off score might be disputable. Alcohol dependence was assessed by the intake questionnaire by participant's CIDI score according to DSM-IV criteria with a cut-off level of three in the category of questions assessing alcohol dependence, subsequently leading to unequal groups of dependent (84.2%) and non-dependent subjects (15.8%). Therefore, it might be interesting for further research to apply the DSM-V criteria of alcohol dependence, or *Alcohol Use Disorder* (AUD) as labelled according to DSM-V as it measures on a continuous scale distinguishing between the subtypes mild (2-3 symptoms), moderate (4-5 symptoms) and severe AUD (6 or more symptoms) instead of categorizing dependent and non-dependent (see Appendix 1). Furthermore, although the DSM-IV categorical approach can be used with confidence as it has shown to be reliable and valid (Hasin et al., 2003) for some research purposes representing alcohol dependence criteria on a continuous scale may offer more information and statistical power (Bucholz et al., 1996). Interestingly, the criterion craving

was added by DSM-V for AUD diagnosis, which was not included in DSM-IV, so it seems a logical presumption for further craving studies to use the DSM-V criteria which include craving to assess level of AUD.

In conclusion, the results showed that no moderating effect of any of the biopsychosocial factors on the relationship between alcohol dependence and stress induced craving or alcohol dependence and alcohol cue induced craving was revealed by this study. However, the uniqueness of the current study's sample containing alcohol dependent subjects indicating their craving based on own initiative for the purpose of treatment might have contributed to the hypothesis rejection as it is not in line with previous craving research using samples of actively approached participants. Furthermore, some of the previously named limitations need to be considered to have possibly contributed to the study's outcomes and should be addressed by further research. The psychometrics the main analyses were based on revealed that stress and alcohol cue induced craving were distinct dimensions, however latent constructs have been found, indicating that the scales are not unidimensional.

Finally, it can be summarized that it is important to further investigate stress induced craving and alcohol cue induced craving with differentiation between the two, providing the benefit of more tailored treatment for individuals more susceptible to stress or alcohol cue induced craving. Also examining biopsychosocial factors that exert influence on stress induced craving and alcohol cue induced craving is crucial to diminish craving thoughts within alcoholics and ultimately provide better treatment and minimize the risk of relapse.

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Appendix

Appendix 1. *DSM IV and DSM V Alcohol Dependence and AUD Criteria*

A Comparison Between DSM–IV and DSM–5

DSM–IV			DSM–5	
In the past year, have you:			In the past year, have you:	
Any 1 = ALCOHOL ABUSE	Found that drinking—or being sick from drinking—often interfered with taking care of your home or family? Or caused job troubles? Or school problems?	1	Had times when you ended up drinking more, or longer, than you intended?	The presence of at least 2 of these symptoms indicates an **Alcohol Use Disorder (AUD).** The severity of the AUD is defined as: **Mild:** The presence of 2 to 3 symptoms **Moderate:** The presence of 4 to 5 symptoms **Severe:** The presence of 6 or more symptoms
	More than once gotten into situations while or after drinking that increased your chances of getting hurt (such as driving, swimming, using machinery, walking in a dangerous area, or having unsafe sex)?	2	More than once wanted to cut down or stop drinking, or tried to, but couldn't?	
	More than once gotten arrested, been held at a police station, or had other legal problems because of your drinking? ****This is not included in DSM–5****	3	Spent a lot of time drinking? Or being sick or getting over other aftereffects?	
	Continued to drink even though it was causing trouble with your family or friends?	4	Wanted a drink so badly you couldn't think of anything else? ****This is new to DSM–5****	
Any 3 = ALCOHOL DEPENDENCE	Had to drink much more than you once did to get the effect you want? Or found that your usual number of drinks had much less effect than before?	5	Found that drinking—or being sick from drinking—often interfered with taking care of your home or family? Or caused job troubles? Or school problems?	
	Found that when the effects of alcohol were wearing off, you had withdrawal symptoms, such as trouble sleeping, shakiness, restlessness, nausea, sweating, a racing heart, or a seizure? Or sensed things that were not there?	6	Continued to drink even though it was causing trouble with your family or friends?	
	Had times when you ended up drinking more, or longer, than you intended?	7	Given up or cut back on activities that were important or interesting to you, or gave you pleasure, in order to drink?	
	More than once wanted to cut down or stop drinking, or tried to, but couldn't?	8	More than once gotten into situations while or after drinking that increased your chances of getting hurt (such as driving, swimming, using machinery, walking in a dangerous area, or having unsafe sex)?	
	Spent a lot of time drinking? Or being sick or getting over other aftereffects?	9	Continued to drink even though it was making you feel depressed or anxious or adding to another health problem? Or after having had a memory blackout?	
	Given up or cut back on activities that were important or interesting to you, or gave you pleasure, in order to drink?	10	Had to drink much more than you once did to get the effect you want? Or found that your usual number of drinks had much less effect than before?	
	Continued to drink even though it was making you feel depressed or anxious or adding to another health problem? Or after having had a memory blackout?	11	Found that when the effects of alcohol were wearing off, you had withdrawal symptoms, such as trouble sleeping, shakiness, restlessness, nausea, sweating, a racing heart, or a seizure? Or sensed things that were not there?	

Appendix 2. ***Drinkwijzer: Original Dutch version***

Hoeveel trek heb je? weinig/geen, nogal, heel erg
Hoe vaak drink je? (bijna) nooit, regelmatig, (bijna) altijd.

Items m.b.t. *gevoel*: 2, 6, 10, 12, 17, 18, 20, 23, 25, 29, 32, 33, 36, 38, 47, 49
Items m.b.t. *gedachten*: 3, 27, 35
Items m.b.t. *situaties*: 1, 4, 5, 7, 8, 9, 11, 13, 14, 15, 16, 19, 21, 22, 24, 26, 28, 30, 31, 34, 37, 39, 40, 41, 42, 43, 44, 45, 46, 48, 50

Lijst met items:

1. Als ik op een feestje ben S
2. Als ik een goede bui heb
3. Als ik denk dat eentje geen kwaad kan
4. Als ik pijn heb N
5. Als ik druk ben N
6. Als ik gespannen ben N
7. Als ik aan het koken ben
8. Als ik gesport heb
9. Als ik alcohol aangeboden krijg S
10. Als ik kwaad ben N
11. Als ik kritiek krijg N
12. Als ik onrustig ben
13. Met feestdagen
14. Als iets waarmee ik bezig ben, niet lukt N
15. Als ik pieker over het verleden N
16. Als ik anderen alcohol zie drinken S
17. Als ik me onzeker voel N
18. Als ik somber ben N
19. Als ik het warm heb en transpireer, terwijl het niet warm is
20. Als ik teleurgesteld ben N
21. Als ik alleen ben
22. Als ik op een terras of in een café/ restaurant ben
23. Als ik zenuwachtig ben
24. Als ik ruzie met mijn partner heb N I

25. Als ik tevreden over mezelf ben
26. Als het gezellig is S
27. Als ik denk dat ik best sociaal kan drinken S
28. Als ik met een groepje vrienden ben S
29. Als ik moe ben
30. Als ik contact heb met iemand die ik aantrekkelijk vind
31. Als de sfeer gespannen is N
32. Als ik ontevreden over mezelf ben N
33. Als ik me ongelukkig voel N
34. Als ik problemen op het werk heb N I
35. Als ik geen toekomst voor mezelf zie N
36. Als ik me eenzaam voel N
37. Als ik niks te doen heb
38. Als ik me schuldig voel N
39. Als er geen alcohol in huis is
40. Als ik problemen in mijn gezin heb N I
41. Als iets dat ik van plan was, niet doorgaat N
42. Als het tegen etenstijd loopt
43. Als ik trillende handen heb
44. Als ik vrij heb, bijvoorbeeld weekends of vakantie
45. Als ik succesvol ben
46. Als ik oneerlijk word behandeld N I
47. Als ik in paniek ben N
48. Als ik boodschappen doe in de supermarkt
49. Als ik me uitgelaten voel
50. Als ik een fout heb gemaakt N

Variabelenamen items Drinkwijzer – Hoeveel trek heb je?	DWtrek1 t/m DWtrek50
Antwoord categorieën	weinig / geen = 1
	nogal = 2
	heel erg = 3

Variabelenamen items Drinkwijzer – Hoe vaak drink je?	DWvaak1 t/m DWvaak50
Antwoord categorieën	(bijna) nooit = 1
	regelmatig = 2
	(bijna) altijd = 3

Periode van export: 01-09-2012 (start ROM intake) t/m 31-08-2015.
Aantal in onderzoeksportal = 1417 / 633 (starters, incl instroom via ftf)
Aantal ROM intakes = 1286 / 526
Aantal Drink Wijzer = ???
Aantal ROM nametingen = 150 (28,5%)

Appendix 3. ***Drinkwijzer: English version***

Items English
Item 1 When I am at a party (ACC)**
Item 2 When I am in a good mood
Item 3 When I think one drink does not matter
Item 4 When I have pain (SC)*
Item 5 When I am busy
Item 6 When I am stressed (SC)*
Item 7 When I am cooking (ACC)**
Item 8 When I worked out
Item 9 When alcohol is offered to me (ACC)**
Item 10 When I am mad/angry (SC)*
Item 11 When I get criticised (SC)*
Item 12 When I am restless (SC)*
Item 13 On festive days (ACC)**
Item 14 When something I do does not go well (SC)*
Item 15 When I ruminate about the past (SC)*
Item 16 When I see other people drinking alcohol (ACC)**
Item 17 When I feel insecure (SC)*

Item 18 When I am cheerless (SC)*

Item 19 When I am sweating although it is not warm (SC)*

Item 20 When I am disappointed (SC)*

Item 21 When I am alone

Item 22 When I am at a terrace or café/restaurant (ACC)**

Item 23 When I am nervous (SC)*

Item 24 When I have an argument with my partner (SC)*

Item 25 When I am satisfied with myself

Item 26 When it is cosy

Item 27 When I think I can drink for socializing (ACC)**

Item 28 When I am together with a group of friends (ACC)**

Item 29 When I am tired

Item 30 When I have contact with a person I consider to be attractive

Item 31 When the atmosphere is tense (SC)*

Item 32 When I am not satisfied with myself (SC)*

Item 33 When I feel sad

Item 34 When I have problems at work (SC)*

Item 35 When I cannot see future perspectives for myself (SC)*

Item 36 When I feel lonely (SC)*

Item 37 When I have nothing to do

Item 38 When I feel guilty (SC)*

Item 39 When there is no alcohol at home (SC)*

Item 40 When I have problems with my family (SC)*

Item 41 When something I planned to do does not go through (SC)*

Item 42 When mealtime comes closer (ACC)**

Item 43 When my hands are shaking (SC)*

Item 44 When I am off, for example at the weekend or during holidays

Item 45 When I am successful

Item 46 When I am treated disingenuous (SC)*

Item 47 When I panic (SC)*

Item 48 When I do grocery shopping at the supermarket (ACC)**

Item 49 When I feel light-hearted

Item 50 When I did a mistake (SC)*

* Stress induced craving

** Alcohol cue induced craving

Appendix 4. ***Behandelflow Alcoholdebaas***

1	Intake vragenlijst
2	Opdracht: voordelen en nadelen
3	Opdracht: agenda bijhouden
4	Opdracht: situaties analyseren
5	Drinkwijzer
6	Lijst tussenmeting
7	Opdracht: doel stellen
8	Lijst motivatie
9	Opdracht: helpende gedachte
10	Opdracht: helpend gedrag
11	Opdracht: beslissingen
12	Opdracht: actieplan
13	Lijst nameting
14	Lijst 6 weken
15	Lijst half jaar

Appendix 5. ***Participant Information 'Drink Wijzer'***

Drink Wijzer

Voor ons volgende contact wil ik graag nog wat meer zicht proberen te krijgen op verschillende situaties waarin je mogelijk zin krijgt in alcohol. Hieronder vind je daarvoor een opdracht, de Drink Wijzer, waarin je verschillende situaties kunt aanvinken waarbij je zin in drinken hebt. Met deze informatie en alle informatie die je hebt gegeven in de vorige

contacten, kan ik een samenvatting maken van de belangrijkste punten rondom je drankgebruik. In het volgende contact gaan we daar dieper op in.

Appendix 6. *Exploratory Factor Analysis: Original questionnaire*

	Factor number								
	1	2	3	4	5	6	7	8	9
Total variance explained (%)	23.86	9.49	5.54	4.16	3.9	3.51	3.45	3.13	2.65
Item 32 Not Self-satisfied	0.78								
Item 10 Mad or angry	0.76								
Item 11 Criticised	0.76								
Item 46 Treated disingenuous	0.76								
Item 33 Sad	0.76								
Item 31 Tense atmosphere	0.74								
Item 20 Disappointed	0.73								
Item 38 Guilty	0.73								
Item 47 Panic	0.73								
Item 36 Lonely	0.72								
Item 40 Family problems	0.69								
Item 50 Mistake	0.69								
Item 17 Insecure	0.69								
Item 18 Cheerless	0.69								
Item 35 No future perspective	0.68								
Item 24 Argument with partner	0.68								
Item 15 Ruminate about past	0.66								
Item 23 Nervous	0.66								
Item 12 Restless	0.62						0.48		
Item 6 Stressed	0.59						0.59		
Item14 Something goes not well	0.58								
Item 34 Work problems	0.51								
Item 4 Pain	0.49								

Item 41 Plan does not go through	0.47		0.42				
Item 22 At café or restaurant		0.75					
Item 28 With friends		0.75					
Item 1 Party		0.74					
Item 26 Cosy		0.73					
Item13 Festive days		0.71					
Item 44 Weekends or holiday		0.63					
Item 9 Alcohol is offered		0.6					
Item 27 Drinking for socializing		0.58					
Item 16 When others drink		0.52				0.45	
Item 45 Successful			0.78				
Item 25 Self-satisfied			0.76				
Item 49 Light hearted			0.68				
Item 2 Good mood			0.58				
Item 19 Sweating				0.79			
Item 43 Shaking hands				0.72			
Item 7 Cooking					0.85		
Item 42 Mealtime					0.82		
Item 29 Tired							
Item 21 Alone						0.69	
Item 39 No alcohol at home						0.51	
Item 37 Nothing to do						0.5	
Item 5 Busy							0.64
Item 48 Grocery shopping							0.76
Item 30 Contact attractive person							
Item 8 Workout							
Item 3 One drink does not matter							

Appendix 7. *Exploratory factor analysis with fixed number of three factors: Original questionnaire*

	Factor number		
	1	2	3
Total variance explained (%)	25.19	10.61	8.01
Item 33 Sad	0.81		
Item 32 Not self-satisfied	0.8		
Item 18 Cheerless	0.77		
Item 10 Mad or angry	0.76		
Item 36 Lonely	0.76		
Item 11 Criticised	0.74		
Item 47 Panic	0.73		
Item 38 Guilty	0.73		
Item 31 Tense atmosphere	0.72		
Item 20 Disappointed	0.72		
Item 17 Insecure	0.71		
Item 46 Treated disingenuous	0.71		
Item 23 Nervous	0.71		
Item 35 No future perspective	0.7		
Item 12 Restless	0.69		
Item 6 Stressed	0.68		
Item 40 Family problems	0.68		
Item 15 Ruminate about past	0.67		
Item 50 Mistake	0.67		
Item 24 Argument with partner	0.62		
Item 14 Something goes not well	0.59		
Item 4 Pain	0.52		
Item 34 Work problems	0.5		
Item 21 Alone	0.42		
Item 37 Nothing to do	0.4		
Item 5 Busy			

Item 48 Grocery shopping			
Item 22 At café or restaurant		0.77	
Item 1 Party		0.75	
Item 28 With friends		0.74	
Item 26 Cosy		0.73	
Item 13 Festive days		0.67	
Item 9 Alcohol is offered		0.63	
Item 27 Drink for socializing		0.63	
Item 44 Weekends or holiday		0.59	
Item 16 Others drink		0.58	
Item 30 Contact with attractive person			
Item 3 One drink does not matter			
Item 45 Successful			0.6
Item 7 Cooking			0.55
Item 19 Sweating			0.55
Item 42 Mealtime			0.54
Item 43 Shaking hands			0.53
Item 2 Good mood			0.51
Item 39 No alcohol at home			0.5
Item 25 Self-satisfied			0.49
Item 49 Light hearted		0.44	0.46
Item 8 Workout			0.42
Item 41 Plan does not go through	0.4		0.42
Item 29 Tired			

Appendix 8. ***Correlations between alcohol cue induced craving items***

	1	2	3	4	5	6	7	8	9	10
1 Item 1 Party		0.17	0.49	0.46	0.4	0.54	0.41	0.52	0.06	0.09
2 Item 7 Cooking	0.17		0.12	0.17	0.14	0.15	0.14	0.08	0.59	0.05
3 Item 9 Alcohol is offered	0.49	0.13		0.34	0.43	0.45	0.37	0.37	0.14	0.18
4 Item 13 Festive Days	0.46	0.17	0.34		0.38	0.45	0.38	0.41	0.15	0.12
5 Item 16 Others Drink	0.4	0.14	0.43	0.38		0.44	0.3	0.27	0.17	0.25
6 Item 22 At café or restaurant	0.54	0.15	0.45	0.45	0.44		0.39	0.57	0.16	0.16
7 Item 27 Drink for socializing	0.41	0.14	0.37	0.38	0.3	0.39		0.48	0.05	0.11
8 Item 28 With friends	0.52	0.08	0.37	0.41	0.27	0.57	0.48		0.06	0.04
9 Item 42 Mealtime	0.06	0.59	0.14	0.15	0.17	0.16	0.05	0.06		0.15
10 Item 48 Grocery shopping	0.09	0.05	0.18	0.12	0.25	0.16	0.11	0.04	0.15	

Appendix 9. ***Correlational analysis with continuous variables***

	1	2	3	4	5	6	7	8	9
1 Dependence		-0.11	-0.12	0.04	-0.02	0.12	-0.18**	-0.11	0.1
2 Stress induced craving	-0.11		0.33**	-0.04	0.04	-0.02	0.07	0.01	-0.01
3 Alcohol cue induced craving	-0.12	0.33**		-0.003	0.15*	0.03	-0.04	0.09	0.03
4 Sex	0.04	-0.04	-0.003		0.01	0.02	-0.09	-0.01	0.03
5 Age	-0.012	0.04	.015*	0.01		0.04	0.001	0.27**	-0.06
6 Educational level	0.12	-0.02	0.03	0.02	0.04		-0.14*	0.09	-0.03
7 Drinks per week	-0.18**	0.07	-0.04	-0.09	0.001	-0.14*		0.09	-0.02
8 Years of alcohol use	-0.11	0.01	0.09	-0.01	0.27**	0.09	0.09		0.06
9 Lifetime tobacco use	0.1	-0.01	0.03	0.03	-0.06	-0.03	-0.02	0.06	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 10. ***Moderator analyses with continuous variables***

Dependent Variable: Stress induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.752[a]	3	.251	1.043	.374
Intercept	15.874	1	15.874	66.080	.000
Dependence	.026	1	.026	.106	.745
Age	.029	1	.029	.122	.727
Dependence * Age	.001	1	.001	.003	.956
Error	53.811	224	.240		
Total	725.368	228			
Corrected Total	54.563	227			

a. R Squared = .014 (Adjusted R Squared = .001)

Dependent Variable: Alcohol cue induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.420[a]	3	.473	2.944	.034
Intercept	16.237	1	16.237	100.971	.000
Dependence	.182	1	.182	1.134	.288
Age	.718	1	.718	4.466	.036
Dependence * Age	.075	1	.075	.467	.495
Error	36.022	224	.161		
Total	941.460	228			
Corrected Total	37.442	227			

a. R Squared = .038 (Adjusted R Squared = .025)

Dependent Variable: Stress induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.691[a]	3	.230	.957	.414
Intercept	22.382	1	22.382	93.064	.000
Dependence	.072	1	.072	.299	.585
Educational level	2.395E-5	1	2.395E-5	.000	.992
Dependence * Educational level	.004	1	.004	.015	.904
Error	53.872	224	.241		
Total	725.368	228			
Corrected Total	54.563	227			

a. R Squared = .013 (Adjusted R Squared = -.001)

Dependent Variable: Alcohol cue induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.647[a]	3	.216	1.313	.271
Intercept	26.958	1	26.958	164.111	.000
Dependence	.194	1	.194	1.181	.278
Educational level	.123	1	.123	.751	.387
Dependence * Educational level	.065	1	.065	.395	.530
Error	36.795	224	.164		
Total	941.460	228			
Corrected Total	37.442	227			

a. R Squared = .017 (Adjusted R Squared = .004)

Dependent Variable: Stress induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.835[a]	3	.278	1.160	.326
Intercept	99.604	1	99.604	415.266	.000
Dependence	.235	1	.235	.980	.323
Drinks per week	.090	1	.090	.375	.541
Dependence * Drinks per week	.006	1	.006	.024	.878
Error	53.728	224	.240		
Total	725.368	228			
Corrected Total	54.563	227			

a. R Squared = .015 (Adjusted R Squared = .002)

Dependent Variable: Alcohol cue induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.964[a]	3	.321	1.972	.119
Intercept	141.895	1	141.895	871.312	.000
Dependence	.790	1	.790	4.853	.029
Drinks per week	.031	1	.031	.193	.661
Dependence * Drinks per week	.293	1	.293	1.796	.182
Error	36.479	224	.163		
Total	941.460	228			
Corrected Total	37.442	227			

a. R Squared = .026 (Adjusted R Squared = .013)

Dependent Variable: Stress induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.845[a]	3	.282	1.175	.320
Intercept	147.398	1	147.398	614.644	.000
Dependence	.727	1	.727	3.032	.083
Years of problematic alcohol use	.111	1	.111	.463	.497
Dependence * Years of problematic alcohol use	.162	1	.162	.677	.412
Error	53.718	224	.240		
Total	725.368	228			
Corrected Total	54.563	227			

a. R Squared = .015 (Adjusted R Squared = .002)

Dependent Variable: Alcohol cue induced craving

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.939[a]	3	.313	1.920	.127
Intercept	195.846	1	195.846	1201.783	.000
Dependence	.612	1	.612	3.756	.054
Years of problematic alcohol use	.403	1	.403	2.470	.117
Dependence * Years of problematic alcohol use	.198	1	.198	1.216	.271
Error	36.504	224	.163		
Total	941.460	228			
Corrected Total	37.442	227			

a. R Squared = .025 (Adjusted R Squared = .012)