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Original article

# Alcohol Homograph Priming in Alcohol-Dependent Inpatients

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**Abstract:** *Aim:* Alcohol dependency is characterized by alcohol-related interpretation biases (IBs): Individuals with high levels of alcohol consumption generate more alcohol-related than alcohol-unrelated interpretations in response to ambiguous alcohol-related cues. However, a response bias could be an alternative account, meaning that individuals with high levels of alcohol consumption generate more alcohol-related IBs because of a greater baseline tendency to endorse alcohol-related responses. *Methods:* To test this alternative explanation, the present study employed a homograph-priming task, reliability of which was also examined. The sample included 577 clinically diagnosed alcohol-dependent inpatients and 61 control inpatients. Participants completed a homograph priming task (primes: homographs with and without an alcohol-related meaning, target words: alcohol and soft drinks) before commencing their behavioral cognitive treatment at a rehabilitation clinic. *Results:* Contrary to our expectations, we did not find an enhanced priming effect in alcohol-dependent inpatients. Moreover, there was no correlation between the priming score and levels of harmful drinking (AUDIT scores). *Conclusions:* The data provide limited support for the existence of alcohol-related IBs, possibly because of the low reliability of the priming task, the features of the task, and the study's design.

**Keywords:** priming task, ambiguity, alcohol associations, interpretation bias, alcohol dependency

**Alkohol "Homograph Priming" bei alkoholabhängigen Patienten**

**Zusammenfassung:** *Zielsetzung:* Zahlreiche Studien belegen, dass Alkoholmissbrauch und -abhängigkeit mit alkohol-bezogenen Interpretationsverzerrungen einhergehen. Diese beinhalten, dass Individuen, die übermäßig trinken, die Neigung haben, mehrdeutige, potenziell alkohol- relevante Reize öfter auf alkoholbezogene als auf neutrale Weise zu interpretieren. Unklar ist jedoch, in wie weit diese Befunde auch durch eine Antworttendenz erklärt werden können: Es könnte sein, dass Individuen, die viel trinken, mehr alkoholbezogene Interpretationen generieren, weil sie generell eine stärkere Tendenz haben, alkoholbezogene Antworten zu geben. Um diese alternative Erklärung zu testen, wurde die vorliegende Studie durchgeführt. *Methodik:* Die Stichprobe umfasste 577 klinisch diagnostizierte alkoholabhängige Patienten und 61 Kontrollpatienten. Alle Patienten absolvierten eine "Homograph Priming" Aufgabe, und zwar vor ihrer stationären Therapie. Als Primes wurden Homographen eingesetzt, die alkoholrelevant verstanden werden können (Kater, Fahne) oder nicht (Bank, Fliege). Alkoholische und nicht-alkoholische Getränke dienten als Targets (z. B. Bier, Wein, Wasser, Cola). *Ergebnisse:* Es wurde erwartet, dass alkoholabhängige Patienten alkoholische Targets schneller kategorisieren, wenn zuvor potentiell alkoholrelevante Primes dargeboten wurden, im Vergleich zu Durchgängen, bei denen alkoholirrelevante Primes gezeigt wurden. Die Ergebnisse konnten den erwarteten Priming Effekt jedoch nicht bestätigen. Zudem gab es keinen Zusammenhang zwischen den Reaktionszeiten in der Priming Aufgabe und dem Maß der Alkoholabhängigkeit (AUDIT-Werte). *Schlussfolgerungen:* Die vorliegenden Daten bieten wenig Unterstützung für die Rolle von alkoholbezogenen Interpretationsverzerrungen bei Alkoholabhängigkeit. Sowohl die Reliabilität der Priming-Aufgabe, als auch ihre Eigenschaften und das Studiendesign könnten Erklärungsansätze für die Ergebnisse bieten. Die Ergebnisse könnten jedoch auch ein erster Hinweis dafür sein, dass den alkoholbezogenen Interpretationsverzerrungen in der Tat eine Antworttendenz zu Grunde liegt. Um diese Aussage zu stützen, sind jedoch Replikations- und Erweiterungsstudien nötig.

**Schlüsselwörter:** Priming-Aufgabe, Ambiguität, Alkoholassoziationen, Interpretationsverzerrung, Alkoholabhängigkeit

# Introduction

The relationship between addictive behaviors and biased information processing has received substantial empirical support. Many models of addictive behaviors incorporate these findings, postulating that such biases are crucial regarding the development and maintenance of an addiction (e. g., Deutsch & Strack, 2006; Wiers et al., 2007; for a critical discussion see Gladwin & Figner, 2014; Gladwin, Figner, Crone, & Wiers , 2011). Alcohol dependency, for example, is characterized by biases in attention, automatically activated approach tendencies, and implicit memory associations (for a review, see Stacy & Wiers, 2010). The present study investigated the role of implicit alcohol-related memory associations.

Word-association tasks are well-established paradigms for studying implicit alcohol-related associations (for review, see Stacy & Wiers, 2010). Participants give their first spontaneous association to ambiguous cues that could be interpreted as either alcohol-related or alcohol-unrelated. Many different operationalizations have been employed, for example, single word cues (e. g., "draft," "shot"), ambiguous situations (e. g., "Friday night'), or open- ended ambiguous scenarios (e. g., Ames & Stacy, 1998; Krank, Schoenfeld, & Frigon, 2010; Salemink & Wiers, 2014; Stacy, 1995, 1997; Woud, Fitzgerald, Wiers, Rinck, & Becker, 2012). Results repeatedly demonstrated the same pattern: Individuals with high levels of alcohol consumption exhibited an alcohol-related interpretation bias (IB). That is, they generated more alcohol-related than alcohol-unrelated interpretations in response to ambiguous alcohol-related cues. More recently, results showed that clinical levels of alcohol dependency are also accompanied by alcohol-related IBs (Woud et al., 2014). This is important as observations in risk populations do not always match observations in clinical populations. From an etiological perspective, the role of alcohol-related IBs can be summarized as follows: Ambiguous alcohol-related cues automatically activate alcohol- related memory schemata that are established and strengthened during repeated alcohol use. Closely related associations become more accessible, which then bias one's thoughts and interpretations. In turn, this "mental exposure" very likely initiates drinking and, once an alcohol dependency has developed, remains a crucial process that maintains the disorder.

Despite the importance of these findings, there is an alternative explanation that could account for the observed effects: a response bias, that is, the finding that individuals with high levels of alcohol consumption generate more alcohol-related continuations toward ambi-guous, alcohol-related cues might result from a greater tendency in these individuals to express alcohol-related *responses* rather than a greater tendency to have alcohol-related *interpretations*, defined here as the semantic activation of alcohol-related concepts. This response bias is particularly relevant if an individual becomes aware of the fact that a cue has two meanings (which does not necessarily mean that an individual becomes aware of the aim of the task) and then automatically chooses the one or the other interpretation.

One way to circumvent this problem involves performance-based measures such as priming tasks. Priming tasks involve the brief presentation of a prime stimulus followed by the presentation of a target stimulus that needs to be categorized. The reaction time (RT) needed to categorize the target serves as an index of the "associative match" between prime and target. Pioneering work by Hill and Paynter (1992) showed that, compared to moderate nondependent drinkers, alcohol-dependent participants more quickly identified alcohol-related target words when these were preceded by alcohol-related than by alcohol-unrelated primes. However, this priming effect did not occur between heavy drinkers and light drinkers (for priming studies addressing different alcohol-relevant conceptualizations, see, e. g., Stacy, Leigh, & Weingardt, 1996; Stewart, Hall, Wilkie, & Birch, 2002; Woud et al., 2013).

The study presented also applied a priming task, namely, a homograph priming task. Alcohol and soft drinks were used as target words, and homographs with and without a possible alcohol-related meaning were used as primes. The assessment of alcohol-related IBs is thus operationalized via the semantic priming effect of alcohol-related versus unrelated homograph primes on the categorization of alcohol-related targets. Only if the ambiguous alcohol-related primes cause the semantic activation of alcohol-related concepts they do function as alcohol-related primes. Hence, the semantic activation of ambiguous primes can be investigated by comparing the RT needed to categorize a target word that is related or unrelated to the different primes. As such, results of our homograph priming task cannot be attributed to an effect of response tendencies following ambiguous alcohol-related cues. Instead, the results of our homograph priming task could be considered as a genuine effect of, in this context, ambiguous alcohol-related cues on the activation of alcohol-related concepts.

To the best of our knowledge, such an application of a homograph priming task is novel to the field of alcohol dependency. A similar approach has been used before in the context of anxiety (Richards & French, 2007), where three different homograph priming tasks varying in stimulus onset asynchronies (SOAs) were applied to

examine the automatic activation of threat-related associations in trait anxiety. Results showed that high-anxious individuals showed a threat-related priming effect, though this effect depended on the SOAs.

Another important focus of the present study was to examine the internal validity of the priming task. According to Bosson, Swann, and Pennebaker (2000), priming effects can be unreliable and might produce small effects (for additional evidence, see Reinecke, Becker, & Rinck, 2010). In the context of alcohol dependency, to the best of our knowledge, only the priming study by Woud et al. (2013) reported reliability indices. That study applied an affective priming task in a clinical sample of alcohol-dependent and nondependent inpatients and assessed the automatic activation of valenced alcohol-related memory associations. Results showed that the priming task's reliability was low (Cronbach's α =.16.). Hence, further examinations of the reliability of priming tasks in the context of alcohol dependency are truly needed.

In summary, alcohol-related IBs may be explained by means of a response bias. Therefore, the present study employed an alcohol homograph priming task in order to test the existence of an alcohol-related IB in an alternative manner. The sample involved a large group of alcohol-dependent inpatients and a large inpatient control group including, among others, patients suffering from a depression or anxiety disorder. We predicted an enhanced priming effect of ambiguous alcohol-related primes on the activation of alcohol-related interpretations in alcohol-dependent inpatients. That is, we expected alcohol-dependent inpatients to show faster categorization times of alcohol targets when primed with alcohol-related than with alcohol-unrelated homographs. Moreover, we expected this priming effect to be correlated positively with levels of harmful drinking (i.e., AUDIT scores): The stronger the alcohol priming effect following alcohol-related homograph, the higher the AUDIT scores should be. In order to test the reliability of our findings, we also examined the internal validity of our priming task.

# Material and Methods

## Participants

Participants were 638 inpatients from the Salus Clinic, Lindow, Germany.[1] The sample's mean age was 45.83 years ($SD$ = 9.15), including 458 male and 180 female participants. Inclusion criterion for alcohol-dependent inpatients was a primary diagnosis of alcohol dependence. The control patient group consisted of patients with a mood or anxiety disorder as a primary diagnosis. Moreover, control patients did not have a history of alcohol dependence and/or comorbid alcohol dependency. The present sample included 577 alcohol-dependent patients (APs) and 61 control patients (CPs). Within the CP group, the primary diagnoses were as follows: 35 inpatients had a mood-related disorder, 12 inpatients had an anxiety disorder, 4 inpatients had a personality disorder, and the remaining 10 were a mixed group including, among others, patients suffering from an eating and somatoform disorder.

## Homograph Priming Task

The homograph priming task required participants to categorize target words into two categories: alcohol or soft-drink. Six alcohol targets and 6 soft-drink targets were used.

Primes consisted of 12 homographs, i.e., words for which the written form has more than one meaning. There were 6 alcohol-related and 6 alcohol-unrelated homographs, presented for 300 ms (for an overview and translations, see the Appendix). Directly after the prime, the target word appeared. Participants were instructed to categorize the target word as quickly as possible into the correct category. It was explained that target words were preceded by other words (i.e., primes). Participants were asked to pay attention to these words. However, only the second word (i.e., targets) should be categorized with the two marked response keys. If participants categorized a target word incorrectly or if they did not react at all within 5 s, an error message was presented. Targets and primes were presented 8 times each, and their combination was random. The homograph priming task included 96 trials and an additional 12 practice trials during which

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[1] In order to avoid miscategorization of participants, the present sample includes only alcohol-dependent inpatients whose AUDIT score was 8 or higher and control patients whose score was lower than 8 (Saunders et al., 1993; for similar procedures, see Woud et al., 2013, 2014). Moreover, we included only inpatients who had complete data on the priming task, AUDIT, and BDI. The present sample is a different sample than that of the Woud et al. (2013) priming study.

each target appeared once, preceded by a task-unrelated prime.

## Procedure

All patients underwent the following 3-stage diagnostic process: According to the procedures of the German rehabilitation system, patients who apply for patient treatment are extensively diagnosed by either a specialized practitioner or an addiction counselor. All applicants are then checked for their diagnosis again as well as for their treatment needs by the Medical Section of the German Pension Fund in order to be eligible for patient treatment. Should there be no consensus about the patient's diagnosis, the patient cannot be admitted to the clinic. However, once a patient is admitted to the clinic, the diagnosis is rechecked by a therapist. In the Salus Clinic, this check is based on criteria such as those formulated in the International Statistical Classification of Diseases (ICD-10; WHO, 1992) and includes the administration of the Alcohol Use Disorder Identification Test (AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993) and the Beck Depression Inventory (BDI; Hautzinger, Bailer, Worall, & Keller, 1994). In addition, some participants completed the computerized version of the Composite International Diagnostic Interview (CIDI; Robins et al., 1988). The control patients also underwent an intensive intake assessment. For the present paper, of greatest importance was confirming the control patients' diagnosis and the absence of lifetime alcohol dependence. Hence, all control patients completed the AUDIT and common alcohol markers were taken (e.g., Gamma GT, GPT, GOT, MCV) as part of the routine intake assessment. Furthermore, during the intake assessment interview all patients were explicitly asked for any lifetime diagnoses including alcohol dependence. Patients with any kind of positive result following this screening underwent an extensive clinical assessment interview based on ICD-10 criteria to check for existing alcohol problems.

All diagnoses reported in the paper are taken from the final diagnostic interview that took place in the Salus Clinic, also in cases of discrepant result during the described 3-stage procedure. There were no exclusion criteria. Participants completed the homograph priming task within this first week. This task was part of a larger computerized test battery implemented as a standard diagnostic instrument that participants are required to complete. For all alcohol-dependent inpatients, testing took place at least 1 week after detoxification, making it unlikely that withdrawal symptoms were affecting our results. The study had the necessary IRB approvals.

## Statistical Analysis

Statistical analyses were performed using SPSS version 23 (IBM Corp, USA). In order to compare RTs of conditions that involve the same targets but different primes, difference scores were used. We computed a difference score for each target word category, i. e., one for alcohol targets (RT alcohol-unrelated homograph prime before alcohol target minus RT alcohol-related homograph prime before alcohol target) and one for soft-drink targets (RT alcohol-unrelated homograph prime before soft-drink target minus RT alcohol-related homograph prime before soft-drink target). Next, these two difference scores were combined into one overall priming difference score (difference score alcohol targets minus difference score soft-drink targets). Positive values thus indicate that alcohol-related homographs increased the categorization speed of alcohol stimuli more strongly than that of soft-drink stimuli. A univariate ANOVA was conducted to test our first prediction that alcohol-dependent inpatients would show faster categorization times of alcohol targets when primed with alcohol-related than with alcohol-unrelated homographs. The Priming Difference score was used as dependent variable, Group (AP, CP) and Sex (male, female) were entered as between-subjects factors. To test our second prediction that the priming effect would be associated positively with levels of harmful drinking (i. e., AUDIT scores), we conducted a correlational analysis.

# Results

## Participant Characteristics

The two patients groups differed significantly on the AUDIT and the BDI. Regarding the AUDIT, APs scored significantly higher than CPs, $t(636) = 24.74$, $p < .001$. On the BDI, APs scored significantly lower than CPs, $t(636) = 3.18$, $p = .003$. Furthermore, the two groups differed significantly regarding sex, $\chi^2(1) = 42.49$, $p < .001$, but not regarding age, $t(636) = 1.49$, $p = .136$ (for means and standard deviations, see Table 1).

## Homograph Priming Task

### Analyses Alcohol Priming Effect of Alcohol-Related and Alcohol-Unrelated Homographs

To correct for potential outliers, we computed median RTs of each participant per prime-target combination (minimum RT to be included in aggregation: 150 ms).

**Table 1.** Demographic data, AUDIT, and BDI scores for the two patient groups

|  | N | Sex (m/f) | Age<br>M / SD | AUDIT<br>M / SD | BDI<br>M / SD |
|---|---|---|---|---|---|
| Patient group |  |  |  |  |  |
| Alcohol | 577 | 436/141 | 45.7 (9.2) | 25.6 (7.3) | 14.3 (11.1) |
| Control | 61 | 22/39 | 47.5 (8.3) | 2.4 (1.9) | 19 (9.6) |
| p |  | p < .001 | p = .136 | p < .001 | p = .003 |

*Note:* AUDIT: Alcohol Use Disorder Identification Test; BDI: Beck Depression Inventory.

**Table 2.** Means and standard deviations of the four category scores and the priming difference scores

|  | Alcohol- related homo-graph – alcohol target<br>M<br>(SD) | Alcohol- unrelated homo-graph – alcohol target<br>M<br>(SD) | Alcohol- related homo-graph – soft-drink target<br>M<br>(SD) | Alcohol- unrelated homo-graph – soft-drink target<br>M<br>(SD) | Priming diffe-rence score<br>M<br>(SD) |
|---|---|---|---|---|---|
| Patient group |  |  |  |  |  |
| Alcohol all | 671.79<br>(166.47) | 679.75<br>(167.44) | 724.70<br>(178.13) | 689.96<br>(175.87) | 33.70<br>(62.09) |
| Alcohol female | 668.47<br>(148.30) | 675.55<br>(137.98) | 708.79<br>(154.13) | 682.12<br>(146.85) | 33.75<br>(62.72) |
| Alcohol male | 672.87<br>(172.13) | 681.12<br>(176.11) | 729.89<br>(185.16) | 704.45<br>(184.17) | 33.68<br>(61.96) |
| Control all | 798.72<br>(395.83) | 813.74<br>(415.12) | 831.97<br>(408.83) | 804.44<br>(410.19) | 42.55<br>(96.89) |
| Control female | 827.65<br>(483.50) | 832.62<br>(506.78) | 850.12<br>(499.95) | 822.70<br>(502.29) | 32.39<br>(108.74) |
| Control male | 747.74<br>(146.54) | 780.48<br>(164.42) | 799.98<br>(157.36) | 772.26<br>(153.92) | 60.45<br>(70.33) |

*Note:* To calculate the priming difference score we first computed difference scores for each target word, i.e., one for alcohol targets (RT alcohol-unrelated homograph prime before alcohol target minus RT alcohol-related homograph prime before alcohol target) and one for soft-drink targets (RT alcohol-unrelated homograph prime before soft target minus RT alcohol-related homograph prime before soft-drink target). We then combined these two difference scores into one overall priming difference score (difference score alcohol targets minus difference score soft-drink targets). Here, positive values indicate that alcohol-related homographs primed alcohol more strongly than they primed soft drinks.

Only correct trials were included. Ten participants of the AP group and one participant of the CP group were excluded because their error score during the priming task deviated more than 3 *SD* from their group's mean error, AP mean error = .03 (*SD* = .07), CP mean error = .03 (*SD* = .04). The data were also screened for outlier scores. Participants whose priming difference score deviated more than 3 *SD* from their groups' mean were excluded from the analysis (AP: *n* = 6, CP: *n* = 2). So the final sample for the analysis was *N* = 619, including *n* = 561 for AP (423 males, 138 females) and *n* = 58 for CP (21 males, 37 females). Please note that the unequal numbers of observations per patient group is statistically unproblematic: We analyzed our data with SPSS, which uses Type

III sum of square, which is independent of the sample size, as default for ANOVAs. As such, effect estimates are not a function of the number of observations per group (Shaw & Mitchell-Olds, 1993).

Results of the univariate ANOVA failed to find a main effect of Group, $F(1,615) = 1.76$, $p = .186$, $\eta p^2 = .003$. This indicates that alcohol-dependent inpatients did not show faster categorization times of alcohol targets when primed with alcohol-related than with alcohol-unrelated homographs. Moreover, there was no main effect of Sex, $F(1,615) = 2.13$, $p = .145$, $\eta p^2 = .003$, and no interaction between Group and Sex, $F(1,615) = 2.15$, $p = .143$, $\eta p^2 = .003$.[2]

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[2] When we kept the reaction time outliers in the analysis, the results slightly changed. The main effect of Group was still not significant, $F(1,623) = .1.55$, $p = .213$, $\eta p^2 = .002$, and the main effect of Sex is still significant, $F(1,623) = 6.57$, $p < .02$, $\eta p^2 = .01$. However, analyses then revealed a

### Relationship Between the Alcohol Priming Effect of Alcohol-Related and Alcohol- Unrelated Homographs and AUDIT Scores Across Alcohol-Dependent Inpatients

A regression analysis among participants of the AP group was conducted to test the relationship between the alcohol priming effect and AUDIT scores. AUDIT scores served as outcome, and the Priming Difference Score and Sex were entered as predictors. Results showed a nonsignificant model, $p = .360$ (adjusted $R^2 = .0$). Moreover, the Priming Difference score was not a significant predictor, $B = -.001$, $SE = .005$, $p = .827$ (Gender: $B = -1.01$, $SE = .71$, $p = .158$).

## Internal Consistency of the Homograph Priming Task

In order to examine the internal consistency of the priming task, we calculated mean scores for all targets words (i.e., 6 alcohol targets and 6 soft-drink targets). In combination with the 6 primes, this then yielded 12 scores per target type (i.e., 6 alcohol-related homograph and 6 alcohol-unrelated homograph scores for alcohol targets, and 6 alcohol-related homograph and 6 alcohol-unrelated homograph scores for soft-drink targets). Next, we computed 6 difference scores for each target type. Regarding alcohol targets, we subtracted alcohol-unrelated homograph scores from alcohol-related homograph scores.

Regarding soft-drink targets, the opposite calculation was used, meaning that we subtracted alcohol-related homograph scores from alcohol-unrelated homograph scores. This yielded six difference scores for each target type; these difference scores were entered separately into an analysis of internal consistency. Both analyses revealed low values: alcohol targets Cronbach's $\alpha = .09$; soft-drink targets Cronbach's $\alpha = .13$.

## Discussion

There is consistent evidence for the existence of alcohol-related IBs (Ames & Stacy, 1998; Ames et al., 2005; Krank et al., 2010; Stacy, 1995, 1997; Woud et al., 2012, 2014). However, a response bias might serve as an alternative

explanation. Hence, the present study tested the existence of alcohol-related IBs in an alternative manner and employed an alcohol homograph priming task. We expected to find an enhanced alcohol priming effect and a positive association between the priming effect and levels of hazardous drinking (i.e., AUDIT scores) among alcohol-dependent inpatients.

The results did not confirm our hypotheses. First, alcohol-dependent inpatients failed to show faster categorization times of alcohol targets when primed with alcohol-related than with alcohol-unrelated homographs. Second, the alcohol priming effect was not positively associated with levels of hazardous drinking. The most plausible explanation is low internal consistency. The low reliability observed in the current study is in line with results of an earlier study in a different sample of patients from the same clinic (Woud et al., 2013). However, this finding is generally not surprising, as priming effects indeed can be unreliable (Bosson et al., 2000). Hence, our data nicely aligns with a recent call by Kahneman (2012) to critically retest previous priming results.

There are a number of limitations. First, we did not pilot the alcohol-related homograph primes, implying that we do not know whether they indeed could be considered as reliable and/or valid alcohol-related primes. Second, the priming task was part of a larger computerized test battery, which may have influenced results negatively. Third, we did not examine comorbidity-related issues. If indeed a response bias is responsible for the existence of alcohol-related IBs, this response bias should appear independent of any comorbidity. This is a potential limitation future research should address. Fourth, the control patients showed higher variances in RTs than the alcohol-dependent patients, which may have influenced our results.

Concerning the primary goal of the present study, i.e., the application of a task capable of detecting a genuine alcohol-related IB unconfounded by an alcohol-related response bias, the results may have important implications. Though necessarily only a highly speculative possibility, the present finding could indicate that there is no semantic priming effect of alcohol-related ambiguous cues, and that previous results concerning alcohol-related IBs are indeed due to a response bias. If we compare our results to those of other priming tasks, the study by Hill and Paynter (1992) comes closest to our approach. Results showed that, compared to moderate non-dependent drinkers, alcohol-dependent participants more quickly identified alcohol-related target words when these were preceded by alcohol-related compared

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significant two-way interaction between Group and Sex, $F(1,623) = 7.42$, $p < .01$, $\eta p^2 = .01$). The result pattern did not change regarding regression analysis.

to alcohol-unrelated primes. At least two procedural differences could explain the deviating results: First, Hill and Paynter's priming task involved unambiguous alcohol-related primes; such primes probably have a much stronger semantic effect on the activation of alcohol-related concepts than the ambiguous alcohol-relate primes we used. Second, Hill and Paynter used a lexical decision task to categorize the targets, whereas we used explicit alcohol-related categories, meaning that our categorization task involved explicit rather than implicit alcohol-related processing. Understanding such differences in task characteristics may be crucial in drawing correct inferences on IB in alcohol addiction and in setting out further research.

In conclusion, the present study employed a homograph priming task to test the existence of an alcohol-related IB more thoroughly. However, results showed neither an enhanced priming effect in alcohol-dependent inpatients nor a relationship between the priming effect and levels of harmful drinking. More research is needed to further disentangle the functional properties of alcohol-related priming effects among clinical samples.

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## Conflict of interests

None of the authors have any conflict of interest with respect to the contents of this paper.

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# Appendix

## Overview stimulus material priming task: Original German stimuli and translation / interpretation

| *German alcohol-related ambiguous prime* | |
| --- | --- |
| Runde | Round of people or round of drinks |
| Korn | Grain or liquor |
| Fahne | Flag or breath which smells of alcohol |
| Kater | Male cat or hangover |
| Nüchtern | Fasting or sober |
| Blau | The color blue or drunken |
| *German alcohol-unrelated ambiguous prime* | |
| Faul | Lazy or rotten |
| Kahl | Bald or bare |
| Kiefer | Jaw or pine tree |
| Golf | Car brand or outdoor ball game |
| Fliege | Fly or bow tie |
| Bank | Financial institute or sofa |
| *German alcohol target* | |
| Wein | Wine |
| Whisky | Whiskey |
| Schnaps | Liquor |
| Bier | Beer |
| Rum | Rum |
| Wodka | Vodka |
| *German soft-drink target* | |
| Cola | Coke |
| Orangensaft | Orange juice |
| Pepsi | Pepsi |
| Apfelsaft | Apple juice |
| Fanta | Fanta |
| Wasser | Water |