Witnesses’ memory for events and faces under elevated levels of intoxication

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\textbf{ABSTRACT}
Research on alcohol and witness memory has burgeoned over the last decade. However, most studies have tested participants at relatively low breath alcohol concentration (BAC) levels, unrepresentative of those encountered by officers in the field. To examine how higher intoxication levels might impair witness memory for events and faces, the current research tested participants’ ability to recall a mock crime at elevated BAC levels (> .08%). The BAC levels of bar patrons (N = 138) were recorded before witnessing a video-taped mock crime. Participants were then interviewed using free recall and cued questions and shown a six-person target-present or target-absent lineup. Results show that alcohol negatively affected both the quantity and quality of recall. Regardless of question format, alcohol also reduced the percentage of accurate information elicited from witnesses; however, only cued questions increased the percentage of inaccurate information reported. Intoxication had no effect on identification accuracy. These findings suggest that the encoding and storage systems for faces and events may be impacted differently by alcohol. Our results also highlight the importance of including higher BAC levels when examining the effects of alcohol on witness memory.

Keywords: Alcohol; memory; lineups; identifications

Eye-witness information is arguably one of the most powerful pieces of evidence during criminal investigations (Keppell & Milne, 1998). Thus, how eye-witness information is collected and how its quantity and/or quality can be increased has been at the center of memory research for decades (Fisher & Geiselman, 2010; Memon, Meissner, & Fraser, 2010; Wells & Olson, 2003). Over the last decade, researchers have examined the potential vulnerabilities of intoxicated witnesses given that law enforcement officers frequently encounter witnesses and victims under the influence of alcohol (Evans, Schreiber Compo, & Russano, 2009; Mohler-Kuo, Dowdall, Koss, & Wechsler, 2004; Palmer, Flowe, Takarangi, & Humphries, 2013). However, little research has examined the effects of high breath alcohol concentration (BAC) levels on witness memory. The present study examined intoxicated witnesses, including those highly intoxicated (BAC > .08%), to assess the effects of realistic BAC levels on witness memory for a criminal event and facial identification.

Prevalence of intoxicated witnesses

In a 2009 survey of U.S. law enforcement, 73% reported that interacting with intoxicated witnesses/victims was either common or very common (Evans et al., 2009), with 90% having interviewed an intoxicated witness within the past month. These intoxicated individuals comprised an estimated 44% of all witness/victims interviewed, had an estimated average BAC level of .11%, and were either under the influence of alcohol during the crime, during questioning, or on both occasions. Similarly, in an archival study, Palmer et al. (2013) analysed 1307 cases referred to the U.S. prosecutor’s office and found that 13% involved at least one intoxicated witness. Although the authors did not report the witnesses’ BAC levels, most (94%) were questioned about the incident on the same day as the event or the following day. Moreover, alcohol plays a particularly important role in sexual assault cases, in which over 50% of victims report being under the influence of alcohol during the crime (see Abbey, 2002; Davis, Norris, George, Martell, & Heiman, 2006; Mohler-Kuo et al., 2004). In a national sample of college women, 72% reported being under the influence of alcohol during an assault (Mohler-Kuo et al., 2004). An estimated 50–70% of sexual assaults go unreported for a variety of reasons (Abbey, 2002; Rape, Abuse, and Incest National Network, 2016); of interest here is that witnesses and victims in these cases often fail to come forward because they fear their memory and/or credibility will be questioned due to their intoxication (National Institute of Health, 2016).

Despite the prevalence of intoxicated witnesses and victims in criminal situations there are little empirical
data regarding the extent to which memories of a crime may be impaired by alcohol and at which intoxication level such impairments are likely to occur. There are also currently no evidence-based guidelines to assist investigators in eliciting reliable information from this potentially vulnerable witness group (Evans et al., 2009).

Intoxication and memory

Alcohol and basic memory research

Research on alcohol and basic memory processes has largely tested participants’ performance using word lists, word pairs, word associations (e.g., Bisby, Leitz, Morgan, & Curran, 2010; Breitmeier, Seeland-Schulze, Hecker, & Schneider, 2007; Garfinkel, Dienes, & Duka, 2006), pictures (e.g., Brown, Brignell, Dhiman, Curran, & Kamboi, 2010; Ray, Mun, Bukman, Udo, & Bates, 2012), digit spans (e.g., Colflesh & Wiley, 2013; Jarosz, Colflesh, & Wiley, 2012; Moulton et al., 2005) and short text passages (e.g., Brown et al., 2010; Moulton et al., 2005). Participants’ memory for these stimuli has also been tested using a variety of different measures (e.g., recognition, free recall, attention switching, resource allocation) and at different time-points during the experiment (i.e., before, during, and/or after intoxication). While most of these studies suggest that alcohol impairs cognitive functions (e.g., Garfinkel et al., 2006; Söderlund, Parker, Schwartz, & Tulving, 2005), others find no effect of alcohol on memory (Breitmeier et al., 2007; Jarosz et al., 2012). In a few instances, alcohol even facilitates memory, such as when administered after the presentation of to-be-remembered information, also known as retrograde facilitation (e.g., Colflesh & Wiley, 2013; Moulton et al., 2005).

Alcohol and witness memory research

In a 2001 survey of psychological experts, 93% indicated that the current literature on alcohol and “basic” memory was reliable enough to endorse the statement “alcohol intoxication impairs an eyewitness’s later ability to recall persons and events” (Kassin, Tubb, Hosch, & Memon, 2001, p. 4). Although the authors did not specify the exact levels of intoxication, this finding is of particular interest because at the time of the survey the state of the literature on alcohol and witness memory consisted of two published studies, one on eyewitness memory (see Yuille & Tollestrup, 1990) and one on offender memory (see Read, Yuille, & Tollestrup, 1992). Since Kassin et al.’s (2001) survey, an emerging body of empirical work has examined the relationship between alcohol and memory within an eyewitness context, some of which cast doubt on the experts’ opinion of intoxicated witnesses. In these studies participants typically view staged or videotaped crimes after consuming a beverage containing no alcohol, a placebo beverage, or an alcoholic beverage aimed at achieving a mean BAC level of .06–.08% (e.g., Hagsand, Hjelmstäer, Granhag, Fahlke, & Söderpalm Gordh, 2017; Hildebrand Karlén, Roos af Hjelmstäer, Fahlke, Granhag, & Söderpalm Gordh, 2015; Schreiber Compo et al., 2011, 2012). Immediately after viewing the crime or after a delay of one week, participants recall the event via free recall/open-ended questions, cued questions, multiple-choice questions, or a mixture of the three, and/or make a facial identification from a lineup (see Altman, Schreiber Compo, Hagsand, & Evans, 2018; Hagsand, 2014, for reviews).

Findings from these studies consistently show that alcohol has no effect on witnesses’ ability to identify a previously seen face (Flowe, Takarangi, Humphries, & Wright, 2016; Hagsand, Hjelmståer, Granhag, Fahlke, & Söderpalm Gordh, 2013b; Harvey, Kneller, & Campbell, 2013b; Kneller & Harvey, 2015; Yuille & Tollestrup, 1990; but see Dysart, Lindsay, MacDonald, & Wicke, 2002 for an exception). However, studies examining event memory have produced mixed results. While some show that alcohol has no direct effect on event memory (e.g., Hagsand et al., 2017; Harvey et al., 2013a; La Rooy, Nicol, & Terry, 2013) others find that alcohol negatively affects the quantity (e.g., Crossland, Kneller, & Wilcock, 2016; Flowe et al., 2016; Hildebrand Karlén et al., 2015) and/or quality of witness memory (e.g., Flowe et al., 2016; Schreiber Compo et al., 2011, 2012; Yuille & Tollestrup, 1990). That is, only under some conditions do intoxicated witnesses recall less information (quantity) and/or fewer accurate details (quality) than sober or less intoxicated individuals. With respect to quality, significant findings are not consistent as some studies report deficits for only cued recall (Schreiber Compo et al., 2012), central details (Flowe et al., 2016), peripheral details (Schreiber Compo et al., 2011) or in women (Hildebrand Karlén et al., 2015), while others find no deficits on these same groups and/or areas.

Many of these findings have been explained by the Alcohol Myopia Theory (AMT), which posits that alcohol narrows drinker’s perceptual ability and later hinders their capacity to recall information (e.g., Dysart et al., 2002; Harvey, Kneller, & Campbell, 2013a, 2013b). That is, while functioning under limited cognitive resources drinkers may predominantly focus on details they feel are important (central) to the immediate situation while disregarding details they consider less relevant (peripheral). This narrow vision can then lead drinkers to encode and retrieve less information than others in similar situations. This potentially weaker memory also increases the likelihood that intoxicated individuals report less accurate information, especially if exposed to outside information (Loftus, 2005; van Oorsouw, Merckelbach, & Smeets, 2015). Conversely, AMT would suggest null findings in regard to intoxicated witnesses’ memory for faces, as perpetrators of crimes are generally considered and processed as a central detail that intoxicated witnesses would be expected to focus on and later identify at similar rates as sober witnesses (Dysart et al., 2002). While AMT helps explain large portions of the findings in the alcohol-
eyewitness literature it cannot account for all findings, especially the inconsistent findings on event memory. These null/inconsistent findings may be attributable to the variety of methodological differences across studies; another possible explanation for the mixed results and/or lack of differences across intoxication levels is the low to moderate BAC levels tested thus far.

**Intoxication levels**

Most research examining alcohol and witness memory has been conducted in laboratories where ethical restrictions prohibit administering high doses of alcohol to participants, ultimately capping the BAC level at or below .08%. Although some laboratory participants exceed this limit (i.e., reaching a peak BAC level between .10% and .12%) these cases are often too few to analyse as a separate group (e.g., Crossland et al., 2016; Hagsand, Hjelmsäter, Granhag, Fahlke, & Gordh, 2013a, 2017; Hildebrand Karlén et al., 2015). Real-world witnesses however often exceed this .08% limit, reaching average BAC levels of .11% (Evans et al., 2009). Therefore, memory tests at higher BAC levels would not only deepen the theoretical understanding of the complex relationship between alcohol and memory across a broader BAC spectrum but also produce results of greater value to practitioners.

The literature on alcohol-induced blackouts may lend guidance on how higher intoxication levels can affect witness memory. Alcohol-induced blackouts occur in two varieties, en bloc and fragmentary (Lee, Roh, & Kim, 2009; White, 2003). En bloc blackouts occur when the transfer of information between short-term and long-term memory is completely interrupted, causing the drinker to have no recollection of a drinking episode (i.e., complete memory loss). This occurs even when the experience was emotionally distressing (e.g., sexual assault) or the drinker is provided with cues (e.g., told by a friend, saw a video) about the event (White, 2003). Fragmentary blackouts occur when the transfer between short-term and long term memory is weakened, creating partial memory loss. These types of blackouts are more common because they occur at lower BAC levels and precede en bloc blackouts (Lee et al., 2009; White, 2003). A person experiencing this type of memory loss will only have trouble recalling information about selected parts of the drinking episode while still recalling others. Under these latter conditions, memory gaps can often be filled if the drinker is provided cues about the event (White, 2003). However, little is known about the accuracy of recollections after fragmentary blackouts.

Identifying the specific BAC level at which an individual experiences a blackout of either variety is difficult given that they can occur across a broad BAC range and are dependent on a variety of factors (see Perry et al., 2006; White, 2003). However, researchers agree that the probability of experiencing a blackout of either variety is positively correlated with the rapid consumption of large quantities of alcohol, with fragmentary blackouts occurring (rarely) at BAC levels as low as .10% (Perry et al., 2006; White, 2003). It is therefore crucial to test participants at elevated BAC levels to determine how witnesses’ memory might be impaired beyond .08%, including the potential risk for fragmentary and en bloc blackouts.

**Field studies**

Few studies have examined how elevated BAC levels affect memory for criminal situations. Regarding eyewitness memory, two studies recruited participants from bar settings yielding BAC levels as high as .21% (Dysart et al., 2002) and .23% (Crossland et al., 2016). In Dysart et al. (2002), patrons were approached by a female assistant who they were later asked to identify from a target-present or target-absent show-up photo while still intoxicated. In Crossland et al. (2016) participants watched a video-taped crime 20–45 minutes after they had quit drinking. One week later (sober) participants were asked to recall the video via open-ended and recognition questions. In line with the assumption regarding low-moderate BAC levels, both studies found that higher levels of intoxication negatively affected witness memory. In Dysart et al. (2002), highly intoxicated witnesses were more likely to make a false identification than those less intoxicated, but only when the target’s photograph was not present. Crossland et al. (2016) found that highly intoxicated individuals (BAC M = .14%) recalled fewer details and less accurate information than those who were less intoxicated (BAC M = .05%).

Another set of field studies has examined how elevated BAC levels can affect mock perpetrators’ memory. In each of these studies participants were recruited from bar settings, yielding BAC levels as high as .24% (van Oorsouw & Merckelbach, 2012) and .26% (van Oorsouw et al., 2015). In van Oorsouw and Merckelbach (2012) participants watched a video-taped robbery through the perspective of the offender. Three to five days later they were asked to recall the video via free and cued questions. In van Oorsouw et al. (2015), participants were asked to commit a staged-robbery. Immediately after committing this crime and 3–5 days later they were asked to recall the event via free and cued recall questions. Similar to earlier research on witness memory the results of these studies confirmed that alcohol can reduce both the quantity and quality of offenders’ statements, especially those who are highly intoxicated.

Taken together, these field studies suggest that the low to moderate BAC levels tested in the majority of laboratory studies may fall short of capturing the full effect alcohol can have on memory. Thus, testing witness memory at more ecologically valid BAC levels is a crucial next step in understanding how alcohol affects witness memory and disentangling the respective effects of intoxication levels in previous research.
Open vs. cued recall

Research strongly suggests that investigators use open-ended questions, as opposed to cued or closed questions, to elicit more accurate and plentiful information from witnesses (Fisher, 1995; Memon et al., 2010; Redlich & Drizin, 2007; Technical Working Group: Eyewitness Evidence, 1999) as open-ended questions allow witnesses to determine their own reporting threshold (Fisher, 1995). Cued or closed questions can prompt witnesses to respond even when they are not certain of the correct answer, potentially inviting them to report below the reporting threshold and guess or provide inaccurate information (Fisher, 1995; Fisher & Geiselman, 2010). Cued questions can also deplete witnesses’ cognitive resources faster by giving them multiple tasks to attend to (e.g., listen to the question, find the specific piece of information, prepare for the next question), rendering it more difficult to locate information in memory (Fisher, 1995). Based on these findings, evidence-based guidelines recommend open-ended interviewing styles (Fisher & Geiselman, 2010; Technical Working Group: Eyewitness Evidence, 1999), especially when interviewing vulnerable witness populations (e.g., elderly, children) who are prone to incorporating suggested information into their statements (see Benia, Hauck-Filho, Dillenburg, & Stein, 2015; Lamb, Orbach, Hershkowitz, Esplin, & Horowitz, 2007). According to AMT, intoxicated individuals may be less able to attend to peripheral aspects of a situation. This impairment not only affects the quantity and quality of intoxicated individuals recall but also renders them more vulnerable to incorporating false or suggested information into their accounts (Dysart et al., 2002; Schreiber Compo et al., 2011; van Oorsouw et al., 2015). Therefore, the widely recommended approach of asking open-ended questions to reduce this vulnerability may be of even greater importance when interviewing intoxicated witnesses.

To date, a handful of studies have examined how question format affects intoxicated individuals, three of which focused on eyewitness memory (Crossland et al., 2016; Hagsand et al., 2017; Schreiber Compo et al., 2012) and two that focused on mock perpetrator memory (van Oorsouw & Merckelbach, 2012; van Oorsouw et al., 2015). Consistent with previous research on interviewing vulnerable populations, Schreiber Compo et al. (2012) found an advantage of open-ended questions such that intoxicated participants who were interviewed using cued questions (as opposed to open-ended questions) reported more incorrect answers compared to placebo and sober witnesses. Similarly, van Oorsouw and Merckelbach (2012) showed that alcohol reduced the quantity/completeness of offenders’ statements regardless of question type; however, recall quality was only diminished when intoxicated individuals responded to cued questions. Also, van Oorsouw et al. (2015) found that regardless of question type alcohol reduced the number of correct items and increased the number of inaccurate items reported. Interspersed within the cued questions however were also pieces of misleading information, which intoxicated individuals were more likely to incorporate than those who were less intoxicated. On the other hand, Crossland et al. (2016) and Hagsand et al. (2017) found that intoxicated witnesses provided fewer details than sober or mildly intoxicated individuals when asked free recall questions. No differences were found in response to cued questions.

Taken together, despite a plethora of research suggesting that open-ended questions are advantageous when eliciting accurate information from witnesses, research examining the effects of question format on intoxicated witnesses and offenders yields mixed results. To increase our understanding of the importance of question format and intoxication levels in eliciting both accurate and plentiful information, the present study examined witnesses’ responses to open-ended and cued questions across a broad BAC spectrum.

Lineup identifications

In line with the AMT, the majority of studies examining the relationship between alcohol and identification accuracy find no effect of alcohol on identification performance (Flowe et al., 2017; Hagsand et al., 2013b; Harvey, Kneller, & Campbell, 2013b). Coincidentally, the only study in the eyewitness literature to find an effect of alcohol on identification performance was Dysart et al. (2002) who examined witnesses at higher BAC levels. While this suggests that alcohol-induced deficits in facial memory may not be noticeable until elevated BAC levels are reached, methodological differences between Dysart et al. (2002) and other alcohol-eyewitness identification studies may also be a factor. One notable methodological difference is that Dysart et al. (2002) employed a show-up procedure whereas the other studies used a simultaneous lineup identification procedure.

The showup procedure has been frequently criticized by researchers because it reduces and/or eliminates safeguards meant to ensure witnesses are not unjustly persuaded into choosing the suspect (see e.g., Dysart & Lindsay, 2007; Sjöberg, 2016; Steblay, Dysart, Fulero, & Lindsay, 2003; Wells, 2001). Mainly, it has been criticized for its omission of fillers which are meant to “hide” the suspect and provide a better test of the witnesses’ memory. The procedure is therefore thought to be inherently suggestive, especially towards innocent suspects who closely resemble the perpetrator (Steblay et al., 2003). As such, researchers highly recommend using a lineup. This recommendation is especially important when the target is absent, because failing to provide a witness with alternative options increases the likelihood of a false identification (Dysart & Lindsay, 2007; Sjöberg, 2016; Steblay et al., 2003; Wells, 2001).

Given the suggestiveness of the showup, Dysart et al.’s (2002) findings could be a function of the identification
procedure (i.e., the showup) rather than the effects of elevated intoxication levels. The present study therefore examined how elevated intoxication levels affect decisions from lineups which have produced consistent null findings in the alcohol and eyewitness literature thus far. However, to maximize any possible effects alcohol may have on witnesses’ lineup decisions and make the lineup more comparable to a show-up procedure, some of the safeguards recommended as lineup instructions (i.e., the cautionary instruction) were removed. These biased instruction have been shown to increase choosing and false identification rates in target-absent situations as compared to using unbiased instructions (Malpass & Devine, 1981; Wells & Quigley-McBride, 2016), yet, intoxicated witnesses should not be more vulnerable given the innocent suspect is “hidden” among fillers that siphon away would-be false identifications (Wetmore, McAdoo, Gronlund, & Neuschatz, 2017). Thus, if alcohol has no effect on identification rates in the present study, even under suboptimal conditions such as biased lineup instructions, it will lend support to the assumption that the show-up procedure employed by Dysart et al. (2002) could be the driving force behind the significant finding. The use of biased instructions is also not uncommon in real-world investigative practices, which do not consistently reflect evidence-based recommendations (Garrett, 2011; Zimmerman, Austin, & Kovera, 2012).

The present study

The overarching goal of this research was to extend the body of work on intoxicated witness memory for events and faces to higher BAC levels in a field setting. The primary aim was to examine event memory across a broad BAC spectrum immediately after witnessing a mock crime. The secondary aim of the study was to collect data on alcohol’s effect on identification performance from target-absent and target lineups. This was a subsidiary aim because intoxicated witnesses are unlikely to be presented with a lineup immediately following a crime (i.e., while in the same intoxication state) given the time it takes to create a lineup (Agricola, 2009; Cicchini & Easton, 2010).

It was expected that alcohol would have a main effect on memory quantity and quality. Specifically, as BAC levels increase witnesses are expected to provide less information and less accurate information. This effect should be more prominent in regard to information quantity rather than quality. That is, deficits in quantity should be consistent across the BAC spectrum as alcohol limits the attention participants can devote towards objects in the environment. Deficits in recall quality are expected to be driven by impairments at the upper end of the BAC spectrum as participants are more likely to experience the symptoms associated with alcohol-induced blackouts. Witnesses at the low-mid range of the BAC spectrum are expected to vary little in terms of recall quality. This research further examined the importance of question format across a broad BAC spectrum. It was expected that higher BAC levels would lead to less accurate and more inaccurate witness information in cued recall given that intoxicated individuals should have lower reporting thresholds. Finally, as the first study to examine the effects of high intoxication levels on witnesses’ identification performance from target-present and target-absent lineups, previous research (Dysart et al., 2002; Flowe et al., 2017; Hagsand et al., 2013b) formed the basis for two predictions: First, in line with AMT no effect of alcohol was expected in target present lineup identifications. In line with Dysart et al. (2002), alcohol was expected to negatively affect identification accuracy from target-absent lineups, especially given the absence of cautionary instructions.

Method

Participants

Participants were recruited from a local bar in a metropolitan area of the Southeastern United States. On testing nights, patrons were asked to participate in a short research experiment examining the effects of alcohol on behavior. In exchange for their time, participants were promised a 10% discount on their food and drink tab. Approval from the university ethics committee (IRB) was obtained before any data were collected. A total of 138 participants agreed to take part in the study (54.2% male; 45.8% female). Participants were between the ages of 19 and 60 (M = 27.67, SD = 7.91). Most participants identified themselves as Hispanic (53.5%) or Caucasian (37.2%). The remaining 10% of the sample was comprised of African Americans (1.6%), Asians (1.6%), Native Americans (8%), and those who reported other (5.4%). Participants’ BAC levels ranged from .00-.29% (M = .08%, SD = .06).

Materials and procedure

Individuals willing to participate were accompanied, one at a time, to a secluded area of the bar (testing room) in which another researcher was waiting to conduct the other aspects of the study. This secluded room was separated from the main bar area by a curtain which muffled sounds. This curtain also prevented participants from viewing the bar area so their focus was on the stimulus materials. Inside the testing room participants provided verbal and written consent before having their baseline BAC measured using a BACtrack S80 Pro Breathalyzer: Professional Edition (KHN Solutions, 2016). This handheld breathalyzer is similar to others that have been used to accurately measure individuals BAC levels in field (e.g., Dysart et al., 2002; Morewedige, Krishnamurti, & Ariely, 2014) as well as in laboratory experiments (e.g, Hagsand et al., 2013a, 2013b, 2017). The two breathalyzers used in the present research were pilot tested against a calibrated benchtop model Intoxilyzer 5000 housed at Florida International University. Other than a blood sample, benchtop
testing devices that can be calibrated are considered the most accurate tool available for measuring an individual’s BAC level (Department of Transportation, 2012). Across 39 trials, the handheld breathalysers produced the same reading as the benchtop Intoxilyzer 30 times (77%). The other nine BAC readings were off by less than .02%. Based on these results it was determined that the BACtrack S80 Pro Breathalyzer Professional Edition was a valid tool to assess participants’ BAC levels.

Following their baseline BAC reading, participants provided a subjective rating of their intoxication level on a 0 (sober) to 100 (extremely) scale (Crossland et al., 2016; Flowe et al., 2016). Next, participants watched a 2-minute video depicting a staged convenience store robbery displayed on a 13” × 8” laptop. In the video a male and female customer walked past a young female attendant inside the convenience store. While the male proceeded to the back of the store and looked for items the female, who was also carrying a dog, purchased a drink and left. As she walked out, a man with a black hooded sweatshirt entered and looked around. The hooded man then proceeded to the front of the store, pulled out a weapon, demanded and received cash from the clerk, and fled from the scene. While watching the video, participants used headphones to protect against the background noise in the bar and to ensure the interaction between the perpetrator and store clerk could be heard clearly. After watching the video participants were asked if everything played correctly (e.g., no skips, pauses, etc.) and if they could hear the video in its entirety. No problems reportedly occurred with the administration of the video.

Following the video participants provided a second BAC and subjective intoxication measure. They were then asked to recall the event they witnessed and identify the perpetrator from a photo lineup. The administration of the interview and lineup was counterbalanced to control for verbal overshadowing effects (Meissner & Brigham, 2001). That is, half the participants were interviewed first followed by the lineup task while the other half were randomly assigned to view a lineup first followed by the interview.

Participant interviews were audio recorded using the Cyberlink software program via the same computer used to display the video theft (2016). During the interview participants were asked to put headphones around their neck so the attached microphone could record their answers and ensure the best audio quality. The interviewer then proceeded to ask the witness 11 questions about the video theft. The initial free recall portion of the interview consisted of two open-ended questions: (1) In as much detail possible tell me everything you can remember about the event you just witnessed, and (2) Is there anything else you remember about the event? Next, the cued recall section of the interview consisted of nine specific questions (e.g., What was the perpetrator wearing? What do you remember about the location of the crime?). These questions were asked in a neutral tone so that the administrator’s emotions or rapport did not affect participants’ recall. Once participants exhausted their recall the recording was stopped.

Either before or after the interview, participants were shown a target-present or target-absent six-person simultaneous lineup administered on the same computer screen used to display the event and record the interview. These lineups were extensively pilot tested to ensure fairness. Fillers for the target-present lineup were selected by research assistants using a matched-description method (Malpass, Tredoux, & McQuiston-Surrett, 2007). This lineup was presented to independent raters (N = 36) and 30% identified the perpetrator. With chance expectation at 16.7%, this difference was not significant when compared to choosing rates of other fillers in the lineup, E’ = 4.84, 95% CI [3.89; 6.38]. To create the target-absent lineup, the filler with the highest similarity rating in the target-present lineup was used as the perpetrator replacement (i.e., innocent suspect). This lineup was similarly pilot tested with new independent raters (N = 35). The “innocent suspect” was identified by 28% of participants suggesting that, relative to the other fillers, he looked most like the perpetrator. This difference was not significant when compared to choosing rates of other fillers in the lineup, E’ = 4.52, 95% CI [3.61;6.05]. Presentation of the lineup photos was counterbalanced such that both the perpetrator and innocent suspect were presented in each of the six possible positions an equal number of times. Before viewing the lineup participants were told: “In a moment, I am going to show you photos of six men. Keep in mind that things like hairstyles, beards, and mustaches can be easily changed and that complexion colours may look slightly different in photographs. When you finish looking at the photospread, tell me which of the men is the one you saw in the video you watched. I will then ask you on a scale of 0–100 (0 = not at all; 100 = extremely) how confident you are in your decision”. After selecting an individual, all participants rated how confident they were in their selection on a 0–100-point scale.

Finally, participants answered questions about their drinking habits (e.g., how many drinking occasions they have per month, how many drinks they consume on a typical drinking occasion, how many drinks they consumed on the night of the experiment, how long they had been drinking on the night of the experiment). Demographic information was also collected, participants were debriefed, provided with a coupon for a 10% discount off their bar tab (as approved by the institution review board), and dismissed. During debriefing participants were repeatedly asked not to discuss the experiment with anyone else.

**Scoring**

**Memory for the event**

Each witness interview was transcribed and broken down into units of information. A unit was defined as a piece of
information that could help solve a crime and could be scored for accuracy. For example, if a participant reported that “There was a girl behind the counter wearing a sweater” it would be broken down into three units (1: there was a girl, 2: behind the counter, 3: wearing a sweater). Consequently, participants with longer and more detailed responses had more scorable units than participants with shorter and less detailed responses. Each unit was then classified as accurate (accurately described information from the video), inaccurate (inaccurately fabricated or modified information from the video), I don’t know (IDK; participant said some variation of the phrase “I don’t know”), or a subjective interpretation (information that could not be scored for accuracy; e.g., “the man made me feel angry”) by two independent scorers using a detailed set of scoring rules. Each scorer independently scored each unit of the first 20 transcripts. Discrepancies in scoring patterns were then resolved by discussion amongst the scorers and the two first authors. Each rater then continued to score the remaining transcripts independently. Inter-class correlations for accurate (.98), inaccurate (.91), IDK (.83) and subjective (.93) responses were high between the two scorers. Participants’ data for some measures were excluded due to technical and/or procedural errors (e.g., inaudible files, failure to follow procedure). This affected some of the identification data (N = 5) and recall data (N = 15). Thus, the sample sizes differ across each analysis.

**Memory for faces**

Participants’ memory for faces was coded in several ways to allow for the examination of different research questions. Participants’ responses were coded dichotomously so the data could be analysed using logistic regressions. Logistic regressions allowed for a well-powered simultaneous examination of both the continuous (i.e., BAC level) and categorical (i.e., target presence) variables in the study (e.g., Flowe et al., 2017; Molinaro, Arndorfer, & Charman, 2013) and has been shown to be an effective method of analysing binomial data in the eyewitness literature (Molinaro et al., 2013; Dysart et al., 2002; Wright & McDaid, 1996).

**Choosing behaviour**

To examine choosing behaviour participants’ responses were divided into choosers (i.e., they positively identified a photo) and non-choosers (i.e., they did not make an identification).

**Accuracy**

To examine accuracy participants’ responses were classified based on the target’s presence. That is, participants in the target-present condition who identified the perpetrator were labeled as accurate. Participants in the target-absent condition who rejected the photos were also labeled as accurate. All other responses in each condition were labelled as inaccurate.

**False identifications**

Although participants in the target-absent condition may not have correctly rejected the photos this does not inevitably mean they falsely identified the a priori innocent suspect. To examine whether the fillers in the target-absent condition siphoned away would-be false identifications (Wells & Quigley-McBride, 2016; Wetmore et al., 2017) and whether alcohol affected this relationship, participants’ identifications of the innocent suspect’s photo were labeled as false identifications. All other responses were labeled as non-false identifications.

**Results**

**Objective and subjective intoxication measures**

Point-biserial correlations were used to examine the relationship between participants’ first BAC measurement and their responses to questions on the drinking history questionnaire. Participants’ first BAC measures were significantly correlated with their second BAC measure (r = .98, p < .01), their first subjective BAC measure (r = .60, p < .01), their second subjective BAC measure (r = .57, p < .01), their reported number of drinking occasions per week (r = .32, p < .01), their reported time spent drinking on the night of the experiment (r = .40, p < .01), and their reported number of drinks consumed on the night of the experiment (r = .54, p < .01). These results suggest that participants perceived alcohol consumption (in general and on the night of the experiment) corresponded with their actual intoxication as measured by their BAC. Participants’ age (r = .17, p = .06), gender, (r = −.12, p = .17), and reported number of drinks per drinking occasion (r = .09, p = .31) were not significantly correlated with their first BAC measurement (see Table 1). Given the high correlation between participants’ first and second BAC measure (r = .98, p < .01), all additional analyses involving BAC were conducted using the first BAC measure.

**Memory for the event**

The effects of alcohol on event memory were analysed using a series of linear regressions. For each regression participants’ BAC level served as the predictor variable. The quantity (number of units reported) or quality (percentage of accurate, inaccurate, or IDK responses) of information provided during the investigative interviews served as the outcome variables.

To fully examine how alcohol affected participants’ quantity and quality measures, three regressions were used for each variable (i.e., quantity, percentage of accurate information, percentage of inaccurate information, and
Table 1. Correlations between participants’ drinking measurements (subjective and objective) and their responses to questions on the Drinking History Questionnaire.

<table>
<thead>
<tr>
<th></th>
<th>1st BAC</th>
<th>2nd BAC</th>
<th>1st Subj. BAC</th>
<th>2nd Subj. BAC</th>
<th>Weekly drinking occ.</th>
<th>Drinks per occ.</th>
<th>Drinking time (exp. night)</th>
<th>Total drinks (exp. night)</th>
<th>Age</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st BAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd BAC</td>
<td>.98**</td>
<td>.59**</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Subj. BAC</td>
<td>.60**</td>
<td>.57**</td>
<td>.91**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2nd Subj. BAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly drinking occ.</td>
<td>.32**</td>
<td>.28**</td>
<td>.08</td>
<td>.01</td>
<td></td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinks per occ.</td>
<td>.09</td>
<td>.12</td>
<td>.01</td>
<td>.03</td>
<td></td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking time (exp. night)</td>
<td>.40**</td>
<td>.42**</td>
<td>.28**</td>
<td>.28**</td>
<td></td>
<td>.19</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total drinks (exp. night)</td>
<td>.54**</td>
<td>.57**</td>
<td>.47**</td>
<td>.43**</td>
<td></td>
<td>.24**</td>
<td>.12</td>
<td>.67**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.17</td>
<td>.08</td>
<td>.01</td>
<td>.01</td>
<td></td>
<td>.22</td>
<td>.08</td>
<td>.18**</td>
<td>.09</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>.20*</td>
<td>.20*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

percentage of IDK information). First, a linear regression was used to examine whether participants’ BAC levels predicted the quantity or quality of information reported by participants collapsed across question format. A second linear regression was used to examine whether participants’ BAC levels predicted the quantity or quality of information reported in response to open-ended questions. Finally, a third linear regression examined whether participants’ BAC levels predicted the quantity or quality of information reported in response to cued questions.

**Quantity**

A linear regression revealed that participants’ BAC levels accounted for a significant amount of the overall variance in recall quantity when collapsed across question format, \( F(1, 117) = 14.49, p < .01, R^2 = .11, \beta = -.33 \). As participants’ BAC levels increased the number of units provided decreased. Participants’ BAC levels also significantly predicted the amount of information reported when responses to open-ended questions acted as the outcome variable, \( F(1, 117) = 13.93, p < .01, R^2 = .11, \beta = -.33 \), and when responses to cued questions acted as the outcome variable \( F(1, 117) = 8.31, p < .01, R^2 = .07, \beta = -.26 \) (see Figure 1). In each case, the amount of information reported decreased as BAC levels increased.

**Quality**

To assess memory quality, the percentage of accurate, inaccurate, and IDK units reported by each participant was calculated by dividing the number of accurate, inaccurate, and IDK units reported by the total number of scorables units provided by that participant (i.e., accurate units + inaccurate units + IDK units). This calculation excludes subjective information provided by each participant.

**Accuracy.** A linear regression revealed that participants’ BAC levels accounted for a significant portion of the variance in the percentage of accurate information reported when collapsed across question format, \( F(1, 117) = 28.74, p < .01, R^2 = .20, \beta = -.44 \). As participants’ BAC levels increased the percentage of accurate information reported decreased. Participants’ BAC levels also significantly predicted the percentage of accurate information reported when responses to open-ended questions acted as the outcome variable, \( F(1, 116) = 8.47, p < .01, R^2 = .07, \beta = -.26 \), and when responses to cued questions as the outcome variable \( F(1, 117) = 24.65, p < .01, R^2 = .17, \beta = -.42 \) (see Figure 2). In each case, as BAC levels increased the amount of accurate information reported decreased.

**Inaccuracies.** A linear regression revealed that participants’ BAC levels accounted for a significant portion of the variance in the percentage of inaccurate information reported when collapsed across question format, \( F(1, 117) = 15.89, p < .01, R^2 = .12, \beta = .35 \). As participants’ BAC levels increased so did the percentage of inaccurate information reported. Participants’ BAC levels also significantly predicted the percentage of inaccurate information reported when responses to cued questions acted as the outcome variable, \( F(1, 117) = 16.97, p < .01, R^2 = .13, \beta = .36 \). In this case the percentage of inaccurate information reported increased as BAC levels increased. Participants’ BAC levels did not significantly predict the percentage of inaccurate information reported when responses to open-ended questions was the outcome variable, \( F(1, 116) = 1.83, p = .18, R^2 = .02, \beta = .13 \) (see Figure 3).

![Figure 1](image1.png)

**Figure 1.** Relationship between participants’ BAC levels and the number of units provided in response to open-ended and cued questions.
I don’t know (IDK) responses. A linear regression revealed that participants’ BAC levels accounted for a significant portion of the variance in the percentage of IDK responses reported when collapsed across question format, $F(1, 117) = 14.19, p < .01, R^2 = .11, \beta = .33$. As participants’ BAC levels increased so did the percentage of IDK responses provided. Participants’ BAC levels also significantly predicted the percentage of IDK information reported when responses to open-ended questions was the outcome variable, $F(1, 116) = 12.91, p < .01, R^2 = .10, \beta = .32$, and when responses to cued questions was the outcome variable, $F(1, 117) = 16.97, p < .01, R^2 = .13, \beta = .36$. In each case, as BAC levels increased the percentage of IDK information increased.

Memory for faces
A first set of analyses examined whether lineup choices and identification accuracy varied as a function of the timing of the lineup presentation (before or after the witness interview). Chi-square analyses revealed no differences in choosing behaviour before or after the interview for those who viewed a target present, $\chi^2(1) = 2.26, p = .13$, or target absent lineup, $\chi^2(1) = .10, p = .76$. Analyses also revealed no differences in identification accuracy before or after the interview for those who viewed a target present, $\chi^2(1) = 0.80, p = .37$, or target absent lineup, $\chi^2(1) = .13, p = .72$.

Choosing behaviour. In the target-present condition 79.45% of witnesses made an identification (see Table 2). In the target-absent condition 85.71% of witnesses made an identification. A logistic regression was used to examine whether participants BAC level, target presence, and the interaction between the two predictors affected witnesses’ decision to make an identification (outcome). The model did not classify witnesses’ choosing behaviour better than a model with no predictors, $\chi^2(3) = 1.30, p = .73$, Nagelkerke $R^2 = .02$. Witnesses in both lineup conditions were likely to make an identification ($p = .33$) regardless of BAC level ($p = .83$). The interaction between lineup condition and BAC level did not significantly increase classifications of witnesses choosing behaviour ($p = .66$).

Accuracy. In the target-present condition 63.00% (N = 46) of witnesses correctly identified the perpetrator (see Table 2). In the target-absent condition 14.30% (N = 9) of witnesses correctly rejected the lineup. A logistic regression was conducted to investigate whether BAC level, target presence, or the interaction between the two predictors helped classify accurate responses (outcome). This model correctly classified 73.10% of cases, significantly more than a model with no predictors, $\chi^2(3) = 36.48, p < .01$, Nagelkerke $R^2 = .32$. Target-presence was the only significant predictor in the model, $\beta = -1.89, SE = .71$, Wald (1) = 7.00, $p < .01$, Exp ($B$) = .15. Participants in the target-present condition were more accurate (i.e., correctly identified the perpetrator) than those in the target-absent condition (i.e., correctly rejected the photos). Participants’ BAC level ($p = .13$) and the interaction between BAC level and target-presence ($p = .42$) were not significant predictors of accuracy.

False identifications. In the target-absent condition 27.00% of witnesses falsely identified the a priori innocent suspect. A logistic regression was run to examine whether BAC level (predictor) helped classify false identifications

Table 2. Participants’ identification decisions across both lineup conditions.

<table>
<thead>
<tr>
<th>Lineup type</th>
<th>Target-present</th>
<th>Target-absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choosing behavior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Made identification</td>
<td>58 (79.45)</td>
<td>54 (85.71)</td>
</tr>
<tr>
<td>No identification</td>
<td>15 (20.54)</td>
<td>9 (14.28)</td>
</tr>
<tr>
<td>ID accuracy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perpetrator IDs</td>
<td>46 (63.00)</td>
<td></td>
</tr>
<tr>
<td>False IDs</td>
<td>17 (27.00)</td>
<td></td>
</tr>
<tr>
<td>Filler IDs</td>
<td>12 (16.40)</td>
<td>37 (58.70)</td>
</tr>
<tr>
<td>Lineup rejections</td>
<td>15 (20.50)</td>
<td>9 (14.30)</td>
</tr>
</tbody>
</table>

Figure 2. Relationship between participants’ BAC levels and the percentage of accurate units provided in response to open-ended and cued questions.

Figure 3. Relationship between participants’ BAC levels and the percentage of inaccurate units provided in response to open-ended and cued questions.
Identification confidence. A linear regression was used to examine how participants’ BAC level, accuracy, choosing behaviour, and the two and three way interactions predicted identification confidence (outcome). These predictors accounted for a significant amount of the variance in participants’ confidence measures, $F(7, 126) = 8.91, p < .01, R^2 = .33$. Participants’ choosing behaviour was the only significant predictor of confidence, $\beta = 46.64, SE = 12.08, t = 3.87, p < .01$. Participants who made an identification were more confident in their decisions than those who did not make an identification. Participants’ BAC level ($p = .57$), identification accuracy ($p = .83$), and the interactions between the variables ($ps > .28$) were not significant predictors of confidence.

Discussion

This study examined how elevated BAC levels affect eyewitness memory for both a mock crime and a mock suspect’s face. Three central findings emerged: (1) alcohol clearly impaired memory for the criminal event by impacting both the quantity and quality of witnesses’ reports, (2) alcohol (even at elevated levels) continued to differentially affect witnesses’ memory for faces and events, that is, alcohol reduced witnesses ability to recall accurate and plentiful information but had no effect on identification performance, regardless of lineup condition, and (3) recall format may play an important role when interviewing intoxicated witnesses across a broad BAC spectrum. That is, both open-ended and cued questions elicited less accurate information from intoxicated witnesses; however, participants reported more information in response to cued questions, especially at higher BAC levels. This increase was likely driven by the increase in inaccurate information elicited from cued questions while open-ended questions did not inflate the amount of inaccurate information reported.

The present findings regarding event memory support the notion that the null/inconsistent results throughout the alcohol-eyewitness literature (e.g., Fowle et al., 2016; Hagsand et al., 2013a; 2017; Schreiber Compo et al., 2011) may be at least partially explained by the low to moderate intoxication levels typically found in laboratory studies. That is, at low to moderate BAC levels the effects of alcohol on memory are not as powerful and therefore possibly not as consistent. As BAC levels rise however memory impairments become larger and more apparent. This assumption is supported by quasi-experiments in the field that have shown more consistent impairments in witness (Crossland et al., 2016) and offender memory (van Oorsouw & Merckelbach, 2012; van Oorsouw et al., 2015) at elevated BAC levels. For example, van Oorsouw et al. (2015) classified participants as sober ($M \text{ BAC} = .00$), moderately intoxicated ($M \text{ BAC} = .06$) and severely intoxicated ($M \text{ BAC} = .17$). Although participants in both intoxication groups (moderately and severely) showed signs of event memory impairment relative to sober individuals, only severely intoxicated individuals showed consistent signs of impairment. The findings in van Oorsouw et al. (2015) and other studies carried out in bars are even more impressive given that all participants were tested 3–7 days after the event (sober) without alcohol affecting retrieval functions, highlighting the detrimental effects of elevated intoxication during encoding. The present study however tested witnesses’ memory immediately after the event, while alcohol affected both encoding and retrieval functions, which was expected to yield even more detrimental effects of alcohol on witness memory compared to alcohol’s effect on witness memory either only at encoding or retrieval. This prediction was supported by the event memory data. Thus, our findings extend previous literature on witness memory by demonstrating the specific vulnerability of witnesses who are highly intoxicated both at encoding and retrieval.

In support of our hypothesis, alcohol only impacted inaccurate information in response to cued questions. The increase in inaccurate information elicited from cued questions suggests that not allowing intoxicated witnesses to determine their own reporting may result in a decrease in accuracy, highlighting a potential vulnerability. This specific finding is in line with research finding that cued recall may yield more inaccurate recall in intoxicated witnesses (Schreiber Compo et al., 2012). Taken together, the data on alcohol and witness recall cautiously suggests that if the focus is on investigative leads, that is, generating a maximum amount of information at the beginning of an investigation, cued questions may be more helpful than open-ended ones, especially at elevated BAC levels (Crossland et al., 2016). If the investigative focus is on accuracy, then open-ended questions may be more useful than cued questions, especially with highly intoxicated witnesses. This is consistent with other research and investigative interviewing recommendations with adult witnesses (Fisher & Geiselman, 2010).

Results from the present study, which included intoxication levels as high as .29%, suggest that alcohol has no effect on facial recognition, a finding that is consistent with empirical work from the laboratory examining the relationship between low to moderate levels of alcohol and witness memory for faces (Hagsand et al., 2013b; Harvey et al., 2013b; Kneller & Harvey, 2015; Yuille & Tollestrup, 1990). Thus, the suggestion that previous null findings in the literature are possibly a function of the low to moderate intoxication levels tested in laboratory studies is not supported by our findings. However, the present findings support the assumption that the significant findings in the Dysart et al. (2002) study could be attributed more to the identification procedure (i.e., showup) used rather than the elevated intoxication levels reached. That is, despite enhancing the
suggestibility of the lineup procedure by excluding a cautionary instruction no differences in identification performance emerged for target-present or target-absent lineups. This is likely a reflection of the fillers in the lineup siphoning selections away from the innocent suspect in the target-absent lineup (Sjöberg, 2016; Steblay et al., 2003). Although other differences (e.g., length of the event, type of event, live interaction versus video) between the present study and Dysart et al. (2002) could also explain the discrepancy, we believe the identification procedure is the most likely factor.

It is also possible that the lack of differences in identification performance across BAC levels is a result of the biased lineup instructions, which were used because they have been shown to consistently increase choosing rates, especially in target-absent situations. This may have created a ceiling effect, masking potential differences across intoxication groups. That is, sober and less intoxicated individuals may have been more likely to make a selection, possibly concealing differences in accuracy rates across the BAC spectrum. This notion is further supported by our similar choosing rates across lineup formats (TP = 79%; TA = 85%) as witnesses who view a target-present lineup are typically more likely to make a selection than those who view a target-absent lineup when given cautionary instructions (e.g., Flowe et al., 2017; Steblay et al., 2003). However, despite elevated choosing rates in the target-absent condition only 27% made a false identification of the a priori innocent suspect. This percentage of false identifications is practically identical to the pilot test of the lineups in which the innocent suspect was chosen 28% percent of the time, suggesting that neither alcohol nor the bias lineup instructions affected identification performance. Furthermore, the fact that alcohol had no effect on false identifications despite potentially increased choosing rates suggests that the fillers in the lineup did protect against false identifications. Had a showup procedure been implemented then these increased choosing rates would have likely resulted in more false identifications. We therefore believe the present findings support existing recommendations that a full lineup be used instead of a show-up with all witnesses, including those who are intoxicated, to safeguard against false identifications because despite elevated choosing rates alcohol did not affect identification accuracy. Of course, to fully examine whether identification format (lineup versus show-up) affects identification decisions across BAC levels future research should systematically manipulate identification format and lineup instructions.

Together, our results support the general principle that people have inherently different processing and memorial systems for episodic autobiographical events versus facial recognition information (see Leibo, Mutch, & Poggio, 2011). In this instance, the episodic autobiographical system was clearly affected by alcohol (especially at high levels) while the other was not. Alternatively, our findings may support the differences between recall and recognition as two different types of processes (Pozzulo, Dempsey, Crescini, & Lemieux, 2009). That is, information recalled about an event is largely dependent on internal cues such as the eyewitnesses’ knowledge of the crime and their confidence in their metacognitive abilities. In contrast, it has been argued that recognition memory, such as a lineup identification, relies more on a sense of familiarity between one of the options (i.e., a lineup member) relative to the other alternatives options presented (Pozzulo et al., 2009; Robinson, Johnson, & Robertson, 2000). As such, future research should continue to examine how these two disparate memory processes are affected by alcohol given that members of the justice system believe alcohol negatively impacts both memory systems equally or that deficits in one area mark impairments in the other.

**Limitations and future directions**

Although it is important to continue testing intoxicated witnesses’ memory at higher BAC levels these field studies are of course not without limitations. For example, as is often the case with quasi-experiments in the field we were unable to randomly assign participants to intoxication conditions or control the type and quantity of alcohol each participant consumed. The lack of an extensive medical screening may have also led to the inclusion of participants who were under the influence of additional substances that were potentially illegal or more memory-altering than alcohol. Thus, part of the variance across the different memory measures may have been explained by participants’ potential consumption of other legal or illegal substances. It is also important to point out that having only one research assistant conduct all experimental procedures was not ideal because knowing a participant’s BAC had the potential to bias the experimenter when collecting subsequent witness data (Rosenthal, 1994).

Future research should account for multi-substance use by potentially adding a few targeted questions. Additionally, since our study utilised biased lineup-instructions, future research should specifically examine the effects of unbiased lineup instructions across the BAC spectrum given that (a) unbiased instructions are recommended (Technical Working Group: Eyewitness Evidence, 1999) and (b) alcohol may affect eyewitnesses’ ability to implement caution, especially at high BAC levels. Future research should also systematically investigate the importance of a (sobering) delay when testing the effects of high alcohol levels on witnesses’ memory for faces and events given that most intoxicated witnesses, even those whose memory is probed immediately while intoxicated, will recount the information at a later time in a sober state (Palmer et al., 2013). This recommendation for future research is arguably even more important in the context of identification performance, as real-world
intoxicated witnesses will likely be presented with a lineup after a sobering delay, when investigators have had a chance to construct a fair lineup based on the information collected throughout the investigation or during the witness interviews (Agricola, 2009; Cicchini & Easton, 2010). Given this delay it is more likely that the intoxicated witness would make a later decision from a lineup in a less intoxicated or sober state. Show-ups however are often administered when a suspect is apprehended within hours after the crime (Agricola, 2009). It is therefore more likely that witnesses viewing a show-up would still be (at least similarly) intoxicated when making an identification. Investigating this question was outside the scope of the current project given the level of approval obtained from the ethics review board. However, it is important to explore venues via which participants contact information can be collected in the field to allow for follow-up assessments which are important in developing this body of work both theoretically and on an applied level. In this context however it is important to point out that follow-up interviews may present their own issues given that participants’ alcohol and drug consumption after the experiment cannot be monitored (Altman et al., 2018) and previous studies that have attempted to re-contact intoxicated participants in the field have not succeeded (e.g., see Dysart et al., 2002). Arguably, this is also an issue in lab-based studies on the effects of alcohol on witness memory. Finally, given the paucity of research and the mixed result of alcohol and question format, future research should incorporate and manipulate additional question formats including suggestive-leading and yes/no questions and examine their respective effects at different intoxication levels.

The present findings highlight the importance of investigating elevated BAC levels effect on witness memory and further illustrate that even at higher BAC levels alcohol differentially affects witnesses’ memory for faces and events. On an applied level, our data suggest that real-world investigators who encounter highly intoxicated witnesses should use best-practice interviewing recommendations such as open-ended questions (Fisher, 1995; Fisher & Geiselman, 2010) to yield the most accurate and plentiful accounts while considering that quality and quantity of witness information may be suboptimal at high intoxication levels. Importantly and somewhat surprisingly, based both on past research and the present study, there is no reason to suggest that intoxication level is associated with poorer identification performance when a lineup is administered, even when investigators forget to provide witnesses a cautionary instruction. On a theoretical level, these findings suggest that low to moderate BAC (e.g., <0.08%) levels do not produce deficits that are large or consistent enough to be detected. Thus, it is recommended that future research test witnesses across a broad BAC spectrum to determine whether a specific BAC level, or range of BAC levels, can help predict when a witnesses’ memory might be compromised.

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