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Citation for the published paper:
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Memory, Vol. 25 , Iss. 4, 2017

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The Effects of Alcohol Intoxication, Retention Interval, and Repeated Interviewing

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Author Note

This work was supported by FORTE: The Swedish Research Council for Health, Working Life and Welfare (Grant number: 2009-1660, PI: Claudia Fahlke). We thank Bengt O. Eriksson (M.D), research nurse Cecilia Nilsson Wallmark, and research assistants Jana Andersson, Lillieanne Johansson, Lukas Jonsson, Jeanette Lundgren, Anna Mattsson, David Sehm, Johan Bondeson, Anna Larsson, Isabelle Hansson, Emelie Ernberg, Petra Valej, and Ann Witte for practical help with the collection and coding of the data.

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Abstract

Intoxicated eyewitnesses are often discredited by investigators and in court, but few studies have examined how alcohol affects witnesses' memory. The primary aim of the present study was to examine how intoxication (alcohol vs. control), retention interval (immediate vs. one week delay), and number of interviews (one vs. two interviews) affect witnesses' memory. The participants (*N* = 99) were randomly assigned to consume either orange juice or alcohol mixed with orange juice, and they all witnessed a filmed mock crime afterwards. The recall took place either (a) immediately and after a one week delay or (b) after a one week delay only. No main effect of alcohol was found on the quantity or quality of the witnesses' statements. Both intoxicated and sober witnesses recalled more details, and were more accurate, during immediate compared to delayed recall. For witnesses interviewed twice, an average of 30% new details were provided in the second compared to the first interview, and these were highly accurate. In sum, contrary to what one can expect, intoxicated witnesses with a low to moderate blood alcohol concentration (below 0.10%) were reliable witnesses.

Keywords: Alcohol, eyewitness, recall, repeated, reminiscence

Witnesses Stumbling down Memory Lane:

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Intoxicated witnesses are common across a range of crimes; e.g., disorderly conduct, domestic disputes, fights, thefts, physical assault, robbery, and rape and thus intoxicated witnesses are also common in the legal context (Evans, Schreiber Compo, & Russano, 2009; Palmer, Flowe, Takarangi, & Humphries, 2013). Given their frequency, surprisingly little is known about the extent to which alcohol affects witnesses' memory. There are however many studies, hereafter referred to as 'basic research', demonstrating that alcohol can impair memory of simple stimuli (e.g., wordlists, association tasks, and pictures) (e.g., Bisby, Leitz, Morgan & Curran, 2010; Curran & Hildebrandt, 1999; Söderlund, Parker, Schwartz, & Tulving, 2005). The results of this 'basic research' may be one explanation for why law enforcement and jurors tend to believe that statements from intoxicated witnesses are less reliable than statements from sober witnesses (e.g., Evans & Schreiber Compo, 2010; Kassin, Tubb, Hosch, & Memon, 2001). However, only a dozen studies have examined alcohol's effect on witnesses' memory of entire events. Even fewer studies have examined how specific factors related to the interview (e.g., retention interval, number of interviews, question types) may affect intoxicated witnesses' statements (see Hagsand, 2014, for a review). Clearly, research is needed both on system variables (e.g., factors related to interviewing) and estimator variables (e.g., witnesses' intoxication level) (Wells, 1978). Therefore, the present study set out to examine how alcohol, retention interval, and repeated interviewing affect the quantity and quality of witnesses' statements. Specifically, will intoxicated witnesses have a poorer memory compared to sober ones and will the retention interval and number of interviews affect this relationship?

A review of the current memory literature showed that there are three major theories of the cause of forgetting (referred to here as consolidation theory, interference theory, and context theory) (see Kelley, 2014, for a review). The consolidation theory builds on a biological model, and this theory is relevant to how alcohol affects memory. Many physiological studies on both animals and humans show that a process of *consolidation* must occur after a memory is *encoded* for it to be *retrieved* after a delay. Consolidation is a process where memories are strengthened through protein synthesis in immediate synapse consolidation (minutes to hours after encoding) and through a later system consolidation (days, weeks, months, or even years after encoding according to some researchers) (Dudai, 2004). The hippocampus is a brain structure essential to the formation of autobiographical memories (e.g., White et al., 2003). According to consolidation theory, the hippocampus operates in two modes: encoding new information versus replaying old information in the cortex for long-term system consolidation (Dudai, 2014). Drugs, including alcohol, can impair the activity in the hippocampus which can have a negative impact both on the immediate encoding of new memories (e.g., White et al., 2003), and on the consolidation process (Dudai, 2014). How much time is needed for a memory to be completely consolidated is still being debated. However, most researchers agree that memory is vulnerable (e.g., to drugs, new learning, interference, lesions) during the hippocampus-dependent encoding and consolidation process, and that memory becomes more stable once fully consolidated in the neocortex of the brain (e.g., after explicit recall over time or implicit processing during sleep) (Dudai, 2004). Empirical findings show that alcohol may affect all phases of memory (encoding, consolidation, and retrieval), but much research suggests that alcohol primarily affects the encoding and/or consolidation of memories (e.g., Dudai, 2014; Hartzleer & Fromme, 2003; Lee, Roh & Kim, 2009; Mintzer, 2007; Söderlund, Grady, Easdon, & Tulving, 2007; White, 2003). Thus, long-term memory may be impaired by alcohol intoxication. In contrast, some research demonstrates that working memory is relatively spared by the effects of alcohol (e.g., Lee et al., 2009; White, 2003). This suggests that a person may engage quite well in a conversation while intoxicated, but may have problems remembering what the conversation was about the next day (White, 2003). However, other laboratory studies have demonstrated that alcohol can impair both working memory *and* long-term memory (see Mintzer, 2007, for a review). The present study examines how intoxicated witnesses remember events both shortly after witnessing an event, and after a delay.

Although alcohol can have a negative effect on both the encoding and/or consolidation process, it is crucial to note that alcohol does not always cause memory impairment. Several ‘basic research’ studies show that the magnitude of memory impairment increases as blood alcohol concentration (BAC) increases (e.g., Lee et al., 2009; Perry et al., 2006; Whetherill & Fromme, 2011; White, 2003), with low doses (e.g., 0.03%) yielding no or little impairment (e.g., Breitmeier, Seeland-Schulze, Hecker, & Schneider, 2007). However, after approximately two alcoholic drinks (BACs above or around 0.06%), alcohol can affect the encoding and consolidation process, which may result in a *fragmentary blackout* (e.g., Wetherill & Fromme, 2011; White, Signer, Kraus, & Swartzwelder, 2004). Higher BAC levels can result in complete memory loss, also called *en block blackouts*. Earlier evidence suggested that a BAC of around 0.25% was the threshold for complete blackouts to occur, however, newer studies suggest that en bloc blackouts can occur below this threshold if a large amount of alcohol is consumed rapidly (see Perry et al., 2006). It is however important to highlight that the effect of alcohol on memory can be moderated by individual differences (e.g., genetic factors, and tolerance) (Lee et al., 2009). That is, not all individuals who rapidly consume a large amount of alcohol will experience an en bloc blackout or fragmentary blackout. Relatively few applied studies have examined alcohol’s effect on the recall of events, and the majority of these studies have used intoxication levels within the legal driving and drinking limit in Europe and USA (mean BACs ranging between 0.05% and 0.08%). These studies have found no, or very small, effects of alcohol on the accuracy and the quantity of the information recalled (e.g., Crossland, Kneller, & Wilcock, 2016; Flowe, Takarangi, Humphries, & Wright, 2015; Hagsand, Roos af Hjelmsäter, Granhag, Fahlke, & Söderpalm Gordh, 2013; Hildebrand Karlén, Roos af Hjelmsäter, Fahlke, Granhag, & Söderpalm Gordh, 2015; Schreiber Compo, Evans, Carol, Kemp, Villalba, Ham, & Rose, 2011; Schreiber Compo, Evans, Carol, Villalba, Ham, Garcia, & Rose, 2012; La Rooy, Nicol, & Terry, 2013; Yuille & Tollestrup, 1990).

In addition to alcohol's effects on encoding and consolidation of new memories, the retention interval might play a pivotal role in determining alcohol's possible effect on witness memory. It is well-known that memory fades with time, and the classical work by Ebbinghaus (Ebbinghaus 1885/1964) still provides a strong base for modern theories about memory and forgetting (see Kelley, 2014, for a review). The shape of the forgetting curve illustrates an initial rapid loss of information after encoding followed by a longer period of slower forgetting (Kelley, 2014). From an evolutionary perspective, the memory system is a highly adaptive system which has evolved to store large quantities of data. However, it would be too energy demanding for the memory system to have all information items readily accessible. The basic assumption is that humans are adapted to an environment where the probability that an event will recur is highest immediately after it has occurred, hence it is important for new information to be easily accessed (e.g., Anderson & Schooler, 1991). Contrary to evolutionary theories are context theories, which can be considered as cognitive models of memory. According to context theories, context is a very broad category which includes experiences that is extra to the core of the event, such as temporal context (e.g., time), environmental context (e.g., location), and internal context (e.g., mood). The absence of any contextual cue can reduce the probability of retrieving core information about the event (see Kelley, 2014, for a review). According to the encoding specificity principle (Tulving & Thomson, 1973), memory retrieval is cue-driven and access to memories is optimal when the cues at retrieval match those that were encoded at test. Consequently, retrieval of an event may suffer because of missing contextual cues. According to this theoretical standpoint, it is not the passage of time itself that causes the forgetting, but the change in context (Kelley, 2014). With respect to witness interviewing, much research on sober persons has shown that an immediate interview yields more information compared to a delayed interview (e.g., Baddeley, 1991; Hope, Gabbert, Fisher, & Jamieson, 2014), but it is unknown if this holds true for intoxicated witnesses. What makes the issue complex with respect to intoxicated witnesses is that alcohol is a drug that causes both stimulant and sedative effects. Alcohol usually increases the subjective feelings of stimulation (e.g., excited, energized, talkative, and vigorous) during rising BACs, while producing more sedative effects (e.g. concentration problems, slow thoughts, inactive, tired) during falling BACs (Martin, Earleywine, Musty, Perrine, & Swift, 1993). The literature shows a strong association between aggressive behaviour and stimulation, but cognitive impairments, such as memory impairments, have been associated with both the stimulant (ascending BACs) and sedative effects (descending BACs) of alcohol (see Hendler, Ramchandani, Gilman & Hommer, 2013, for a review). This has clear implications in the legal arena; when should law enforcement officers interview intoxicated witnesses? Intoxicated witnesses might be either stimulated, or sedated by the drug during an immediate interview, which might affect their cognitive performance. Hence, it might be preferable to interview intoxicated witnesses after a longer retention interval when they are sober and more able to focus on the task. However, this would be contradictory to the predictions based on the forgetting curve, and empirical studies on sober witnesses that indicate an immediate interview usually is superior to a delayed. The only study examining this issue found that both intoxicated and sober witnesses who recalled immediately reported more information and were more accurate compared to witnesses who recalled after a one week delay (Yuille & Tollestrup, 1990). Given the scarce literature, the present study sets out to examine this matter further.

Another important factor to take into consideration is the number of recall attempts. According to cognitive models of memory such as interference theory, there is competition between different memories in each search of a particular memory because most internal or external cues at recall are associated with a wide network of different memories in the brain (see Kelley, 2014, for a review). For example, the cue “car” might trigger competing memories of a person’s own car, the neighbour’s car, or for example a car belonging to a perpetrator speeding away from a crime scene. The ratio-rule states that the probability of retrieving a particular memory given a specific cue is a function of the strength of that particular memory divided by the sum of the strength of all other memories associated with that cue (Shiffrin, 1970). When a memory is re-activated (e.g., during explicit recall), it strengthens the existing representation to that memory. According to the ratio rule, a stronger memory is more likely to be recalled than a weaker memory (Kelley, 2014). The importance of repetition and recalling memories in order to reduce the likelihood of forgetting is not exclusive to cognitive models of memory, but is also present in biological models such as in the consolidation theory. In consolidation theory retrieving a memory is believed to make the memory trace more stable and less vulnerable to interference (e.g., from new learning or drugs) (Dudai, 2004). However, the relatively new, and debated reconsolidation theory (see Sara, 2000, for a review) proposes that when a memory is retrieved, it must be consolidated again, and then re-enter a stage of vulnerability to factors that could disrupt the consolidation. If this is the case, it means that details of the event could be forgotten and errors could be incorporated in the memory trace, reducing the accuracy of the recollection. In real-world settings, witnesses are often interviewed several times during an investigation (e.g., La Rooy et al., 2013), making it important to examine the effects of repeated interviewing on witness memory. The effects of repeated interviews have been a source of controversy in legal contexts, and empirical studies have highlighted both advantages and disadvantages (e.g., Gilbert & Fisher, 2006; Odinot, Memon, La Rooy, & Miller, 2013). The negative aspects of repeated interviewing include confidence inflation, retrieval induced forgetting, and an increased risk of reporting misinformation. Repeated interviews per se do not have to be problematic, but suggestive repeated interviews may yield inaccurate information (e.g., La Rooy, Katz, Malloy, & Lamb, 2010). An advantage of repeated interviewing is that new information might be recalled in later interviews (i.e. reminiscence). In fact, a large majority of witnesses will exhibit reminiscence at a second recall (Gilbert & Fisher, 2006; Odinot et al., 2013). Critically, people usually report reminiscent details with a high degree of accuracy (e.g., Gilbert & Fisher, 2006; La Rooy et al., 2010). However, investigators, jurors, and judges have been found to be sceptical to the accuracy of reminiscent details (Gilbert & Fisher, 2006; La Rooy et al., 2013). An often used criterion in court to assess the credibility of statements (e.g., in the US and Sweden) is that witnesses should be consistent across accounts (Schelin, 2007; Sixth Circuit Pattern Criminal Jury Instruction Committee, 2014). Inconsistencies (e.g., contradictions and reminiscence) between recall attempts are regarded as indicators of low overall accuracy (Brewer, Potter, Fisher, Bond, & Luszcz, 1999; Krix, Sauerland, Lorei, & Rispens, 2015; Potter & Brewer, 1999). This belief is in direct contrast to findings showing that inconsistency between different recall attempts is not, or only weakly, related to overall accuracy (Odinot et al., 2013; Smeets, Candel, & Merckelbach, 2004). However, it is important to distinguish between two types of inconsistencies; reminiscent and contradictory details. Whereas contradictory details are typically negatively associated with a statements' overall accuracy, reminiscent details are usually not associated with the overall accuracy of the second recall (e.g., Krix et al., 2015). In fact, reminiscent details are usually relatively accurate (Gilbert & Fisher, 2006; Krix et al., 2015; La Rooy et al., 2013).

Only three studies have examined the effects of repeated interviewing on intoxicated witnesses or victims' reports (see Flowe et al., 2015; La Rooy et al., 2013; Yuille & Tollestrup, 1990), and two of these studies (Flowe et al., 2015; La Rooy et al., 2013) have analysed the consistency (e.g., consistent, reminiscent, omitted, and contradictory details) between the two statements. Furthermore, the findings in these three studies are mixed, and the studies did not examine the same dependent variables, which makes comparisons difficult. Yuille and Tollestrup (1990) found that witnesses remembered more information at their second recall attempt (one week after the immediate recall) compared to delayed recall only (without an immediate recall opportunity). Hence, an immediate recall boosted the performance at the delayed recall. Furthermore, La Rooy et al. (2013) found that both sober and intoxicated witnesses exhibited reminiscence. In fact, as many as 20% of the details recalled at the second interview were new details. Also, Flowe et al. (2015) found that both sober and intoxicated witnesses reported accurate reminiscent details at the second recall. Overall, Flowe et al. (2015) found no difference in terms of the quantity of the reports, comparing a 24-hour delayed recall against a 4-month delayed recall. However, they did find that both sober and intoxicated persons were more accurate at the 24-hour recall than after 4 months. The mixed findings in the studies on alcohol and repeated witness interviewing may be explained by their differing methodologies. For example, participants' memory was tested after different retention intervals: immediately after the event while still intoxicated and again while sober (1 or 7 days later) (La Rooy et al., 2013; Yuille & Tollestrup, 1990), or after a short delay when sober, and again after a longer delay (4 months) while sober (Flowe et al., 2015). In Yuille and Tollestrup's study (1990) only half of the participants were tested while still intoxicated, while the other half was tested only in a sober state after a recall delay. Additionally, the studies differed in manipulating and comparing different recall formats. Although Yuille and Tollestrup (1990) used both free and cued recall, unfortunately the differences between the two formats were not analysed. La Rooy et al. (2013) used only written free recall, and Flowe et al. (2015) used a written multiple choice recognition task. Hence, Flowe et al. (2015) and La Rooy et al. (2013) did not use face to face witness interviews. To eliminate potential shortcomings of written or multiple choice recognition tests, the present study used live face to face interviews to mirror real-life police interviews. Furthermore, in order to address the shortcomings of previous work, the present study also analysed the memory outcomes separately for free and cued recall. The motivation behind the separate analyses is that alcohol's effect on memory reports can depend on recall format. If the event is insufficiently encoded, for example among persons suffering from fragmentary blackout, more retrieval cues may be needed for a complete recall. An instruction to freely recall an event does not offer much in terms of retrieval cues. In cued recall on the other hand, cues are provided through the specific questions, which may function as reminders (Lee et al., 2009). Therefore, participants with fragmentary blackouts can benefit from cued recall, at least with respect to the number of details recalled (Hartzler & Fromme, 2003; Lee et al., 2009; White et al., 2004). With respect to witness memory, Schreiber Compo et al. (2012) found no difference between intoxicated, and sober witnesses in the quantity of information reported, regardless of recall format. There was a difference however in the accuracy of information reported. Intoxicated witnesses recalled more incorrect information than sober ones in cued but not in free recall. Taken together, there is little research on the specific effects of different recall formats on intoxicated witnesses' memory for events, thus the present study analysed memory outcomes separately for free and cued recall.

The Present Study

The primary aim was to examine how intoxication (alcohol vs. control), retention interval (immediate vs. delayed), and number of recall attempts (one vs. two interviews) affect witnesses' memory for a complex event involving several people. The present study extends previous research on witnesses' memory as it systematically manipulates several system variables (retention interval and repeated interviewing) and one estimator variable (witnesses' intoxication level), allowing us to address several important theoretical and applied questions. The relatively low intoxication level (BAC below 0.10%) allowed us to examine the pharmacological effects of alcohol under conditions that have previously been found to produce fragmentary blackouts. As the aim of the present study was not to examine psychological (expectancy) effects of alcohol, we did not include a placebo group in the experimental design.

Hypotheses

First, because of the fading of memory over time suggested by the forgetting curve (Ebbinghaus 1885/1964), evolutionary theory (e.g., Anderson & Schooler, 1991), context theories (see Kelley, 2014, for a review), and empirical findings on both sober persons (e.g., Baddeley, 1991) and intoxicated witnesses (Yuille & Tollestrup, 1990) we predicted a main effect of retention interval for both sober and intoxicated witnesses. Specifically, that witnesses interviewed immediately would remember more details than witnesses interviewed after one week (H1). Second, in line with the theoretical frameworks that suggest re-activation of a memory (e.g., during explicit recall) strengthens the memory trace in the brain, and thus facilitates later recall (e.g., Dudai, 2004; Kelley, 2014; but see Sara, 2000), and empirical findings on the benefits of repeated interviewing both among sober (e.g., Odinot et al., 2013; La Rooy et al., 2010) and intoxicated witnesses (e.g., La Rooy et al., 2013), a main effect of the number of interviews was predicted. Specifically, the combined outcome of two recall opportunities were expected to yield more details for both sober and intoxicated witnesses compared to one recall (H2). Third, based on consolidation theory, which suggests that drugs can disturb the consolidation of new information (e.g., Dudai, 2004), and empirical findings that alcohol can have a negative impact on the transfer of information to long-term memory (see White, 2003, for a review), it would seem logical to predict a main effect of alcohol on memory. However, it is crucial to make a more nuanced prediction given the fact that the alcohol dose used in the present study was not high enough to cause complete en block blackouts, and was more likely to produce fragmentary blackouts. Given the reasoning behind context theories, that specific cues can aid retrieval of the original event (see Kelley, 2013), and empirical findings showing that persons suffering from fragmentary blackout can be aided by cued recall (e.g., Lee et al., 2009), an interaction between intoxication level and recall format was expected. Specifically, we predicted that intoxicated witnesses would recall fewer details than sober witnesses in free recall but the same number of details as sober witnesses in cued recall (H3).

Method

Recruitment and Screening of Participants

The method was based on one of our previous studies (see Hagsand et al., 2013). Participants were recruited through advertisements placed at various departments of the University of Gothenburg, Sweden. Psychology students were excluded from participation in the study. The participants (N = 178) were screened for initial eligibility in a telephone interview with the first author. The screening interview lasted 10–15 minutes and information was collected on age, gender, body mass index (BMI), education level, use of medicines or contraceptives, general mood status, amount and frequency of alcohol consumption, smoking, and use of drugs. Participants who indicated poor physical or mental health were excluded (N = 53). The remaining participants (N = 125) were invited to and participated in a physical examination by a physician. On the same occasion, they completed the psychiatric symptom checklist (SCL-90; Derogatis, 1983), and the Alcohol Use Disorder Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Participants were excluded if they had any current medical condition that required medication, any current Axis 1 psychiatric disorder according to the DSM-IV (American Psychiatric Association, 2000) or any history of psychosis, history of drug or alcohol abuse or dependence, lack of fluency in Swedish, night-shift work, reported any currently harmful alcohol drinking habits (total score >10 on AUDIT), had a BMI value <19 or >26, or were pregnant or nursing. Eight participants were excluded based on the outcomes of the medical examination and the self-rating questionnaires. In total, 117 participants were invited to take part in the experiment. The first author answered any questions that the participants had before they signed the formal written consent. The study was approved by the regional Ethical Review Board (diary number: 727-09) in Gothenburg, Sweden.

Procedure

Phase 1. The study took place in a laboratory furnished as a living room, at the Sahlgrenska Academy, University of Gothenburg, Sweden. Participants in the control group consumed only orange juice, while participants in the alcohol group consumed alcohol (vodka, 40%) mixed with orange juice. Once in the laboratory, the participants were correctly informed about which beverage they would consume. Hence, participants in the control group were informed that they would consume only orange juice and participants in the alcohol group were told that they would consume orange juice and alcohol. The doses were adjusted for body weight and gender (0.65 g/kg for females and 0.70 g/kg for males). Dose adjustment with respect to gender was based on research showing that females often achieve higher BAC if consuming the same dose as males (e.g., Mumenthaler, Taylor, O'Hara, & Yesavage, 1999). The alcohol dose administered in the present study was aimed at reaching an average BAC of 0.05- 0.07%, which is both an ethically acceptable level, as well as an ecologically valid intoxication level that may cause fragmentary blackouts. For example, the amount of alcohol served to a man weighing 70 kg was equivalent to approximately four Swedish standard glasses (12 g pure ethanol per glass) of alcohol (e.g., 15 cl of wine x 4, or 4 cl of vodka x 4). The experimenter (the first author) mixed the drinks and monitored the alcohol consumption to ensure a steady ingestion pace over a period of 15 minutes. Research nurses and physicians were available in case of any serious adverse event. No participants had any serious adverse reactions to the alcohol. The objective measurement, breath alcohol concentration (BAC), was measured at various times throughout the experiment: at baseline, and 20, 35, 50 minutes after the start of consumption using the handheld Breathalyzer Alert J5 (Alcohol Countermeasure Systems Corp, 2006). Twenty minutes after start of consumption (5 minutes after the end of consumption), participants were administered 2 cl of water to rinse their mouth before the BAC was measured, since mouth alcohol concentration has been found to be higher than blood alcohol concentration at this point in time (e.g., Holt, Stewart, Adam, & Heading, 1980). Participants were never told about their BAC level. To measure the subjective effects (stimulation and sedation) of alcohol, the Biphasic Alcohol Effects Scale (BAES) (Martin et al., 1993) was administered at the same times as participants' BAC was measured. Studies has confirmed the validity and reliability of the BAES as a measure of alcohol-induced stimulation and sedation (e.g., Earleywine & Erblich, 1996; Rueger, McNamara, & King, 2009).

Five minutes after participants had finished consuming alcohol (20 minutes after the start of beverage consumption), they watched a mock crime video lasting 3 minutes and 50 seconds with a viewing distance of 3 to 4 meters. Participants were instructed not to discuss the film with anyone during the viewing or the retention interval. In the mock crime video (filmed from a witness perspective) a woman is waiting at a bus stop as a car stops at the bus stop and two men get out of the car and walk up to the woman. The woman is handed an identity paper, and then one of the men quickly locks her arms and presses a handkerchief against her mouth. The woman resists but is eventually overpowered. During the fight, the woman drops her purse, and as one of the two men bends down to pick it up, he is approached by the camera (witness). As the man realizes this, he pulls out a gun and points it at the camera. Faced with the gun, the camera backs up into the original position at the bus stop. One of the two perpetrators then gets up and drags the woman, who at this point appears half-unconscious, into the back seat of the car. Finally, the car speeds away. This stimulus material has been used in previous research (e.g., Granhag, 1997; Hagsand et al., 2013).

After witnessing the event (35 minutes after the start of the beverage consumption), participants completed filler tasks (a word and number task) for 15 minutes. The participants who had been randomly assigned to the 1-week delay condition only were sent home by taxi once their BAC reading was <0.05%, and this procedure was ethically approved. The remaining participants (50%), randomized to the repeated interview condition, were then interviewed about the mock crime by a research assistant trained as an interviewer. The mean duration of the interview was 13.74 (*SD* = 4.89) minutes. All interviewers were blind to the experimental conditions and study hypotheses. The interview started with a free recall phase, whereby the participants were asked to report everything they could remember of the criminal event (“Please, I would like you to tell me, as carefully as you can, what happened. All details are important, even the smallest one”). Directly after the free recall phase, a cued recall phase took place for all witnesses. Witnesses were informed that they would be asked additional direct questions, and were instructed to respond to the questions as detailed as possible, even if they had already addressed the question in a previous answer. The cued recall consisted of a series of open-ended questions about the actors, actions, conversations, objects, and locations involved in the criminal event in order to ensure that witnesses reported information concerning all aspects of the incident.

The cued questions were asked to probe for additional information (e.g., “What did the woman look and what did her clothes, face, and hair look like? Did you see any other persons at the bus stop before the car came? What did the car look like? Can you tell me about the person or the persons in the car and what they did to the woman? What did the first man look like and what did his clothes, face, and hair look like? What did the second man look like and what did his clothes, face and hair look like? Were there any other witnesses to the event?”). Previous studies have used similar open-ended cued questions (see Roos af Hjelmsäter, Strömwall & Granhag, 2011; Schreiber Compo et al., 2012). Finally, all witnesses were asked if they had any other information that might be of value to the investigation. After each question, a follow-up question was used to encourage witnesses to report any additional information that could be remembered. After the interview, and when participants reached the safety limit of BAC <0.05%, they were sent home by taxi.

Phase 2. All participants were invited to an interview one week after the first session. This interview was conducted at a different location than the first interview, and with a new interviewer, who also was blind to the witnesses’ conditions and to study hypotheses. Interview 2 followed the same protocol and question formats as interview 1 with the exception that the interviewer started by instructing the participants to report everything again, even if they had already mentioned it during interview 1 (repeated condition only). Across both conditions (repeated and delayed only), interview 2 lasted on average 14.71 minutes (*SD* = 5.52). After completion, the participants received financial compensation (a choice of €40 or three cinema tickets), and were debriefed.

Coding

Amount of Information. The interviews were transcribed and scored by coders blind to the participants’ conditions, and to the study hypotheses. The coding followed a similar scoring system to those used in previous studies (e.g., Hagsand et al., 2013; Roos af Hjelmsäter et al., 2011). To measure the amount of information participants reported, transcripts were broken down into units of information. The following principles were applied: (a) statements about actors and the actions performed were counted as one unit. Thus, the sentence "*A person walked*" would count as one unit; (b) statements about an object were counted as one unit, e.g., "*There was a bag*"; (c) each descriptive detail of the object was counted as a separate unit. For example, the sentence "*The bag was brown and black*" would count as three units. Only information that could be verified was coded, thus subjective opinions (e.g., "*The man looked angry*") were not coded. Information repeated within the same interview was not coded the second time it was mentioned. Non-information (e.g., "*I do not know*") was not coded. Two individuals coded 20% of the interviews. Coding disagreements were addressed in a scoring meeting by revisiting the original set of scoring rules followed by an opportunity to re-score a particular unit independently. As the levels of agreement between the coders were high (81.41%), one individual coded the remaining interviews. The dependent measure was the total amount of information recalled (correct and incorrect details). This was calculated both for the overall recall (free and cued recall together), and for free and cued recall separately.

Accuracy Rate. Each information unit was then coded as either correct or incorrect. Coders used a transcript of the film to verify the accuracy of each unit. Units that could not be defined as either correct or incorrect were excluded from the coding. If the witness first reported something, and subsequently changed his or her statement, only the latest statement was coded as correct or incorrect. Two individuals coded 20% of the interviews, and as the inter-rater agreement rate was high (86.65%), one of the individuals continued to code the remaining interviews. Accuracy rates for each participant were calculated by dividing the number of correct units reported by the number of correct and incorrect details. Accuracy rates were calculated both for the overall recall (free and cued recall together), and for free and cued recall separately.

Consistency Category. A piece of information that was reported in both interviews was coded as a *consistent* detail. Details that were recalled in the first interview but left out from the second interview were coded as *omitted* details. New details mentioned only in the second interview were coded as *reminiscent* details. Details that were mentioned in the first interview but that were changed in the second interview were coded as *contradictory* details. Two individuals coded 20% of the interviews. As the level of agreement between the coders was high (85.07%), one individual coded the remaining interviews. All coders were blind to the participant's conditions and to the hypotheses. The accuracy rate was calculated separately for each consistency category. Since units scored as contradictory details were present in both interviews, the accuracy for contradictory details was calculated by dividing the number of correct contradictory details (at the second recall) by the number of correct and incorrect contradictory details (at the second recall).

Results

Participants' Demographics

Of the 117 participants who were invited to the experiment, 102 chose to take part in the first experiment phase. One person did not attend the second phase one week later, and two participants were excluded from the data analyses because they had watched the criminal event previously during another study. Thus, the final data set included 99 participants. The mean age was 24.76 (*SD* = 4.19) years. The participants were randomly assigned to either the control group (*N* = 48) or the alcohol group (*N* = 51). There were slightly more women (57.60 %) than men (42.40%) in the total sample, but the proportions of women and men did not differ between the control group (58.30% women) and the alcohol group (56.9% women), x^2 (1, *N* = 99) = 0.02, *p* = .882.

Manipulation Checks

Objective and subjective measure of BAC. There was a significant difference between the mean BAC in the control group (*M* = 0.00, *SD* = 0.00), and in the alcohol group (*M* = 0.05, *SD* = 0.02), *t* (50) = -17.90, *p* < .001. The main effect of gender on participants' BACs was not significant, *F* (1, 49) = 0.45, *p* = .507, demonstrating the successful adjustment of the alcohol dose based on gender. As expected, the alcohol group experienced the stimulant effects of alcohol, measured using the BAES, (*M* = 41.33, *SD* = 13.50) to a larger extent than the control group (*M* = 31.10, *SD* = 11.82), *t* (97) = -4.00, *p* < .001. Also, the alcohol group experienced the sedative effects to a higher degree (*M* = 15.98, *SD* = 10.58) than the control group (*M* = 10.40, *SD* = 9.15), *t* (97) = -2.80, *p* = .006.

Between Group Comparison: Immediate vs. Delayed Only Interview

Number of details. A mixed-model ANOVA was conducted with intoxication (alcohol vs. control) and retention interval (immediate vs. delayed) as between-subject factors, recall format (free and cued) as a within-subject factor, and the number of details recalled as the dependent variable[1] (see results in Table 1). No significant main effect of intoxication was found, *F* (1, 94) = 1.50, *p* =.224, η_p^2 = 0.016. There was a significant main effect of retention interval, *F* (1, 94) = 9.37, *p* =.003, η_p^2 = 0.091, such that witnesses in the immediate recall condition reported more details (*M* = 67.07, *SD* = 38.02) than witnesses in the delayed only recall condition (*M* =

[1] To examine if intoxication and retention interval had an effect on the *overall* number of recalled details (free and cued recall together) a univariate ANOVA was also conducted. There was no main effect of intoxication, *F* (1, 95) = 1.22, *p* =.272, η_p^2 = 0.013, but a main effect of retention interval was present, *F* (1, 95) = 8.73, *p* =.004, η_p^2 = 0.084. The number of recalled details was larger in the immediate than in the delayed recall condition. No interaction was found between intoxication and retention interval, *F* (1, 95) = 0.01, *p* =.977, η_p^2 = 0.000.

56.19, *SD* = 31.56), which was in line with our prediction (H1). Furthermore, there was a significant main effect of recall format, F (1, 94) = 76.70, p < .001, η_p^2 = 0.449. Witnesses reported more details in free recall (*M* = 72.37, *SD* = 28.14) than in the cued recall (*M* = 50.36, *SD* = 17.35). As predicted, there was a significant interaction between intoxication and recall format, F (1, 94) = 14.89, p < .001, η_p^2 = 0.14. Simple effects analysis with a Bonferroni correction showed that sober witnesses recalled more details (*M* = 79.58, *SD* = 26.86) than intoxicated witnesses (*M* = 65.44, *SD* = 27.83) during free recall (p = .006), but there was no difference between sober (*M* = 47.56, *SD* = 15.02) and intoxicated witnesses (*M* = 53.04, *SD* = 19.10) during cued recall (p = .112), supporting our prediction (H3).

Accuracy rate. A similar ANOVA as described above examined the effects of intoxication, retention interval, and recall format on witness accuracy[2]. No significant main effect of intoxication were found, F (1, 94) = 2.03, p =.158, η_p^2 = 0.021. There was a significant main effect of retention interval, F (1, 94) = 9.40, p =.003, η_p^2 = 0.091. Witnesses were slightly more accurate when recalling immediately (*M* = .88, *SD* = .05) than after a delay (*M* = .84, *SD* = .05). Furthermore, there was a main effect of recall format on accuracy, F (1, 94) = 183.25, p < .001, η_p^2 = 0.66, such that witnesses were more accurate during free recall (*M* = .92, *SD* = .04) than cued recall (*M* = .80, *SD* = .08). No significant interactions were found[3], all *p*s > .05.

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[2] To examine if intoxication and retention interval had an effect on the *overall* accuracy rate (free and cued recall together) a univariate ANOVA was also conducted, revealing a main effect of intoxication, F (1, 95) = 4.02, p =.048, η_p^2 = 0.041. Intoxicated witnesses were slightly less accurate than the sober ones, but the effect size was small. There was a main effect of retention interval, F (1, 95) = 11.06, p =.001, η_p^2 = 0.104 on accuracy such that witness accuracy was slightly higher in the immediate recall condition than in the delayed recall condition. No interactions were found between intoxication and retention interval, F (1, 95) = 0.01, p =.721, η_p^2 = 0.008.

[3] This study had 70% power to detect a medium effect size (Cohen's f^2: 0.25) in order to find an interaction between intoxication, retention interval, and recall format in our 2 x 2 x 2 mixed measures ANOVA, with the last factor being a repeated measure (G*Power: Faul et al., 2007).

Repeated Interviewing

Number of details per consistency category. A mixed-model ANOVA was conducted with intoxication (control vs. alcohol) as a between-subject factor, and consistency category (consistent, omitted, reminiscent, and contradictory details) as within-subject factors and number of details as the dependent variable. There was no significant main effect of intoxication, F (1, 45) = .32, p =.57, η_p^2 = 0.007, but there was a main effect of consistency category, F (1, 45) = 313.81, p < .001, η_p^2 = 0.875. Post-hoc analyses with Bonferroni tests showed that the number of consistent details (M = 90.47, SD = 33.28) between the two interviews was larger than the number of omitted details (M = 47.15, SD = 17.90), reminiscent details (M = 38.68, SD = 17.94), and contradictory details (M = 6.94, SD = 4.50). No significant interaction effect between intoxication and consistency category was observed, F (1, 45) = 1.02, p =.319, η_p^2 = 0.022. Furthermore, every witness recalled at least 4 reminiscent details during the second interview. Around 30% of the information given in the second recall was new information, see Table 2. This finding suggests that reminiscence occurred for all witnesses and that two recall opportunities was superior to one recall opportunity, supporting our prediction (H2).

Accuracy of the consistency category. A mixed- model ANOVA was conducted with intoxication (alcohol vs. control) as a between-subject factor, consistency category (consistent, omitted, reminiscent, and contradictory details) as a within-subject factor, and accuracy rate as the dependent variable (see Table 2). No significant main effect of intoxication was observed, F (1, 44) = .38, p =.540, η_p^2 = 0.009. A main effect of consistency category was found, F (1, 44) = 5.78, p = .020, η_p^2 = 0.116. Post-hoc analyses with Bonferroni correction showed that the accuracy rate for consistent details (M = .90, SD = .05) was significantly higher than the accuracy of the omitted (M = .82, SD = .07), p < .001, reminiscent (M = .80, SD = .11), p < .001, and contradictory details (M = .70, SD = .23), p < .001. Both omitted, p = .003, and reminiscent details, p = .012, were more accurate than the contradictory details. The accuracy of omitted and reminiscent details did not differ, p = 1.000. No significant interaction between intoxication and consistency category was observed, F (1, 44) = .51, p =.481, η_p^2 = 0.011.

Reminiscence, contradictions, and overall accuracy. A series of correlations with Bonferroni corrections compared the association between reminiscent details and overall accuracy, and contradictory details and overall accuracy. Results revealed that the number of reminiscent details was not related to the overall accuracy of the second recall for the alcohol group, r(24) = - .20, p = .342, nor was it related for the control group, r(23) = -.22, p = .303. However, there was a medium negative correlation between the number of contradictions and the accuracy of the second recall, both for the alcohol group, r(24) = -.57, p = .003, and for the control group, r(23) = -.54, p = .009. When the number of contradictory details increased, the accuracy rate of the second recall decreased.

Discussion

There was no main effect of alcohol on the quantity or quality of the witnesses' statements, which is somewhat unsurprisingly given the low to moderate alcohol dose used in the present study. In line with our predictions, the immediate interview rendered a larger amount of correct details than the delayed only interview, and this was true both for intoxicated and sober witnesses. Also in line our with predictions, two recall opportunities yielded more correct details than only one such opportunity, regardless of intoxication level at the time of encoding. Further, as expected, there was an interaction between intoxication level and recall format with respect to the quantity of details reported. Intoxicated witnesses recalled fewer details than sober witnesses in free recall, but provided the same amount of information as sober witnesses in cued recall.

However, it is important to note that all witnesses recalled more information, with a higher accuracy rate, in free recall compared to cued recall.

Alcohol

The objectively (BAC) and subjectively (BAES) measured manipulation checks indicated that participants experienced effects of alcohol consumption. Still, we did not find a main effect of alcohol on the quantity of details in the reports. This finding is in line with most previous studies on intoxicated witnesses using low to moderate intoxication levels (e.g., Crossland et al., 2016; Flowe et al., 2015; Hagsand et al., 2013; Hildebrand Karlén et al., 2015; La Rooy et al., 2013; Schreiber Compo et al., 2011; Schreiber Compo et al., 2012). In contrast, Yuille and Tollestrup (1990), who used a slightly higher dose, found that alcohol impaired both the quantity and the quality of the witnesses' statements. Nonetheless, the effect size was small. A few recent studies examining the effects of higher intoxication levels on suspect memory for events also lend support to the notion of a dose-response relationship for memory of relatively complex events. That is, the memory-undermining effect of alcohol becomes greater at higher intoxication levels (see Van Oorsouw et al., 2015). Despite this emerging evidence for a dose-response relationship in witness and suspect studies, the issue is likely more complex. For example, no study to date (including the present one) has disentangled whether alcohol has a direct negative effect on the persons' memory, or if (highly) intoxicated participants use a memory regulation technique (i.e., only report the items they are most certain about) in order to compensate for anticipated poor performance.

Alcohol and Retention interval

There is evidence that alcohol via its dualistic effect as a stimulant and sedative drug can cause cognitive impairments in general, and memory impairments specifically, during both ascending and descending BACs (see Hendler et al., 2013, for a review). This in turn could make witnesses unfocused during an initial interview while still intoxicated compared to a delayed interview while they are sober. However, the present study found that both intoxicated and sober witnesses recalled more details and were more accurate when recalling immediately compared to when recalling after a delay only. This outcome is in line Ebbinghaus' classical work on the forgetting curve, (Ebbinghaus 1885/1964), evolutionary theories proposing that humans are programmed to have better access to newly created memories than older memories (e.g., Anderson &Schooler, 1991), as well as context theories stating that it is the context change over time that causes forgetting, not the time itself (see Kelley, 2014, for a review). The result in the present study is also in line with empirical findings on intoxicated witnesses (Yuille & Tollestrup, 1990) and sober persons (e.g., Baddeley, 1991; Hope et al., 2014). A conclusion that can be drawn is that an immediate interview with witnesses who have a low to moderate intoxication level (BAC below 0.10%) is superior to only conducting a one week delayed interview.

Alcohol and Repeated Interviewing

It is proposed by interference theories (see Kelley 2014, for a review) and consolidation theory (see Dudai, 2004, for a review) that activation of a memory (e.g., during explicit recall) strengthens the memory trace. Also, according to the ratio rule, a stronger memory is more likely to be recalled than a weaker memory (Shiffrin, 1970). Given this, we predicted that two recall attempts would be superior, in terms of the overall number unique details recalled, compared to one recall attempt. This prediction was supported by the findings in the present study since the total number of unique details obtained across two recall attempts was larger than for only one recall attempt.

Previous work shows that it is common for sober witnesses to recall reminiscent details at a subsequent recall (e.g., Gilbert & Fisher, 2006). Both sober and intoxicated witnesses in the present study reported approximately 30% new details, similar to what has been reported by La

Rooy et al. (2013), where witnesses who had been intoxicated recalled 20% new details during a second interview, when sober. Recollection of reminiscent details was also found among intoxicated witnesses in the study by Flowe et al. (2015). According to the reconsolidation theory, activation (i.e. during explicit recall) of a memory can make it vulnerable to interference, modifications and errors (Dudai, 2005; Sara, 2000). In an eyewitness context this could mean that both the number of recalled details, as well as the accuracy rate of the statement, are reduced. As the veracity of reminiscent details is often questioned in the legal arena (e.g., Gilbert & Fisher, 2006; Krix et al., 2015; La Rooy et al., 2013), the present study contributes important data relevant to this criticism and extends it to intoxicated witnesses. Here, reminiscent details were correct at a rate of approximately 80% for both sober and intoxicated witnesses. Hence, the new information was quite reliable, however it should be noted that 20% of the reminiscent details were incorrect. We found no correlation between the number of reminiscent details and the overall statement accuracy at time of the second interview. However, there was a negative correlation between the number of contradictory details and the accuracy of the overall statement at the second interview, which is in line with findings from La Rooy et al. (2013). Moreover, consistent details were more accurate (approximately 90%) than reminiscent, omitted, and contradictory details, which is also is in line with previous research (e.g., Krix et al., 2015; La Rooy et al., 2013). Further on, emerging evidence suggest that intoxicated persons, at least if they had a high blood alcohol concentration, have a difficult time detecting discrepancies between misleading information and the original event information, leading them to incorporate erroneous information in their reports (Van Oorsouw et al., 2015). In our view, this might lend some support for the reconsolidation theory. It is important to note that the positive effect of repeated interviewing found in the present study might be due to the fact that no misleading questions were asked.

Alcohol and Recall Format

Our data supported the predicted interaction such that alcohol reduced the number of recalled details in free recall but not in cued recall. This may be due to the fact that alcohol intoxication caused some of the witnesses to experience fragmentary blackouts, which may have rendered free recall more difficult (e.g., Lee et al., 2009; Wetherill & Fromme, 2011). Cued recall, on the other hand, seemed to have assisted participants' retrieval with respect to the number of recalled details, (e.g., Lee et al., 2009). This is in contrast to the findings of Schreiber Compo and colleagues (2012). Furthermore, the present study failed to find accuracy differences between sober and intoxicated witnesses both in the free, and cued recalled conditions. This is again in contrast to the findings of Schreiber Compo et al. (2012), who found that witnesses who were intoxicated during an event were less accurate than sober witnesses in an immediate cued recall. In the present study, both sober and intoxicated witnesses were more accurate in free than in cued recall. These findings are in line with the outcomes of studies on sober witnesses (e.g., Evans & Fisher, 2011) and Koriat and Goldsmith's (1996) notion that because direct questions can have contaminating effects on witness memory, information should first be collected via free recall before moving on to more direct questions. Koriat and Goldsmith also state that the information obtained in free recall should be given more weight, which is a notion that the present study found support for. It is however important to note that recall format was a within-subject factor in the present study. Future research might benefit from manipulating recall format as a between-subjects factor, to examine the importance of within vs. between-subject design in recall format's potential effect on intoxicated witnesses' memory.

Limitations and Future Directions

First, our sample in the present study was narrow and limited to healthy young adults (mostly university students) with a low to medium tolerance for alcohol, and future studies should examine other groups. Second, observing a crime in a laboratory setting is in many respects different from witnessing a real crime. For example, many real crimes cause the eyewitness to experience anxiety and fear (e.g., Chae, 2010). A limitation is that the present study did not measure emotional arousal in relation to the target event.

Third, given the fact that the current study did not employ a placebo group design it is not possible to know whether intoxicated witnesses in the free recall phase reported fewer details compared to sober witnesses due to pharmacological (actual) effects of alcohol, or due to psychological (expectancy) effects of how alcohol would affect their memory. Research has found that alcohol expectancy can have a profound effect on people's social and affective behaviour, but that it tends to have a small (or a null) effect on non-social behaviour such as cognitive functions (e.g., memory) (see Flowe et al., 2015). However, Schreiber Compo et al. (2011) found an expectancy effect of alcohol on witnesses' memory. Therefore, future research would benefit from examining expectancy effects of alcohol on memory using a balanced placebo design as recommended by Hull and Bond (1986), and Marlatt and Rohsenow (1980).

Fourth, we did not control for state-dependent effects. The state of intoxication at the two interviews was same for the sober witnesses (T1: sober, T2: sober), but different for the intoxicated witnesses (T1: intoxicated, T2: sober). According to context theories (see Kelley, 2014), the encoding specificity principle (Tulving & Thomson, 1973), and the more specific framework on state-dependent memory (see White, 2003), cues that are associated with the event at encoding tend to help trigger recall at a later time. Based on this reasoning, it could be argued that witnesses who were intoxicated at the time of the crime may have remembered better if they had also been intoxicated at the time of delayed recall. However, although alcohol may function as a cue, the negative effect at encoding is comparatively more influential (Lee et al., 2009). Also, in the 'basic research' on alcohol and memory, clear evidence of state-dependent learning under the influence of alcohol is lacking (e.g., Duka, Weissenborn, & Dienes, 2001; Lisman, 1974; Weissenborn & Duka, 2000). To our knowledge, there has not been any research on the effects of alcohol on state-dependent learning with respect to memory for events, where cues may play a more crucial role. Therefore, one suggestion for future research is to examine this matter more closely.

Fifth, as with all non-significant effects of alcohol on memory, one has to be cautious when interpreting the findings. For example, finding “no difference” does not prove that alcohol has no effect on memory. Simply put, it might very well be an issue of low power. Although the present study had overall acceptable power for detecting medium effects, one limitation is that it was slightly underpowered to find small effect sizes. It is important to keep in mind that the few effects that have been found regarding alcohol’s effect on witnesses’ memory in other studies have yielded small effect sizes. Therefore, studies with larger samples and increased power would be required to rule out that the current lack of effect is not simply due to low experimental power. It is however important to remember that this study was able to detect an interaction effect (alcohol x recall format), suggesting that overall low power was not a main concern in this study. In applied contexts, moderate to high intoxication levels are of great relevance. As such, future research should investigate specifically the possible effects of moderate to high intoxication levels on witness memory.

A final limitation is that ‘don’t know’ answers were not coded. It would be of interest to include this coding in future studies since it is possible that witnesses who have been intoxicated at encoding would use this type of response more frequently compared to sober witnesses as a memory regulation technique, that is, to compensate for their memory loss and maintain a relatively high accuracy rate (see Flowe et al., 2015). Crossland et al. (2016) found that witnesses on the higher end of the BAC curve reported more “don’t know” answers compared to witnesses on the lower end. Although we did not count the “don’t know” answers, the participants had the opportunity to provide this response. Future studies should examine a broader range of answer categories, including ‘don’t know’ answers.

Final Remarks

The present study is one of the first to examine how a critical estimator variable (intoxication) and several important system variables (retention interval, and number of interviews) affect witnesses’ memory of a complex event. Overall, intoxicated witnesses and sober ones recalled the same number of details and with the same accuracy rate. Furthermore, as with sober witnesses, intoxicated witnesses recalled more information, and were more accurate when interviewed immediately, compared to only after one week. Thus, an immediate interview is recommended, at least with witnesses who have a low to moderate intoxication level. Two recall opportunities were also superior to one recall opportunity with respect to the number of correct details recalled, highlighting a potential way to increase investigative leads in both sober and intoxicated witnesses. Furthermore, with respect to free and cued recall, it is important to note that both sober and intoxicated witnesses were more accurate in free than cued recall, potentially highlighting the risk that specific questions can increase witnesses’ motivation to report details they are relatively uncertain about, leading in turn to a decrease in overall accuracy. The present study give support to that witnesses with a low to moderate intoxication level (BAC below 0.10%) can be as reliable as sober witnesses.

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Table 1

Mean (*SD*) number of recalled details and accuracy rates as a function of intoxication (alcohol vs. control), retention interval (immediate vs. delayed), recall format (free vs. cued recall), and overall recall.

	Control (*N* = 48)			Alcohol (*N* = 51)		
Condition	Overall	Free	Cued	Overall	Free	Cued
Immediate						
Number of details	137.57	92.74	46.13	129.50	74.29	55.13
	(34.43)	(22.35)	(13.63)	(43.30)	(31.62)	(20.45)
Accuracy rate	.89	.92	.83	.89	.93	.82
	(.05)	(.04)	(.08)	(.05)	(.04)	(.07)
Delayed only						
Number of details	116.36	67.48	48.88	108.70	57.27	51.12
	(33.72)	(25.22)	(16.36)	(29.00)	(21.35)	(17.95)
Accuracy rate	.87	.92	.79	.84	.89	.77
	(.05)	(.04)	(.06)	(.07)	(.07)	(.09)

Table 2

Mean (*SD*) number of recalled details and accuracy rate of the consistency category as a function of intoxication (alcohol vs. control) at the second recall.

	Control (*N* = 23)	Alcohol (*N* = 24)
Condition	Overall	Overall
Consistent		
Number of details	94.17	86.92
	(28.08)	(37.86)
Accuracy rate	.89	.91
	(.06)	(.05)
Omitted		
Number of details	48.83	45.54
	(14.68)	(20.71)
Accuracy rate	.85	.79
	(.07)	(.07)
Reminiscent		
Number of details	38.83	38.54
	(19.72)	(16.47)
Accuracy rate	.81	.79
	(.11)	(.11)
Contradictory		
Number of details	6.13	7.71
	(4.90)	(5.07)
Accuracy rate	.70	.70
	(.25)	(.21)