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Recollections of a Robbery

Effects of Arousal and Alcohol upon Recall and Person Identification*

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One week after committing a simulated robbery while intoxicated or sober, each of 142 subjects recalled the event within a "cognitive interview." In an initial exploratory experiment, alcohol consumption reduced the accuracy of recall of a variety of types of information, in particular, information about persons. In the second experiment, person identification suffered following the consumption of alcohol, but only when arousal was low. Higher levels of arousal appeared instead to minimize the negative impact of alcohol upon encoding and recall. Second, whereas the recollections by subjects of what they saw during the crime were not impaired by alcohol consumption, their recollections of what they did were impaired. Both experiments examined the effects of arousal upon the subjects' recalls, and Experiment 2 tested the hypothesis that increased arousal serves to reduce attention to peripheral sources of information. This hypothesis was supported because the identification of persons central to the crime benefited from increased arousal but the identification of persons peripheral to the crime did not. A similar hypothesis about the effects of alcohol received only mixed support because the subjects' behaviors reflected "alcohol myopia" but their identifications of target persons did not. Finally, manipulations at the time of retrieval of the subjects' beliefs about how much alcohol had been consumed also altered accuracy of recall.

Generally, researchers of eyewitness testimony have tested one observer's memory for another person's actions. Most frequently, witnesses have simply observed a simulated crime on slide, film, or video (e.g., Cutler, Penrod & Martens, 1987: Loftus & Burns, 1982). Less frequently, witnesses have been drawn into a

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field study (e.g., Krafka & Penrod, 1986; Malpass & Devine, 1981) or have observed a real crime (e.g., Yuille & Cutshall, 1986) or, even more rarely, have been the recipients of a criminal's actions (e.g., Fisher, Geiselman, & Amador, 1989; Keuhn, 1974; *San Jose methods test,* 1972, cited in Christianson & Loftus, 1987). It is peculiar that researchers have focused so heavily upon the memories of observers when the defendant/criminal must also present his or her own recollection of the events and have that recollection assessed for credibility. In many crimes, the question of exactly who did what to whom can be of considerable importance, particularly in crimes involving multiple perpetrators. The present research differs from earlier studies by assessing the abilities of persons who carried out crimes to recall and recognize the details of the event in which they actively participated, rather than simply observed, and, as a result, we believe it to be the first to explore the criminal's as opposed to the witness's memory for a crime. More generally, because the research explores memory for a complex activity by those who participated in it, the results may contribute in a broad way to an understanding of memory for one's own actions in and observations of an event. The crime was a theft of cash following an entry into a university professor's office, a theft simulated by subjects, but their roles, actions, and anxieties otherwise convincingly mimicked those involved in a real crime. Hereafter we refer to this setting, instructions, and procedure as the crime paradigm.

Once the light of interrogation has been turned from witness to perpetrator, it is clear that the same issues that stimulated eyewitness research are equally appropriate to the perpetrators and their actions. For example, one variable that is likely to be of particular importance for the cognitive processes and memories of both the criminal and the witness/victim is the level of arousal, the effects of which on witnesses have been investigated in a variety of paradigms (e.g., Christianson & Loftus, 1987; Deffenbacher, 1983; Loftus & Christianson, 1989; Maass & Kohnken, 1989; Peters, 1987; Tooley, Brigham, Maass, & Bothwell, 1987). It is likely that for some types of crime the person who commits the crime achieves a level of arousal at least as high as that achieved by the witnesses to the crime. Exploration of the effects of arousal upon the participants' memories will thus test the generality of the earlier research and, perhaps, reveal points of difference between actors in and witnesses to an event. For example, one result that has characterized eyewitnesses under conditions of high arousal is differential memory for "central" and "peripheral" information from an observed event, with increasing impairment of memory for peripheral information as arousal increases (e.g., Loftus & Christanson, 1989). In the present research, we asked whether similar results would be also obtained from those who participated in an activity and whether these results would generalize from the recall of details to the identification of persons. Level of arousal was manipulated by varying the threat of being apprehended during the subjects' crimes, and we examined the effects of these manipulations upon the recall of several types and sources of information as well as the identification of target persons.

A second feature of crimes is that they are frequently carried out by persons under the influence of alcohol. For example, in the majority of cases of assault, family violence, and robbery, alcohol is implicated (e.g., Gerson, 1978; Steele &

Josephs, 1990). Yet, we know surprisingly little of its effects upon memory of the witnesses, much less the perpetrators of crime. Unfortunately, earlier attempts to explore systematically the relationship between alcohol and memory in real crimes have been unsuccessful because police records are frequently incomplete with regard to the critical details of alcohol use: for example, the amounts of alcohol consumed or the time elapsed since consumption (Gerson, 1978; Yuille & Tollestrup, 1990). Accordingly, two laboratory studies were completed in which a theft was committed while subjects were or were not under the influence of alcohol. However, because laboratory investigations of effects of alcohol upon memory have most frequently implicated encoding as opposed to retrieval processes (e.g., Birnbaum & Parker, 1977; Hastroudi, Parker, DeLisi, & Wyatt, 1983) and because intoxication at the time of testing has little forensic relevance, all testing was carried out while subjects were in a sober state.

EXPERIMENT 1

In an exploratory first step with the use of the crime paradigm, some subjects received alcohol prior to committing a theft of cash from a professor's office and others did not. Instead of a placebo condition, an absolute control condition wherein subjects knowingly received no alcohol was used. Our reasons for doing so were as follows: First, in a previous study with witnesses to a staged crime by Yuille and Tollestrup (1990), no differences in memory performance between a placebo and absolute control condition were found, and second, given the dosage of alcohol administered to the experimental subjects, it was unlikely that placebo instructions intended to convince subjects that they had received a comparable dosage to that of the experimental subjects would be credible (cf. McMillen & Wells-Parker, 1987; Sher, 1985).

There is no doubt that alcohol impairs many sensory, motor, and cognitive functions, the magnitude of impairment generally increasing with dosage but subject to a host of task, instructional, cognitive process, and individual difference variables (Birnbaum & Parker, 1977; Carpenter, 1962; Levine, Kramer, & Levine, 1975; Marlatt & Rohsenow, 1980; Ryback, 1971; Steele & Josephs, 1990). As with research on sensory-motor functioning, investigations of alcohol's impairments of intellectual or cognitive functioning often suffer from the use of laboratory or simulation tasks that frequently do not reflect the complexity of the real-world behaviors to which the results are intended to generalize (cf. Carpenter, 1962). Indeed, in some studies either no effect of alcohol or an enhancement effect upon intellectual functions has been reported (Carpenter, 1962; Lowe, 1981). As Parker, Alkana, Birnbaum, Hartley, and Noble (1974) put it, "The more demanding the task, the greater the impairment from alcohol" (p. 826).

In contrast, the crime paradigm provided opportunities for subjects to encode a variety of types of information, including their own behaviors. As the basis of the alcohol impairment seen in previous research has been suggested to result from insufficient elaborative processing of information (Craik, 1977; Ryback,

1971), an assessment of subjects' abilities to recall various types of information following alcohol consumption should reveal processing deficits. Further, following current interpretations of the effects of arousal, we might also expect both overall differences in recall and differential performance across categories of recalled information between two levels of arousal (cf. Deffenbacher, 1983). The latter differences would be expected to occur as a result of a restriction of focus or narrowing of attention with increased arousal (e.g., Easterbrook, 1959; Christianson & Loftus, 1987; Loftus & Christianson, 1989; Loftus, Loftus, & Messo, 1987; Maass & Kohnken, 1989; Tooley et al., 1987). Two levels of arousal were created by manipulating the threat of apprehension during their criminal acts.

Method

Subjects

Subjects were 78 male university student volunteers recruited from advertisements placed on campus. Although these advertisements also provided opportunities for females to volunteer, none did so. All were over the legal drinking age (M = 21.1) and reported having had prior drinking experience with alcohol at levels consistent with the dosage used in the experiment. Prior to admission each subject completed a medical questionnaire and an informed consent form that described their activities within the experiment including the possibility that they may be asked to steal money from a university professor's office. Assurances were given that no harm would come to them if caught stealing: They were instead "actors" whose roles required them to steal. None declined to simulate the theft. Subjects refrained from eating for a 4-hour period prior to the experiment, which was run in the late afternoon and evening. Subjects received $5.00 for their participation in the experiment. Seven subjects were replaced for failing to return for the second (interview) session.

Design and Procedure

The 2 × 2 experimental design included two between-subjects variables: alcohol (present versus absent) and level of arousal (low versus high). Each of 40 subjects consumed a quantity of alcohol previously demonstrated (Jones, 1973) to raise blood-alcohol concentrations (BAC) to a maximum of 110 mg % (.11). To do so, each subject's total dosage of 95% ethanol was determined on the basis of 1.32 ml/kg and distributed evenly over three mixed drinks, each consumed within a 10-min period (Jones, 1973; Yuille & Tollestrup, 1990). Experimenters and subjects engaged in light conversation during the consumption period. Alcohol was mixed in a 1:4 ratio with fruit juice and a carbonated soft drink. Although several subjects reported that the mixture's taste was unpleasant, all successfully consumed their drinks. An additional 38 subjects consumed no alcohol prior to the thefts and spent a comparable 30-min period viewing videotapes. From consumption of the last drink to arrival at the crime room, approximately 20 min had elapsed and, therefore, approximately 50 min since drinking was initiated, a time period that, according to Levine et al. (1975) should produce maximal impairment on the types of tasks used herein. The experimental sessions included 4–5 subjects

at a time and contained either all alcohol or all control condition subjects. Subjects were individually released from the drinking area to carry out the thefts.

The professor's office ("crime room") was approximately 55 m from the meeting room and was reached by walking through a hallway complex. The office had dimensions of 4.6 × 3.5 m and was furnished with a desk, bookcase, coat rack, and so forth. The room was identified as belonging to a university professor, and, given the subjects' ages and year of study, it is unlikely that they would have had reason to believe otherwise. With the placement of a cup of warm coffee and a radio set at low volume in the room, it was hoped that subjects would be further led to believe that the professor might return at any time. Apparently, the room and its props were convincing to other members of the university as well: A university administrator wrote the mythical professor and asked for justification of his or her continued use of the office.

Level of arousal was manipulated by varying the subjects' perceptions of the likelihood of being caught in the act of stealing. Each low arousal condition subject was accompanied by a research assistant from the meeting to the crime room. After the subject had knocked and entered the office, the research assistant waited outside and, upon the subject's exit, accompanied him to two other rooms: one for blood pressure and heart rate measurements and then to another for a 2-h detoxification period (alcohol condition subjects only). In the high arousal condition, on the other hand, each subject was responsible for reaching the professor's office unassisted. In contrast to the low arousal condition subjects, who were frequently reassured that no harm would come to them if caught, the high arousal condition subjects had been told explicitly (and correctly) that other members of the psychology department and university security were unaware of the research project and that as there had been a recent spate of robberies in the area, they should be extremely careful not to arouse suspicion by their actions. They had also been told that the professor might return at any time and that it was therefore important to complete the theft as quickly as possible. Further, if a security officer happened to catch them in the professor's office, they were told that they would have to handle the situation until a member of the research team could assist. And, during the theft itself, several unanticipated events occurred that were designed to increase arousal for these subjects. First, the room had been rigged in such a way that the subjects unknowingly triggered a booby trap when they searched through a coat jacket for the cashbox key and, in doing so, tripped a wire attached to a precariously balanced group of soda cans that fell to the floor and caused considerable noise. A second event was a knock on the door and entry into the office by a student confederate (an "intruder") looking for the professor. Low arousal condition subjects were also interrupted by this student but, unlike the high arousal subjects, they had been previously warned that someone looking for the professor might knock at the door.

The specific instructions given the subjects both prior to and following alcohol consumption were as follows: Enter the office, locate a cashbox key in a suit jacket, find the cashbox in a desk drawer, remove its cash contents ($20), return the box to the desk drawer, and then leave the room. Subjects in the high arousal condition were also required to make their way back unassisted with the stolen money to the original meeting room. While subjects were in the crime room, a

hidden observer behind a shuttered one-way mirror recorded their subjects' actions on a checklist. During the detoxification period, alcohol condition subjects viewed videotapes, were provided with snacks and coffee, and prevented from discussing the experiment. At the time of the initial screening, all subjects had also been advised not to discuss the experiment with others who might be involved. Medical assistance to the experimenters was always available through the Student Health Services but was never required. Following the detoxification period, subjects were either walked or driven to their residences by a research assistant and left in the company of a friend or relative.

One week later, subjects returned for a "cognitive interview" in which they verbalized their recollections of everything they saw and did while completing the theft. The interview instructions provided four primary recommendations for enhancing recall (e.g., Fisher et al., 1989; Geiselman, 1988) and each interview was recorded on tape.

Manipulation Checks

To determine whether the arousal manipulation had been successful, blood pressure and heartrate readings were taken at three times: at entry into the experiment, following the 30-min waiting (or alcohol consumption) period, and immediately following the theft itself. In addition, a mood and anxiety scale was completed by the subjects at the beginning of the experiment and shortly after the theft. Subjects indicated on a 4-point scale the extent of their agreement or disagreement with each of 20 statements intended to tap subjects' feelings of apprehension, anxiety, and security.

Results and Discussion

Physiological and Self-Report Measures

Analyses of variance of both the blood pressure and heart-rate measures demonstrated significant increases from the beginning of the experiment to a point immediately following the theft itself, F's(2,146) $\geq$ 6.15, $p < .05$, the level of significance used throughout this research. Further, subjects in the high-arousal conditions had both significantly higher heart rates (M = 74.87) and blood pressure readings (M = 136.71/75.21) than subjects in the low arousal conditions (M's = 68.41 and 130.87/70.14, respectively), F's(1,73) $\geq$ 5.23. As expected and as is normal, systolic pressure significantly exceeded diastolic pressure across all subjects. The differences between the two arousal conditions were nonexistent at the outset of the experiment and largest immediately following the theft itself and, again for both measures, produced significant interactions between arousal level and timing of measurement, F's(2,146) $\geq$ 3.22. For neither the heart-rate nor blood pressure indices did alcohol have any significant main or interaction effects.

The anxiety questionnaires were scored by assigning a value from 1 to 4 to each subject's response and summing across questionnaire items. Across all conditions the subjects judged themselves significantly more anxious immediately following the crime (M = 45.67) than before it (M = 34.70), $F(1,73)$ = 89.19, MS_e = 51.71. Further, in agreement with the physiological indices, high arousal sub-

jects rated themselves, on average, significantly more anxious (M = 43.47) than low arousal (M = 36.90) subjects, $F(1,73)$ = 11.45, MS_e = 144.53, and the gain in anxiety from pre- to postcrime was significantly greater for high than low arousal subjects, $F(1,73)$ = 4.03, MS_e = 51.71. In contrast to the physiological indices, alcohol did affect anxiety ratings but only under conditions of low arousal where the effect of alcohol was to reduce anxiety (M = 31.19) significantly below that of the control condition (M = 43.73) subjects. With high arousal, the alcohol and control conditions reported equivalent levels of anxiety (M's = 42.10 and 44.,85, respectively). As a result, both the main effect of alcohol and its interaction with arousal were significant, F's $\geq$ 4.97, MS_e = 144.53. Taken together, the physiological and self-report measures suggest that the arousal or threat manipulation was successful in producing differential levels of arousal or anxiety. Further, the activity of committing a simulated crime raised these levels, particularly so for subjects in the high arousal conditions, and suggests that the crime, despite its simulated nature, was taken seriously by the subjects. Feedback from the subjects during and following the project supported this interpretation. The effects of alcohol were only detected on the anxiety scale and reflected a reduction in anxiety by alcohol in the low arousal condition.

Cognitive Interview

Analysis and scoring of the complete 10–20 min interviews followed the procedures described by Yuille and Cutshall (1986) in which the interviews had been transcribed and then parsed into descriptive details, which, respectively, provided information about an action or event, or person (including the intruder's comments and physical characteristics), objects, and other aspects of the office environment. Each detail was examined and compared to verifying information (i.e., an inventory of the objects and their placement within the office, the action checklist recorded by the hidden observer) to determine if it was accurate, inaccurate, or unscoreable. The latter category included details that could not be assessed because they referred to unavailable or unrecorded information such as thoughts, emotions, and subject details. Each correct or incorrect detail in these categories was then assigned a score to reflect the amount of information it contained. Hence, dependent measures for the transcribed protocols were the numbers of accurate and inaccurate units of information for the office environment, the subjects' actions, and the intruder's appearance. Each transcript was scored by one and, in many cases, two scorers working independently and blindly with respect to the subjects' experimental conditions. Previous uses (Yuille & Cutshall, 1986; Yuille & Tollestrup, 1990) of this parsing and scoring procedure obtained interscorer reliabilities of .95.

Analyses of variance were completed on the total numbers of details in each of the three scoreable categories and the percentage correct of all details recalled in each category. First, despite the significant differences between the two arousal conditions on the physiological and self-report measures described above, in none of the analyses did the arousal manipulation have a significant effect, either alone or in interaction with the alcohol variable, all F's(1,73) $\leq$ 1.37. Accordingly, the arousal variable is discussed no further for this experiment.

On the other hand, the effects of alcohol were significant and consistent. Specifically, on mean accuracy measures [number of correct/(number of correct + number incorrect items) × 100] for recalled information in the intruder (76.0 vs. 61.7%), environmental context (83.5 vs. 78.1%), and the actions taken (98.2 vs. 95.9%) categories, respectively, the control condition subjects performed at a significantly higher level than the alcohol subjects in every case, all F's$(1,76) \geq 6.37$. With the exception of the action category, however, wherein the control condition subjects ($M = 22.93$) recalled a significantly higher number of correct units of information than alcohol condition ($M = 20.26$) subjects, $F(1,76) = 6.19$; $MS_e = 22.93$, the accuracy measure advantages arose because alcohol condition subjects recalled significantly more incorrect information details than control condition subjects. Increased recall of nonscorable information was also significantly higher in the alcohol ($M = 8.59$) than control ($M = 5.32$) condition, $F(1,76) = 12.02$, $MS_e = 17.02$. It is possible that the alcohol condition subjects reported more incorrect details because of their expectancies about the effects of alcohol upon encoding and subsequent recall. In other words, a retrospective assessment of their states may have lowered their criteria for the reporting of information, much of which proved to be incorrect. In Experiment 2 we attempt to assess this possibility.

A second analysis of variance in which the three types of information were included as a within-subjects variable revealed significant effects of alcohol and type of information. With respect to alcohol, the mean overall proportion correct was significantly higher in the control (.80) than the alcohol (.70) condition, $F(1,69) = 35.16$, $MS_e = .017$. With respect to recall of the three types of information, a significant main effect was obtained that reflected the overall mean differences between the recall of actions (.89), object (.73), and person details (.62), $F(2,138) = 77.21$, $MS_e = .018$. More importantly, the analysis also revealed a significant two-way interaction between condition and type of information: Specifically, the impairment produced by alcohol differed as a function of type of information with the largest impairment in the recall of intruder information, but smaller and equivalent impairments on environmental context and action information, $F(2,138) = 3.60$, $MS_e = .018$. It is worth noting that the magnitude of the overall difference in mean proportion correct (.10) between control and alcohol conditions was considerable larger than that (.035) reported by Yuille and Tollestrup (1990) for comparable conditions with subjects who simply witnessed a staged event and lends support to the suggestion that it is meaningful to assess the effects of alcohol upon perpetrators (criminals) as well as upon passive witnesses.

In summary, alcohol significantly impaired performance with greater losses for intruder information than for environmental context and action information. In spite of the physiological and self-report differences reported for arousal and anxiety, the arousal manipulation had no measurable effects upon either task.

Experiment 2

A common theme in the cognition and alcohol literature is the finding that alcohol impairs performance in difficult, divided-attention tasks, such that per-

formance on one task is usually sacrificed for performance on the other in a manner that suggests a restriction of the attentional field toward one task component (Craik, 1977; Moskowitz & Sharma, 1974). More recently, Steele and Josephs (1990) have similarly argued that alcohol consumption produces cognitive and perceptual deficits that, taken together, may yield a variety of behaviors they characterized as "alcohol myopia." If these arguments have generality, this kind of tunnel vision or myopia should reduce encoding of some types of information, presumably that which is more peripheral to the task at hand. Although the results of Experiment 1 suggest differential effects of alcohol upon encoding as a function of the type of information, the types of information had not been equated for difficulty or memorability. The literature on the effects of arousal upon memory also suggests an increasing discrepancy in the amount of attention paid to (and encoding of) central and peripheral sources of information with increasing arousal (e.g., Christanson & Loftus, 1987; Easterbrook, 1959; Maass & Kohnken, 1989). To date, differential identification of central and peripheral persons has not been demonstrated to result from increased arousal. To investigate the narrowing of attentional field hypothesized to occur with increases in both alcohol consumption and arousal, subjects in Experiment 2 were exposed to two different individuals in two different interactions, one central (relevant and proximal) and one peripheral (irrelevant and distal) to the crime itself. Later, following the cognitive interview, subjects were presented with two photo identification tasks, one for each target.[1] To control for differential memorability, both targets played both roles in a completely counterbalanced fashion within experimental conditions.

Considering alcohol and arousal together, the criminal subject who both consumes alcohol and experiences high arousal should demonstrate differential recall of central and peripheral information to the greatest degree. Subjects who experience a lower level of alcohol and receive no alcohol should demonstrate the least differential impairment in performance. According to Steele and Josephs' (1990) interpretation of alcohol myopia, the myopic consequences of alcohol for behavior should be most evident under high arousal because this condition provides cues to behavior that would be relatively more salient than those provided by the low-arousal instructions. It is recognized, however, that the two variables of arousal and alcohol may work at cross-purposes. Normally we associate the consumption of alcohol with a reduction of anxiety, and, therefore, a rank ordering of the four conditions based upon overall arousal would not follow a simple additive model. Although we make no predictions as to their interactive effects, it is worth noting that some investigators have hypothesized and found an increase, rather than a decrease, in arousal with the consumption of moderate amounts of alcohol (Wilson, 1982).

A final, related, issue is the role of expectancies regarding alcohol's effects upon one's actions, cognitions, and memorial ability. On the one hand, placebo designs have been used by many researchers to investigate the typically signifi-

[1] A photo identification task had also been used for the "intruder" in Experiment 1; however, a procedural complication that led to the use of different intruders for the alcohol and control conditions rendered the identification results uninterpretable.

cant effects of expectancies upon one's encoding processes in a variety of situations, ranging from motor skills to the acquisition of word lists (Hastroudi et al., 1983; McMillen & Wells-Parker, 1987; Marlatt & Rohsenow, 1980; Rohsenow, 1983). The effects of alcohol expectancies upon retrieval have, on the other hand, received relatively little attention, although Nelson, McSpadden, Fromme, and Marlatt (1986) recently demonstrated an effect of alcohol upon retrieval of information from semantic memory.

To investigate expectancy effects, *all* subjects were led to believe that they had consumed a quantity of alcohol that would normally be sufficient to raise their BAC levels to a maximum of 80 mg % (.08). The belief was justified for the alcohol condition but not for the placebo condition subjects. We reduced the quantity of alcohol from Experiment 1 so that the deception used for the placebo condition and a second deception at retrieval would have greater opportunities for success (e.g., Sher, 1985). To assess the effects of expectancy upon retrieval in particular, we provided information at test that was or was not consistent with what the subject had been told earlier. On any type of memory test, subjects respond in a manner that they believe is expected of them and to the extent that they believe themselves capable (Anderson & Pichert, 1978; Geiselman, 1988). If subjects believe they were intoxicated at the time of an event, their expectancies about the effects of alcohol may play some role in the quantity and quality of their recollections about the event (cf. Rohsenow, 1983).

On the other hand, subsequently learning that they probably had not been intoxicated when they had previously thought that they had been intoxicated may similarly alter the amount and quality of information expected by them. With rare exception (Nelson et al., 1986) alcohol has been demonstrated not to impair retrieval processes and, in this context, an effect of alcohol expectancy upon retrieval alone would be surprising. However, to our knowledge no previous study has requested recall of integrated and complex events by subjects whose actions contributed to the events. Manipulations of a subject's state in a retrospective manner proved successful for Kassin (1985), who provided subjects with retrospective self-awareness of their behavior during an identification task so that the relationship between their identification accuracy and confidence judgments was enhanced. In a similar manner, we hoped to alter retrospectively the subjects' assessment of their states at the time of encoding and thereby perhaps alter their criteria for the reporting of information. To do so, one half of the subjects in both the alcohol and placebo conditions were told at retrieval that they had, in fact, received essentially no alcohol. In the case of alcohol condition subjects, this information was inconsistent both with what they had been told previously and with what they had, in fact, consumed. Indeed, these subjects frequently reacted to the information with surprise and incredulity. The remaining subjects were instead reminded of what they had been previously told (that they had received alcohol). For placebo condition subjects, however, this information was still inconsistent with what they had consumed.

The credibility of the retrieval manipulation depended upon two factors: (1) the success of a debriefing preceding the cognitive interview that discussed the psychological effects of alcohol and the inability of most people to distinguish

successfully between the effects of moderate doses of alcohol and a placebo in an experimental setting and, therefore, the utility of placebo conditions in research; and, (2) the subjects' awareness of their postalcohol experiences (sleepiness, headaches, etc.) and their attribution of these effects to some cause other than alcohol consumption (e.g., the flu). As unlikely as the real-world presentation of such inconsistent and retrospective information might seem, the frequency of discrepancies between autobiographical knowledge and objective reality may increase with the frequency of intoxication (Ryback, 1971), as well as the time between intoxication and retrieval. Difficulties of this sort might be expected among chronic abusers of alcohol.

METHOD

Subjects

The subjects were 64 male volunteer residence students at a different university and who were slightly, but not significantly, younger (M = 20.6) than the sample used in Experiment 1. Otherwise, details of the subject solicitation, medical, and alcohol experience screening, and admission to the experiment were similar to those of Experiment 1. Five additional subjects were replaced because of measurement errors and transcript losses due to faulty recording equipment. Subjects received $10 for their participation.

Design and Procedure

The experiment included three between-subjects variables and three counterbalancing variables related to the identification tests that were imbedded within the eight conditions generated by the first three independent variables. Within these, the 2 × 2 × 2 experimental design included the variables of alcohol consumption (alcohol vs. placebo), level of arousal (low vs. high), and the consistency of information at retrieval (consistent vs. inconsistent) with that provided at encoding. Each of the 8 subjects in each experimental condition received one of eight different combinations of lineup type, target sex, and target role.

The crime paradigm of Experiment 1 was altered to reflect the particulars of the different campus environment and experimental variables of interest. The differences were as follows: First, as students were taken from the drinking to a smaller room to receive further instructions, they briefly observed a "bystander" person who was apparently studying in the area. Second, the distance between the instruction area and the crime room was considerably farther (150 m) and more varied than that used in Experiment 1. Third, the use of an electronic signaling device allowed the hidden observer to notify the intruder precisely when the subject had the cash box open so that the intruder's entry into the room coincided with the theft itself. Finally, to better assess the effects of alcohol upon the recall of their own actions in the crime room, the subjects' activities were recorded on tape by the hidden observer and provided the necessary verification of the subject's recall efforts with respect to the types and sequence of their activities.

Another detail that differed between the experiments was the administration of 40% alcohol (vodka) to the subjects rather than 95% ethanol. To enhance placebo effects, both alcohol and placebo condition subjects were administered the drinks in the same room and at the same times. The total dosage of vodka in the three drinks for alcohol condition subjects was 2.38 ml/kg and corresponded to a 1-ml/kg dosage of ethanol. Placebo condition subjects received drinks with a thin layer of vodka floated on top—an amount that would be insufficient to produce a measurable BAC reading. As in Experiment 1, BAC levels were not measured: Instead, on the basis of previous research, individual dosages were calculated to produce average BAC readings of .08 (Jones, 1973). The assistant who served the drinks was blind to the subjects' experimental conditions and assignment of subjects to conditions was based upon order of appearance at the laboratory. To compare the subjective states of intoxication of the alcohol and placebo condition subjects, a 10-point intoxication rating scale was completed by the subjects shortly after the drinks had been consumed. Following a 90-min detoxification period subjects were accompanied to their residence areas and subsequently monitored by a roommate.

Target Roles and Photographic Lineups

Two targets were used: one seen immediately after alcohol consumption (the "bystander") and at the same time as the presentation of the detailed theft instructions, and the second target (the "intruder") who entered the crime room as subjects took the money from the cashbox. From the perspectives of relevance and proximity to the crime, we judged the first target to be peripherally and the second to be centrally located. The two actors who served in these roles were both young without obvious distinguishing characteristics. Within each of the eight experimental conditions, each target served equally often as the bystander and intruder.

The color head-and-shoulder foil photos were of people who matched a general description of the targets and were photographed wearing identical clothing against an identical background. The lineup displays included five photographs and a "not present" option. Each subject received both a target-present and a target-absent lineup (one for each target) and, across subjects, the two lineups occurred equally often in the first position. Further, one target was male and one female, and as their roles had also been counterbalanced across conditions, their presentations at test were also counterbalanced. Following their identification choices, an assessment of confidence on a 5-point scale from *not all* to *very confident* was made.

Cognitive Interview

Subjects returned for their interviews 7 days after the crime; however, holiday weekends and personal schedules on occasion necessitated the testing of subjects between 4 and 9 days after the first session. These departures were distributed equally across experimental conditions. The format followed that of

Experiment 1 with the exception that following the interview and identification task a short multiple-choice questionnaire was also administered. Its 10 questions focused upon specific details within the office environment. Finally, a thorough debriefing including dehoaxing and desensitizing followed the cognitive interview and, at the experiment's completion, subjects were mailed a detailed, written summary of the primary findings of the research.

Results and Discussion

Manipulation Checks: Physiological and Self-Report Measures

Blood pressure and heartrate readings were taken at three points within the first session (prealcohol, postinstructions, and postcrime) and once in the second session, at the end of the cognitive interview. The manipulation of the retrieval variable occurred at the cognitive interview and, therefore, was not included in these analyses. Analysis of variance in which the variables of alcohol and arousal were crossed with the within-subjects variables of timing of measurement and type of pressure (systolic versus diastolic), resulted in significant main effects of pressure type (as anticipated) and timing of measurement as well as a significant interaction involving pressure type and arousal. Overall blood pressure readings increased significantly from prealcohol to postcrime, $F(3,165) = 13.63$, $MS_e = 239.08$. And this effect of timing of measurement was greater upon systolic than diastolic pressure, particularly so at the postcrime measurement, $F(3,165) = 4.81$, $MS_e = 74.92$. Heart rate measurements demonstrated essentially no differences as a function of alcohol or arousal but, as with blood pressure, increased significantly from the pre- to the postcrime measurements, $F(3,180) = 9.73$, $MS_e = 54.69$.

On the self-report measure of anxiety subjects reported, as in Experiment 1, significantly more anxiety following ($M = 45.03$) than preceding the crime ($M = 32.72$), $F(1,60) = 55.29$, $MS_e = 87.74$. Although the arousal manipulation did not have a significant main effect on the anxiety scores, its interaction with alcohol approached significance, $F(1,60) = 3.44$, $MS_e = 135.49$, $p = .07$. Specifically, whereas alcohol condition subjects obtained similar mean scores in the low- (39.0) and high-arousal (37.06) conditions, placebo condition subjects obtained higher scores following the high (42.56) than low (36.88) arousal instructions. Taken together, the physiological and self-report measures demonstrated increased arousal with the execution of the crime.

Finally, subjects had evaluated their states of intoxication following consumption. Only the variable of alcohol condition was significant, with the alcohol subjects ($M = 4.91$) providing significantly higher ratings than the placebo ($M = 2.50$) subjects, $F(1,60) = 36.96$, $MS_e = 2.51$. If one assumes that the placebo subjects would have given ratings of 1 (completely sober) prior to the experiment, the postconsumption ratings of the placebo condition subjects are reliably higher than this hypothesized preconsumption level by t test, $t(31) = 2.27$. In short, the placebo condition subjects appear to have felt intoxicated in the absence of alcohol.

Cognitive Interview

The tape-recorded interviews were subjected to the blind scoring technique described in Experiment 1. Analyses of variance of the various dependent measures included the three independent variables (alcohol, arousal, and the retrieval manipulation), but, for clarity, discussion of each is presented separately. Before doing so, let us make some general comments about the memorability of the actors and their roles. Subjects recalled significantly more correct information about the male (M = 63.21%) than female (M = 51.34%) actor, $F(1,48) = 9.88$, $MS_e = 456.26$. Similarly, subjects recalled significantly more information about the intruder (M = 52.2%) than the bystander (M = 46.27%), and these effects of the role upon recall were significantly greater for the female than the male actor, F's$(1,48) \geq 3.20$, $MS_e = 348.82$.

Alcohol. First, with respect to alcohol and in contrast to its debilitating effects upon recall in Experiment 1, its effects here were smaller. Although the numerical differences in the recall scores typically favored the placebo condition, analyses of the numbers of correct, incorrect, and nonscorable recall measures across the descriptions of actions, environment, and people revealed but one significant difference in favor of this condition. This difference reflected the higher frequency of incorrect information about the female target (as an intruder and as the bystander) recalled by the alcohol (M = 3.72) than by the placebo condition (M = 2.88) subjects, $F(1,56) = 4.03$, $MS_e = 2.82$. Further, when the amount of correct information was calculated as a percentage of the total information recalled in each information category, no significant differences in accuracy as a function of alcohol consumption were found. This lack of effect of alcohol may be cautiously interpreted as demonstrating that lower levels of alcohol consumption, relative to Experiment 1, may not have detrimental effects upon recall performance. We say cautiously because Experiment 2 differed from Experiment 1 in two respects: First, the amount of alcohol consumed in the alcohol condition had been reduced by approximately 24% in quantity, and, therefore, its effects should be reduced (Levine et al., 1975). Second, all subjects in the second experiment expected to receive alcohol and, as reported, the placebo deception altered the subjects' perceptions of their own sobriety. These beliefs may have carried over to the cognitive interview where comparable shifts in the subjects' criteria for reporting information may have occurred. As a result, we might expect smaller differences between the two conditions than were obtained in Experiment 1.

In addition to the description of the subjects' actions, the hidden observer's tape-recorded protocol allowed for a more detailed analysis of their actions than was available in Experiment 1. Therefore, for actions recalled, we assessed the relationship between each subject's recollection of the action sequence and the hidden observer's record of the actual sequence. Overall, the alcohol and placebo subjects recalled approximately equal numbers of their actions within the crime room (M's = 10.65 and 10.31, respectively), but when scored with respect to the actual sequence of actions, a large and significant difference in favor of the placebo (M = 59.57%) compared to the alcohol (M = 45.63%) condition was ob-

tained, $F(1,56) = 8.27$, $MS_e = 375.59$. To summarize, alcohol had few effects upon the subjects' recollections of the details of *what they saw* (i.e., descriptions of the room, intruder, bystander, and their own actions) but had large and significant effects upon their recollections of *what they did,* in particular, *the order of their actions.*

Subjects did not carry out only those actions required of them. Instead, they often engaged in a number of other unpredictable activities during the theft, most of which were recorded by the hidden observer. According to Steele and Josephs's interpretation of the myopic effects of alcohol upon behavior, it would not be unreasonable to anticipate differences as a function of both alcohol consumption and arousal. Specifically, Steele and Josephs argue that following alcohol consumption a subject's behavior often becomes more extreme in response to the salient cues in the situation. These exaggerated responses occur because alcohol is thought to reduce attentiveness to and processing of other situational and social cues that would normally (i.e., in a state of sobriety) signal inhibition of the behaviors. Here, we anticipated that because the instructions and procedures were designed to make salient the threat of discovery or apprehension, high-arousal alcohol condition subjects, in particular, would demonstrate exaggerated behaviors consistent with carrying out a theft. To assess this possibility, we tabulated and categorized instances of all "other behaviors" engaged in by the subjects: They included frustration, task-relevant and task-irrelevant behaviors, and evasive behaviors. As only the latter category revealed differences between conditions, we focus our attention upon it. The "evasive actions" taken by subjects were all attempts to avoid detection and included the removal of fingerprints, attempts to lock the office door while inside, hiding behind the door when the intruder entered, attempts to close one-way mirror blinds, and the "theft" from the room of objects not requested by the instructions: chocolate bars and other objects. To simplify matters, we compared the numbers of subjects in the various conditions who engaged in at least one of these activities. First, 17(53.1%) of the alcohol subjects engaged in at least one whereas only 4(12.5%) placebo condition subjects did so, a highly significant difference by $\chi^2(1,N = 64) = 11.98$. Further, of the alcohol condition subjects who did so, 12(75.0%) had received high-arousal and 5(31.1%) low-arousal instructions, also a significant difference, $\chi^2(1,N = 32) = 6.15$. Of the placebo condition subjects who engaged in at least one evasive activity, 3 were in the high-arousal and 1 in the low-arousal condition, a nonsignificant difference (with Yates correction), $\chi^2(1,N = 32) = 1.47$. In short, it would appear that alcohol condition subjects demonstrated the kind of behavioral myopia described by Steele and Josephs (1990) and, as a result, we anticipated that the consequences of such myopia might also be evident on the target identification tasks.

Arousal. In contrast to the first experiment, the level of arousal did affect recall performance with significantly higher total correct recall by subjects in the high-arousal ($M = 24.30$) as compared to the low-arousal ($M = 21.28$) condition, $F(1,48) = 4.50$, $MS_e = 1.30$. With respect to the multiple-choice questionnaire, however, the high-arousal condition ($M = 4.59$) was numerically, but not significantly, superior to the low-arousal condition ($M = 4.0$), $F(1,48) = 2.66$, $p = .10$.

In summary, differences observed in the recollection of amount of correct information favored the high- rather than low-arousal subjects.

Expectancies at Retrieval. The retrieval manipulation interacted with the alcohol variable in the recall of descriptive person information about the male target. Specifically, mean percent correct information was higher when alcohol condition subjects were told they had not consumed alcohol (69.0%) compared to subjects who were simply reminded of their alcohol consumption (54.31%). On the other hand, for placebo condition subjects, performance was reduced when told they had not received alcohol (58.67%) compared to subjects who were simply reminded of their (nonexistent) alcohol consumption (70.85%), $F(1,56) = 6.30$, $MS_e = 458.13$. The basis of this interaction, as with the previously discussed decrements in performance following alcohol consumption in both experiments, resided in the amount of incorrect as compared to correct information recalled. One interpretation of these effects rests upon retrospective inferences made by subjects about their states of intoxication in the experiment. That is, if by the time of the interview alcohol subjects had concluded they had indeed received alcohol and placebo subjects had concluded they had not, provision of information at the interview that was discrepant with these beliefs in both cases enhanced recall performance relative to those conditions that received information consistent with their beliefs. Although this evidence of a criterion shift at recall is small, the research nonetheless demonstrated an impact of alcohol expectancies upon retrieval as compared to encoding processes.

Identification Performance

Significant effects of the three independent variables upon identification performance were obtained only for target-present lineups. Two chi-squares were computed for each comparison, one that reflects the type of response (hits, false positives, and incorrect rejections) and a second that reflects whether the response was correct or incorrect. There were neither main effects of alcohol nor arousal but their interaction was significant. Specifically, the alcohol condition subjects (31.3%) made only one half as many correct identifications as placebo condition subjects (68.8%) when arousal was low, $\chi^2(2,N = 32) = 4.75$, $p < .10$ and $\chi^2(1,N = 32) = 4.50$, $p < .05$. But, when arousal was high, the alcohol (56.3%) and placebo (56.3%) conditions performed identically, $\chi^2(2,N = 32) = 1.16$ and $\chi^2(1,N = 32) = 0$. In short, high-arousal condition subjects overcame the debilitating effects of alcohol in regard to the encoding and retention of information relevant to the identification of the targets. Next we consider separately the identification of the bystander (peripheral) and intruder (central) targets.

The two panels of Figure 1 present for the placebo and alcohol conditions identification performance for the bystander and intruder targets. Overall, performance was not related to target role, $\chi^2(2,N = 64) = 1.61$ and $\chi^2(1,N = 64) = 1.0$, but when assessed as a function of arousal, a difference emerged. Specifically, in agreement with the hypothesis concerning the effects of arousal upon the encoding and retention of central as compared to peripheral details, subjects more frequently identified the intruder (75.0%) than the bystander (37.5%) under high

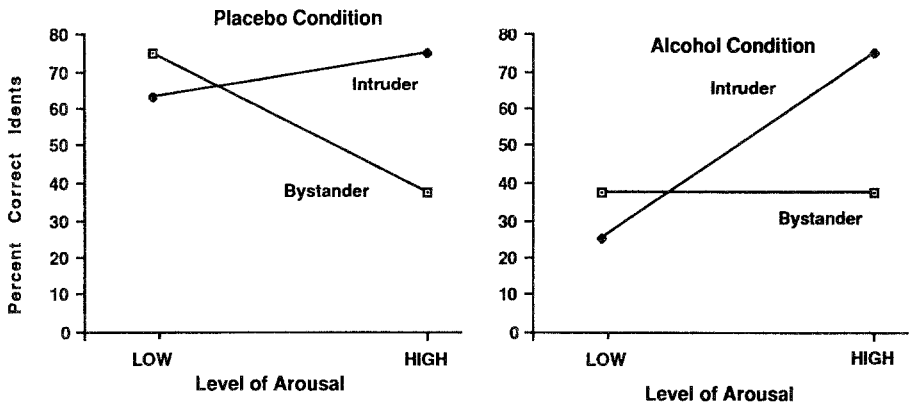

Fig. 1. Percentage correct identifications of the intruder and bystander targets plotted as a function of arousal condition (low or high) and presented separately for the placebo (left panel) and alcohol (right panel) conditions in Experiment 2.

arousal, $\chi^2(2,N = 32) = 4.67, p < .10$ and $\chi^2(1,N = 32) = 4.57, p < .05$, but not under low arousal where identification performances were highly similar (43.8% vs. 56.3%), $\chi^2(2,N = 32) = 2.75$ and $\chi^2(1,N = 32) = 0.60$, p's $> .10$. As may be seen, apart from the previously described overall superior performance of placebo over alcohol condition subjects who experienced low arousal, identical differences in identification accuracy for the intruder and bystander were achieved by the alcohol and placebo conditions. Indeed, with high arousal it would appear that the placebo and alcohol condition subjects arrived at this equivalence via different routes, with the placebo condition subjects demonstrating reduced encoding of the bystander and alcohol condition subjects demonstrating an enhanced encoding of the intruder relative to their encoding following low-arousal instructions. It is possible and probably likely, however, that a "basement" effect in lineup identification performance prevented a comparable reduction in bystander encoding and retention for the alcohol condition subjects. It is important to note here that because the magnitude of the intruder-bystander identification difference was equivalent for alcohol and placebo conditions, the hypothesis concerning differential encoding of central and peripheral details as a function of alcohol consumption was not supported, at least within the realm of information about target persons. Despite the prior evidence of alcohol myopia in the subjects' "evasive" behaviors, this myopia apparently did not extend to their encoding of the two targets.

A second dependent measure of identification performance was obtained by combining each subject's responses (correct or incorrect) to the intruder and bystander lineups with their confidence ratings to yield a 10-point scale of response accuracy. For example, a correct response followed by a maximum confidence rating of 5 was assigned a score of 10, whereas an incorrect response accompanied by the identical assessment of confidence was assigned a value of 1. In agreement with our hypotheses and the identification data reported above, arousal interacted significantly with target role: Overall mean accuracy scores

were significantly higher for the intruder (7.09) than the bystander (5.63) under high arousal but were not significantly different following low-arousal (5.94 and 6.69, respectively) instructions, $F(1,56) = 3.97$, $MS_e = 8.58$, $p = .05$. Finally, analyses of the relationship between accuracy and confidence for those subjects who chose someone revealed correlation coefficients that were essentially equivalent for the intruder, $r(34) = .34$, and bystander, $r(34) = .39$, lineups. These coefficients fall at the upper end of the range of values obtained by Bothwell, Deffenbacher, and Brigham's (1987) meta-analysis of field identification studies.

To summarize the identification results, alcohol subjects demonstrated significantly lower performance than the placebo subjects but only in the low-arousal condition. In the presence of higher arousal, the alcohol subjects performed as well as the placebo subjects, suggesting that these subjects overcame the detrimental effects of alcohol consumption. For both placebo and alcohol subjects, however, high arousal produced a large difference in favor of intruder over bystander identifications. With low arousal, identification of the two targets was virtually identical. Finally, the consumption of alcohol did not magnify the discrepancies seen between central and peripheral target identifications and, therefore, the myopic effects of alcohol were restricted to the subjects' recollections of what they did rather than what they saw.

GENERAL DISCUSSION

Both experiments revealed effects of alcohol on recall. The effects were stronger in Experiment 1 than in Experiment 2 and may be attributed to the reduced dosage and the use of a placebo rather than an absolute control in the latter experiment. However, the two experiments differed in the effects of the arousal manipulation. The physiological and self-report data argue that low- and high-arousal condition subjects differed in terms of their levels of anxiety and general arousal immediately following the crime in Experiment 1. Similarly, the self-report measures and the physiological indices provided support for the manipulation's effectiveness in producing differential anxiety levels in Experiment 2. However, whereas the arousal variable had no discernible effects in the first experiment, its effects upon recall of details and person identification were significant in Experiment 2. Comparisons of the mean levels of blood pressure, heart rate, and related anxiety do not readily provide a basis for suggesting that overall levels of arousal differed across experiments, however inadequately these measures may reflect a broad concept of arousal. Thus we believe that our instructions produced groups of subjects who differed on these overall measures, but we recognize the inherent limitations of such indices and, indeed, of any single view of arousal.

Nonetheless, the results of the second experiment demonstrate that the manipulation of arousal produced two theoretically relevant effects. One was the higher recall of correct details by the high- than low-arousal condition subjects in

Experiment 2. In addition, neither experiment provided any support for the view that increases in arousal produce decrements in recall performance (e.g., for review see Deffenbacher, 1983; Peters, 1987). As other writers have argued, it is impossible, however, in the absence of independent measures of arousal, to compare the levels of arousal produced herein with levels produced in other studies. Although the Yerkes–Dodson hypothesis regarding the effects of arousal has much intuitive appeal, its shape can easily provide an explanation for virtually any result of arousal manipulations. The second, perhaps more important, finding was the differential encoding (shown in Figure 1) of central (the intruder) and peripheral (the bystander) person information under conditions of high but not low arousal. These results extend to person identification, Easterbrook's (1959) cue-utilization hypothesis suggesting a reduction in attention paid to sources of information that are irrelevant to the primary task as arousal increases. Recent research on the weapons effect has also provided support for this interpretation of the effects of arousal (e.g., Loftus et al., 1987; Tooley et al., 1987).

Our interpretation of the lower recall performance produced by alcohol consumption in the two experiments, and poorer identification performance in the second study, was that alcohol impaired the encoding of information and that such impairment was selective with respect to type of information. In Experiment 1, the largest effects of alcohol were upon the recollection of information about the intruder. In Experiment 2, alcohol consumption significantly reduced the recollection of information about the female target overall and, under low arousal, reduced the identification accuracy of both targets. As well, recall of the sequence of a subject's actions was impaired following alcohol consumption. These more restrictive effects may reflect reduced impairment in Experiment 2 rather than any qualitative difference in the type of information impaired. According to this interpretation, had records of the actual sequences of the subjects' activities in Experiment 1 been collected, the recall of correct action sequences in Experiment 1 would have been at least as impaired as those of Experiment 2.

In line with this view of alcohol's progressively greater impairments with dosage level, the results suggest that as the amount of alcohol consumed increases, the retrieval of information about what one does becomes inaccessible before the loss of information about what one sees. It would not be difficult to recast this conclusion in terms of the differential losses of central (what one saw) and peripheral (the order of what one did) information with increased alcohol consumption. To do so would provide additional support for the observation of alcohol myopia among the alcohol condition subjects of Experiment 2 who were observed to engage significantly more frequently in evasive activities. It appears that following alcohol consumption, subjects failed to process further the information and cues that would normally have inhibited their behaviors. For example, a little additional processing would normally have made obvious to the alcohol subjects that the situation really did not call for the removal of their fingerprints (after all, why would the experimenters require fingerprints to know who stole the money?) or the futility of hiding behind the door (perhaps an even more suspicious action than simply being in the office).

On the identification tests, alcohol consumption produced fewer correct identifications than the control conditions on the target-present lineup and only following the presentation of low arousal instructions in Experiment 2. In this connection, it appears that increased arousal or perceived threat ameliorates to a large degree the encoding impairments of moderate dosages of alcohol and, perhaps, the ease with which the crime is completed. Perceived threat or increased arousal may have served to "sober up" our subjects in Experiment 2 or may have provided an opportunity for alcohol subjects to attend to the task in an exaggerated manner which may have minimized the negative consequences of alcohol for the person identification test.

That the placebo condition of Experiment 2 was successful in providing subjects with evidence of intoxication was evident in the ratings, and their beliefs that they were to some degree intoxicated may have also, in turn, restricted the effects of the alcohol manipulation upon their recollections of what they had seen. However, in both the types of behaviors engaged in and the sequence of those behaviors, consumption of alcohol nonetheless produced significant decrements in performance. It is noteworthy that because the evasive behaviors characterized as reflecting alcohol myopia were not evident among placebo subjects, their presentations appear to be unaffected by expectancy effects. On the other hand, we also found that what one is told at the time of testing about the amount of alcohol consumed alters the quality of information recalled. The effect was restricted to the recall of person information about the male target. To our knowledge, there have been no prior demonstrations of the effects of alcohol expectancies alone upon retrieval. Progress on this point, however, will likely require placebo and deception designs that are considerably more complex than that used here.

In summary, the crime paradigm has provided useful information about the effects of alcohol and arousal upon encoding and retrieval processes. For this reason, the crime paradigm appears to be successful in simulating the variety and complexity of forces that act upon persons involved in real-world crimes, both as perpetrators and witnesses. Although the cognitive interview procedure provided a level of forensic validity not available with standard laboratory testing procedures, its utility in assessing the effects of alcohol and arousal may be limited, because, in general, the effects of alcohol consumption and arousal were not reflected by large differences in either the quantity or quality of reported information. Instead, small differences were obtained, perhaps because the question of what information was to be reported was left to the subject rather than to the interrogator. As a result of this freedom, the procedure may have been insensitive to other memorial differences that existed between the subject groups. Apart from the manipulation of the centrality of persons seen by the subjects in Experiment 2, no effort was made in these experiments to assign values of relevance or importance to the particular details recalled. It follows that future research should investigate remembered information that is differentiated by not only this dimension of centrality but also by dimensions of, for example, evidential utility, encoding opportunity, perceptual salience, the person's role as perpetrator or witness, and so forth. To do so, the use of a wider variety of recall and recognition procedures in concert with the cognitive interview is recommended.

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