Improving Eyewitness Recall for Licence Plates

DAVID P. MACKINNON
Department of Preventive Medicine, University of Southern California, USA

KIM E. O'REILLY and R. EDWARD GEISELMAN
Department of Psychology, University of California, Los Angeles, USA

SUMMARY

Two methods for maximizing the completeness and accuracy of eyewitness recall for licence plates were evaluated in this research: (1) asking questions derived from generally accepted principles of memory retrieval enhancement (Geiselman, Fisher, Firstenberg, Hutton, Sullivan, Avetissian and Prosk, 1984; Geiselman, Fisher, Mackinnon and Holland, 1985, 1986) and (2) providing subjects with a licence plate simulation device to view and interchange alphanumeric characters. Undergraduate subjects viewed a series of slides portraying a young man, placing a television set in a car and driving down the street. With a seven-character California plate in Experiment 1 (n = 151), subjects in the condition with the simulation device and cognitive interviewing had a significant 22 per cent increase in correct licence plate recall. The results were replicated in Experiment 2 (n = 108) with an 18 per cent increase in correct information using a six-character plate. Errors appeared to be those letters adjacent in the alphabet to the licence plate letters.

Research on the investigative process has emphasized that the completeness and accuracy of eyewitness accounts are important factors in whether cases are solved (Rand Corporation, 1975). Thus, a critical component of effective law enforcement is the ability of police investigators to obtain accurate and detailed information from eyewitnesses. However, psychologists and others have documented that eyewitness reports are often incomplete, unreliable, partially constructed (confabulated), and malleable during the questioning procedure (Clifford and Hollin, 1983; Loftus, 1975, 1979; Loftus, Miller and Burns, 1978; Wells, Ferguson and Lindsay, 1981). Yuille (1980) has proposed that considerable effort now be focused on how we can improve eyewitness performance. Wells (1978) made a similar argument with his distinction between variables that can be manipulated to reduce eyewitness fallibility (system variables) and those that cannot be controlled in actual crime cases (estimator variables). He concluded that system-variable research has greater potential for positive contributions to criminal justice.

One critical task often required of an eyewitness is the recall of a licence plate. While most law-enforcement professionals would probably agree that eyewitness recall of a licence plate can be the backbone for case solutions (e.g. for bank robberies), memory for licence plates has received little attention in the eyewitness or police science research literature. Nothing can be done in the course of an interview with a witness who has failed to look at a plate, but there are many instances where a witness has attended to a plate but either misreads the characters.
or cannot retrieve the characters from memory when interviewed. An excellent example is the Chowchilla, California school bus hijack case (Kroger and Douce, 1979), where the bus driver dutifully attended to and memorized the plates on the suspects' vans, but could not retrieve the characters later. With the aid of hypnosis the witness was able to recall one plate completely and the other plate with the exception of one character. The use of hypnosis by law enforcement to retrieve seemingly forgotten information from witnesses has been severely curtailed in many states as a general safeguard against the confabulation of memories.

Geiselman et al. (1984, 1985) developed a memory retrieval procedure for eyewitnesses, called the Cognitive Interview, that consists of four general memory jogging methods and a variety of specific ones. Of the general techniques, two attempt to increase the overlap of elements between stored memory and retrieval cues (Flexser and Tulving, 1978): (a) mentally putting yourself back at the scene of the crime before attempting your report, both in terms of environmental factors and emotional reactions (Malpass and Devine, 1981; Smith, 1979); and (b) reporting everything, even partial information, regardless of the perceived importance of the information. The other two methods encourage using many access routes to memories (Tulving, 1974): (c) recounting the events in a variety of orders, such as in reverse order (Burns, 1981; Loftus and Fathi, 1985; Whitten and Leonard, 1981); and (d) reporting the events from a variety of perspectives, such as role-playing the suspect (Anderson and Pichert, 1978; Firstenberg, 1983). These techniques were found to increase the amount of correct information obtained from witnesses about persons, objects, and events by 35 per cent. The results were not related to the length of the interview or the number of questions asked.

The cognitive retrieval techniques proposed for licence plate recall were derived from the principles of the Cognitive Interview. The reinstatement of context surrounding the licence plate was a straightforward extension of the Cognitive Interview. Subjects were instructed to reinstate and image the lighting, type of car, tail-lights, etc. To encourage multiple-access routes, subjects were asked about a variety of plate attributes including 'cognitive impressions'. Many licence plates are to some extent meaningful to each observer, and may produce cognitive impressions which can aid the reconstruction of some of the characters comprising the plate. As a real-world example, one witness to a robbery in Los Angeles recalled the first and last few characters on the plate from a getaway car, but he could not recall the characters in the middle. (That the first and last characters should be remembered is supported by basic research on memory for letter strings, Harcum, 1967.) He could, however, relate his cognitive impression that the center of the plate was 'busy-looking'. The actual plate turned out to contain 'NXW' in the centre, characters with many lines and angles. Discussing the concept of cognitive impressions with a witness could either jog memory or provide guidance towards generating a more complete description of a licence plate.

In a second method for enhancing eyewitness memory for licence plate information, subjects had the opportunity to manipulate a licence plate simulation device. The device allowed the subject to display and interchange possible licence plate characters. It was hypothesized that the device would reinstate the visual context of the licence plate and provide an opportunity for the witness to generate candidate character configurations, thereby making the task somewhat more like recognition.
A final purpose of the research was to examine the pattern of errors that witnesses make in reporting licence plates. Frick (1986), Glanzer (1966), Mackworth (1963), and Miller (1972) have found that, with brief exposure to letters, the limiting factor in performance is the clarity with which the letters are registered in the visual system, while with longer exposures, such registration is assured. Analyses of inter-letter, visual similarity judgements (Kuennapas, 1966, 1967; Holbrook, 1975) suggest that confusion errors at brief exposures should fall along three dimensions: (1) curvature or roundness (O, U, S); (2) horizontality or rectangularity of lines (E, F, L); and (3) vertical linearity (I, L, U). However, visual similarity appears to have little, if any, effect on performance with relatively longer exposure to letter strings (Laughery and Harris, 1970). Instead, the encoding of the letters appears to involve a translation of the visual stimulus into its auditory equivalent for rehearsal in short-term memory (Sperling, 1963; Conrad, 1964). Hence, the confusion errors are likely to be acoustic rather than visual (e.g. T for V, rather than W for V). Errors that follow either pattern can provide useful information in the search for the actual licence plate.

EXPERIMENT 1

The effectiveness of the cognitive retrieval strategies and the license plate simulation device were investigated in Experiment 1. Errors were also recorded to test the hypotheses of visual and acoustical errors.

Method

Subjects
The subjects were 151 undergraduate students from introductory psychology classes at the University of California, Los Angeles. Before agreeing to participate in the study, all subjects were informed that they would be viewing a series of slides portraying an event, and after the slide presentation, they would be asked questions about the event.

Materials
Slide Sequence. The nine colour slides used in the experiment were photographed on a residential street. The event in the slides depicted a young man walking to a car with a 13-inch portable television set. He approached the car, put the television set in the back seat, sat in the car, and then drove down the street. The licence plate on the car was 1MJT407.

Device. The licence plate simulation device was the actual size of the California plate, yellow letters on a blue background. The device was made of coloured cardboard and vinyl letters, with a slot between the background and the front frame such that letters and numbers could be easily inserted and removed. The letters were 2 × 4 inches, with a handle on top to aid in the manipulation of the letters. Two copies of each of the letters and numbers were available. The device had 'California' centred at the top of the plate with registration stickers in both corners.
Procedure

Prior to the experiment, each subject was assigned to one of the four groups created by the two retrieval strategies (cognitive versus standard) and the two device conditions (device versus no-device).

Subjects were seated 7 feet from the screen where the series of nine slides were each shown for 5 seconds. After the slides were presented, subjects entered another room and described the events on the slides in their own words (i.e., a narrative account). They were asked to give a full description of the person, automobile, type of neighbourhood, and the material placed in the car. The second author conducted all of the interviews.

After this initial questioning, subjects were asked questions concerning the licence plate. Then a second questioning routine determined by the experimental condition was administered. (Descriptions of the cognitive and standard questioning strategies are given below.) In the conditions with the device, subjects were given the device and manipulated the characters themselves. At the end of the interview, each subject was asked to again recall the plate.

Cognitive questioning for licence plates. The cognitive retrieval techniques included the reconstruction of the context surrounding the plate (Smith, 1979): 'Visualize the car in your mind. Did the car remind you of anyone else's car? Now visualize the back end of the car. Focus on the trunk, the tail lights, now the bumper. Were there any stickers on the bumper? Now centre in on the licence plate.' To approach the task from a variety of access routes (Tulving, 1974), these subjects were further asked: 'Did the letters or numbers remind you of any words or things?' 'Did the characters look to be close together or not?' (This was to estimate the total number of characters.) 'Did the plate have any special characteristics that stood out?' 'Do you think the numbers were high or low?' 'Did the characters have lines, curves, or anything special about them?'

Standard (control) questioning for licence plates. The control subjects were asked a series of questions generated from a poll of several detectives in the Los Angeles area regarding their interview techniques for licence plates. Thus the control questions constitute a composite, 'standard' police interview and included the following: 'What colours were on the licence plate?' 'Was it a personalized plate?' 'How many letters and numbers were there?; Were they in groupings?' The control group was included to determine the effect of asking standard questions, and to provide a baseline for interpreting the effect of cognitive questioning. That is, perhaps inducing a witness to think about the plate for a longer period of time is sufficient to generate more information, and the precise nature of the questions, cognitive or otherwise, does not matter.

Simulation condition. A group of 47 subjects generated a licence plate without any exposure to the slides of the crime. The proportion of subjects recalling each character was taken as the probability of generating each character by chance. These probabilities were used to correct recall performance for bias due to differences in the chance recall of licence plate characters. Analysis of corrected and uncorrected data led to identical research conclusions. The results for corrected data are described because the characters differed in the probability of chance generation.
For the error analysis, the simulation condition provided the expected proportions that were compared to observed proportions of errors to determine if the distribution of errors was consistent with chance, or if they were more likely to look or sound like the licence plate characters.

The chance generation of characters was used to adjust memory performance to give greater weight to characters generated less often, and less weight to characters generated more often. The weight equalled the reciprocal of the proportion of subjects who generated each character divided by the sum of the reciprocals for all characters. For example, the letter A was generated by .43 of the subjects, and the sum of the reciprocals for all characters was 310.08 yielding a weight for the letter A ((1/.43)/310.08) equal to .0075. The letter B was generated by .043 of the subjects, yielding a .075 weight, reflecting that B is ten times less likely to be generated than letter A.

Correct recall performance was the sum of the weights for each licence plate character recalled, divided by the sum of the weights for all licence plate characters. In the same manner, the incorrect recall measure was the sum of the weights for each character recalled that was not on licence plate, divided by the sum of the weights for all of the characters not on the licence plate. For example, on the first attempt to recall the licence plate the first subject recalled character 1, receiving a score of .072 for correct recall (weight for recalling the character 1 by chance = .0098/sum of weights for all licence plate characters = .1365) and .0 for incorrect recall. At the second recall trial the first subject recalled 17LT, receiving a score of .203 for proportion correct ((.0098 + .0107 + .0072)/.1365) and .024 (.0207/.8635) for proportion incorrect.

The proportion of correct characters recalled could be increased by guessing additional characters. Therefore, a memory score corrected for guessing was obtained by dividing the proportion correct minus the proportion incorrect by one minus the proportion incorrect. The calculation adjusts the proportion correct by the observed proportion incorrect, yielding a measure of correct performance adjusted for guessing (Kintsch, 1977, p. 35). For example, the first subject obtained a score of .0716 ((.0716-0.0)/(1-0.0)) for the first recall trial and .183 ((.203-.024)/(1-.024)) for the second recall trial. The adjusted proportion was then multiplied by 7 to equal the number of correct characters adjusted for guessing.

Results and discussion

Recall performance

Complete and accurate licence plate reports were obtained from 17 per cent of the subjects. Partially correct reports were obtained from 59 per cent of the subjects, and 24 per cent of the subjects were unable to recall any of the licence plate characters. The average subject recalled 50 per cent or 3.5 characters, and the guessing rate was low (3 per cent), averaging .7 characters.

An analysis of variance was conducted with two between-subjects factors of interview type and device presence and one within-subjects factor of time of recall (pre versus post-interview). The performance means for each recall attempt and experimental group are displayed in Table 1. Increases in the number of correct and incorrect characters were observed in each group. The number of licence plate characters corrected for guessing was the dependent variable used in the analysis.
Table 1. Memory performance as a function of interview type, simulation device presence, and recall attempt in Experiment 1

<table>
<thead>
<tr>
<th>Group</th>
<th>Recall attempt</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>C</td>
<td>I</td>
<td>C'</td>
<td>C</td>
<td>I</td>
</tr>
<tr>
<td>Standard interview</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device absent</td>
<td>44</td>
<td>3.65</td>
<td>0.36</td>
<td>3.63</td>
<td>3.67</td>
<td>0.49</td>
<td>3.63</td>
</tr>
<tr>
<td>Device present</td>
<td>44</td>
<td>3.25</td>
<td>0.23</td>
<td>3.22</td>
<td>3.53</td>
<td>0.67</td>
<td>3.42</td>
</tr>
<tr>
<td>Cognitive interview</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device absent</td>
<td>33</td>
<td>2.63</td>
<td>0.14</td>
<td>2.61</td>
<td>2.96</td>
<td>0.75</td>
<td>2.80</td>
</tr>
<tr>
<td>Device present</td>
<td>30</td>
<td>3.08</td>
<td>0.56</td>
<td>3.02</td>
<td>3.86</td>
<td>1.16</td>
<td>3.69</td>
</tr>
</tbody>
</table>

Note: C — mean number of correct characters; I — mean number of incorrect characters; C' — mean number of correct characters corrected for guessing.

This measure reflects that the probability of recalling a correct licence plate character is less likely because there are 7 licence plate characters and 29 non-licence plate characters. The average subject recalled 48.6 percent or 3.4 licence plate characters after correcting for guessing.

Subjects receiving the cognitive retrieval strategies showed a significant increase in correct information between the first and second recall trial compared to the subjects not receiving the cognitive interview strategies (Interview × Time interaction, $F(1,147) = 9.66, p < .01$). The availability of the simulation device also improved recall compared to subjects not receiving the device (Device × Time interaction, $F(1,147) = 9.23, p < .01$). The Device × Interview × Time interaction was not significant ($F(1,147) = 1.91, p > .05$), indicating that the effects of the cognitive and device presence conditions were additive. Tukey’s post-test (Winer, 1971, pp. 216–218) revealed that the increase in memory performance in the device plus cognitive interview condition was superior to all other groups (all $p$ values $< .05$). Memory performance in the standard-no device group was significantly worse than all other groups.

In summary, the control subjects improved throughout the interview by 0 percent additional correct characters, the subjects with either cognitive interviewing or the plate simulation improved by 6 and 7 percent, respectively. Furthermore, the two effects were additive statistically. Subjects who received cognitive interviewing plus the plate simulation performed best of all, with a 22 percent increase relative to the controls in additional correct characters. Of the 30 subjects in the device plus cognitive interview condition, 14 increased and one subject decreased memory performance at the second recall trial compared to the no-device, standard interview condition in which only three improved and two of the 44 subjects did worse.

It is unlikely that these results were due to increased motivation in the cognitive and device present conditions, because there is no evidence that motivation to try harder can enhance the recall of memories (Weiner, 1968). Furthermore, the additive effects of the device and cognitive interview conditions cannot be explained by the motivation interpretation, unless one assumes that the two procedures result in twice the motivation.
Transposition errors
Another important source of information in licence plate recall is the retention of the order of the licence plate characters. Once a candidate plate is obtained, a search is made for the licence plate in a motor vehicle licence data base. If the order of the characters is known, the size of the search is reduced. To investigate order retention we computed a transposition score by dividing the number of correct transpositions by the total number of transpositions. For example, with four characters there are three possible pairs of characters that can be scored for transposition errors, and if one of the pairs is in the wrong order then a score of .66 is obtained. There were no significant differences between the groups on this order score. Order scores were extremely high (M = .90) with 71 per cent of the subjects having perfect retention of the order of the characters they remembered.

The retention of licence plate characters at each position in the plate was investigated by determining the number of subjects recalling each character. The proportion of the subjects recalling characters 1 to 7, was equal .64, .56, .48, .41, .51, .49, and .46, respectively. There was a tendency to recall the first character more than the remaining six characters. However, on a seven-character California licence plate the first character must be either a 1, 2 or less often a 3, making the identification of this character somewhat easier than the others.

Patterns of errors
As outlined in the Introduction, a case could be made that the errors should be either acoustic (sound-alike errors) or visual (look-alike errors). There were a total of 67 letter errors and 57 number errors for all subjects. Look-alike errors were defined as letters that were confused with M, J, or T, at least 2.5 per cent of the time based on table 1 in van der Heijden, Malhas and van den Roovaart (1984). The look-alike letters were I, U, H, K, N, R, P, X, W, F, L, and Y. Sound-alikes were the letters B, N, A, K, C, D, E, G, P, V, and Z, based on Conrad (1964). The expected frequencies for the chi-square tests were computed as the total number of errors observed across subjects (67) times the expected proportions of chance generation of the 23 non-plate letters determined in the simulation condition. For the case of look-alike errors, the letters were collapsed into categories determined by look-alike versus not look-alike for both the observed and expected frequencies. A chi-square statistic was then calculated comparing the observed and expected number of errors. The same procedure was conducted to test the hypothesis of sound-alike errors. The same conclusions described below were obtained when only the first error from each subject was included in the analysis.

There were significantly more intrusions of letters that do not sound like those on the plate than sound-alike letters ($\chi^2 (1, n = 67) = 13.33; p < .01$). There was a significantly greater number of look-alike errors ($\chi^2 (1, n = 67) = 6.06; p < .01$). However, examination of the frequency of look-alike errors revealed an interesting pattern. There appeared to be a preponderance of errors to letters adjacent in the alphabet to the letters on the licence plate. The errors were more likely to be letters adjacent to the licence plate letters ($\chi^2 (1, n = 43) = 5.31; p < .05$). This exciting, yet counterintuitive, finding can be explained post hoc with a spreading-activation model of memory encoding (Meyer and Schvaneveldt, 1971). The letters of the alphabet are stored in semantic memory in a linear array. When a letter is seen in the environment the representation for this letter is activated in memory, along
with the letters immediately adjacent. When a letter is forgotten, the most likely intrusion errors will be those letters that also were activated when the plate was viewed (i.e. the adjacent letters in the alphabet). If this result can be widely replicated it would be valuable for reconstructing licence plates.

There was no evidence for an adjacent number effect however ($\chi^2 (1, n = 57) = .86, p > .20$) suggesting that recall of licence plate numbers may be qualitatively different from recall of licence plate letters. More subjects made errors to the number 2 than any of the other numbers. It appears that subjects chose this number because the most common first letter on a seven-character California plate is either a 1 or a 2.

**EXPERIMENT 2**

The second experiment was conducted to replicate the adjacent letter effect and the positive effects of cognitive retrieval strategies and the licence plate simulation device. Perhaps, for example, the pattern of errors was specific to the characters used in Experiment 1. Given that most California plates contain either six or seven characters, the replication was carried out with a six-character plate. On the basis of Experiment 1 the errors from the recall of the licence plate characters were hypothesized to be letters adjacent in the alphabet to the characters on the plate.

This experiment included an additional control condition, where non-mnemonic questioning was used to determine whether additional questioning would produce as many correct characters as the cognitive strategies and device.

**Method**

**Subjects**
The subjects were 108 undergraduate students from the introductory psychology class at the University of California, Los Angeles.

**Materials and procedure**
The materials and procedure for Experiment 2 were identical to Experiment 1 except that a six-character licence plate (640VYE) was used. Forty-nine subjects participated in a simulation condition for the six-character plate. These data were used to compute memory performance scores, and expected values for the error data as described in Experiment 1.

**Results and discussion**

**Recall performance**
Complete and accurate licence plate reports were obtained from 30 per cent of the subjects. Partially correct reports were obtained from 43 per cent of the subjects, and 27 per cent of the subjects were unable to recall any of the licence plate characters. On average, subjects recalled 50 per cent or 3.0 of the six characters on the plate. The guessing rate was 2 per cent, with an average of .7 incorrect characters.

The performance means in this experiment are presented in Table 2. Note that the same two between-factors (interview type and device presence) and time of
Table 2. Memory performance as a function of interview type, simulation device presence, and recall attempt in Experiment 1

<table>
<thead>
<tr>
<th>Group</th>
<th>Recall attempt</th>
<th>1 Memory performance</th>
<th>2 Memory performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>C</td>
<td>I</td>
</tr>
<tr>
<td>Standard interview</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device absent</td>
<td>27</td>
<td>2.91</td>
<td>0.25</td>
</tr>
<tr>
<td>Device present</td>
<td>27</td>
<td>2.77</td>
<td>0.48</td>
</tr>
<tr>
<td>Cognitive interview</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device absent</td>
<td>26</td>
<td>3.04</td>
<td>0.25</td>
</tr>
<tr>
<td>Device present</td>
<td>28</td>
<td>2.79</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Note: C — Mean number of correct characters; I — Mean number of incorrect characters; C' — mean number of correct characters corrected for guessing.

recall within-factor was used as in Experiment 1. The average corrected proportion was 48.8 per cent or 2.9 characters.

The results of Experiment 2 paralleled the results of the first experiment. There was a significant improvement in recall performance in the device presence group (Device × Time interaction, \(F(1,104) = 4.45, p < .05\)) and with the cognitive interview (Cognitive × Time interaction, \(F(1,104) = 5.98, p < .05\)). The Cognitive × Device × Time interaction was not significant (\(F(1,104) = 1.37, p > .05\)). Tukey's post-test revealed that the device present plus cognitive interview condition led to a significantly greater increase in recall performance compared to each of the other groups (all \(p\) values < .05). The differences between the remaining groups did not reach conventional levels of significance but were in the predicted direction. Subjects in the cognitive interview condition plus the simulation device had a significant 18 per cent increase in correct recall performance. Of the 28 subjects in the cognitive interview and device group, 13 improved and one decreased in memory performance at the second recall trial compared to the standard, no-device group, in which one subject improved and two of the 27 subjects did worse.

**Questioning effects**

In order to evaluate the possibility that the improved recall performance was obtained because of greater number of questions asked, or a novelty effect, a group of 24 subjects was presented the same procedures described above except that they were instructed in a non-mnemonic questioning procedure. The questions in this condition were the same as in the standard, no-device condition except that they were asked two additional times under the following conditions. On the second round subjects were instructed that they could improve their recall of the licence plate by imagining that they were in the place where they can think the most clearly, such as home, at their desk or at the library. On the third round they were instructed to imagine that they were in the place where they are the most relaxed. Average memory performance did not change (\(M = 3.36\)) between recall trials, and the improvement in recall in the device present plus cognitive interview condition was significantly different from this isolated control group (\(F(1,127) = 6.66\),
Thus, it is not an increase in questioning that leads to an increase in the amount of correct information.

**Transposition errors**
Like Experiment 1, retention of the order of the characters was quite high, with an average order score of .86, and 81 per cent of the subjects had perfect recall for the order of the characters that they remembered. The proportion of subjects recalling characters 1 to 6 was .61, .51, .53, .57, .45, and .45, respectively. A slightly greater number of subjects recalled the first letter and the first number.

**Patterns of errors**
The adjacent letter effect was replicated in this experiment ($\chi^2 (1, n = 36) = 15.13, p < .01$). There was little evidence for more look-alike errors ($\chi^2 (1, n = 36) = 2.00, p > .05$). Again, there were more errors to letters that do not sound like the licence plate characters ($\chi^2 (1, n = 36) = 4.84, p < .05$). Look-alikes were B, G, F, L, I, P, R, L, T, U, W, X, and Z. Sound-alikes were B, C, D, G, P, T, Z, and I. There was no adjacent number effect ($\chi^2 (1, n = 41) = .14, p < .05$).

**GENERAL DISCUSSION**

The major conclusions from this research are that (1) memory for licence plates can be improved with retrieval strategies derived from the principles of recall enhancement using the Cognitive Interview and a licence plate simulation device, and (2) the errors made when recalling a licence plate are most likely the letters adjacent in the alphabet to the letters on the plate. Although the entire plate was not always recovered, extra information greatly reduces the number of possibilities. For example, with four characters (two letters and two numbers) rather than two (one letter and one number) recovered from a seven-character plate, the number of possible plates is reduced from 767,000 to 260. This greatly reduces the number of false leads and hence saves valuable investigation time. Partial information is also useful when a suspect is under investigation, or when multiple-witness reports can be combined.

It is hypothesized that the retrieval strategies based on reinstatement of context and cognitive impressions guide the eyewitness in retrieving the licence plate from a variety of perspectives. The licence plate simulation device may be effective because it makes the recall of the licence plate more like a recognition test. The device may also clarify and concretize the process of making a mental image of the plate while searching memory for the characters.

The most intriguing finding of this research is the adjacent letter error phenomenon. Although the two plates used in this research are representative, future research should investigate the recall of characters with other licence plates and under different viewing conditions before the adjacent letter phenomenon is widely accepted. In this spirit, Mende, MacKinnon, and Geiselman (1987) have replicated the adjacent letter effect under both short and long exposure times. Thus, when a witness is unsure about a character, the letters to check first are those immediately adjacent to that character in the alphabet. This error correction rule
may be used to complement the retrieval strategies and plate simulator in maximizing the amount of accurate plate information.

ACKNOWLEDGEMENTS

Portions of this paper were presented at the 1986 meeting of the Western Psychological Association. We thank Amina Memon for comments on this manuscript, and Detectives Rocky Kennedy and Bob Horowitz of the Van Nuys, California Police Department for asking, ‘What retrieval strategies can we use to enhance eyewitness recall for licence plates?’ Requests for reprints should be addressed to R. E. Geiselman, Department of Psychology, 1283 Franz Hall, University of California, Los Angeles, California 90024, USA.

REFERENCES


