Abridgment

Contributions of Psychological Set to Drivers' Route Choice Decisions

Joseph I. Peters and Donald A. Gordon, Federal Highway Administration
John C. Townsend, Catholic University of America

A route diversion system involves the monitoring of two or more alternate routes to provide the driver with real-time information about the traffic conditions on each route (1). The real-time nature of the information is predicted on a sign format that allows message content to be periodically changed. This changing nature of message content, the lack of driver familiarity with this new type of sign, and the possible lack of driver familiarity with alternate routes might be considered as factors detracting from a driver's expectancy of the road ahead. One goal of this study then was to demonstrate that, according to the principles of expectancy as a component of psychological set, drivers with a greater familiarity of the road situation ahead would make route choice decisions significantly faster and would have a greater tendency to switch routes than would drivers with less familiarity.

Another aspect of psychological set is a driver's intention or readiness to respond in a certain way. A driver survey has shown that drivers rank travel time as most important for a trip to work and rank scenery as most important for a vacation trip (2, pp. 53-89). It appeared that, although many qualities of a desirable route existed, drivers valued some qualities more highly than others depending on trip purpose.

Because drivers ranked travel time as most important for business-related trips, it was hypothesized that, if drivers were told to imagine they were on a business trip, they would be more tense, would have more of an intention to "get there on time," and consequently would react more quickly to route choice situations than would those told to imagine that they were on vacation trips. It was also hypothesized that business drivers would choose the time saving route significantly more times than would vacation drivers. As a check on the validity of experimentally instilling trip purpose through instructions to the subjects, the results of the instilled trip purpose groups were statistically compared with results obtained by those with actual business and vacation trip purposes.

Publication of this paper sponsored by Committee on Motorist Information Systems.

RESEARCH SETTING

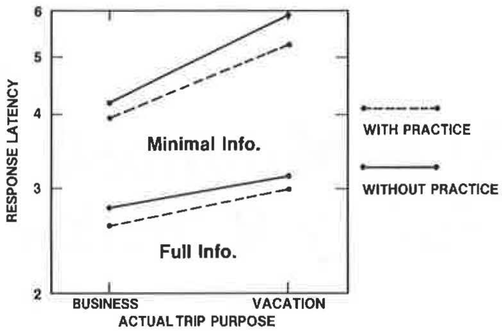
The study took place at the Maryland House restaurant located on the John F. Kennedy Expressway (I-95), approximately 32.2 km (20 miles) north of its junction with the Baltimore Beltway (I-695). I-95 to Washington, D.C., is routed through the city of Baltimore and under the Patapsco River via the Baltimore Harbor Tunnel. An alternate route to the sometimes congested tunnel route is the Baltimore Beltway. The tunnel route is 27.3 km (17 miles) long, and the beltway route is 43.4 km (27 miles) long.

Experimentation took place in a mobile trailer parked adjacent to the Maryland House gift shop. One hundred naive volunteers participated in a stationary laboratory simulation of a route choice situation. The simulation technique consisted of having a subject respond to 12 color slides of roadway situations in which real-time route diversion signs were superimposed over actual signs in the original pictures. Each slide contained a view of the road ahead on a three-lane expressway and an overhead sign that informed the driver of conditions on each of two alternate routes. Subjects were asked to push one of two buttons that would indicate which route they would take. The dependent variables were decision time and route choice.

A 2 × 2 factorial design was employed with two types of psychological set, expectancy and intention, as the independent variables. Situational expectancy was represented by the amount of practice and situational information provided. The full information group was provided with full information about both alternate routes, including information on relative distances and tolls. After the initial inquiry, each full information group subject was given a written description of the existence of each alternate route and of the experimental task. When finished reading this, the subject was seated in the trailer and the experimenter read the procedural instructions. When this was done, the subject was given four practice slides with a description of each.

Members of the minimal information group, on the other hand, received no information about the specifics of the experiment after the initial inquiry; instead, they were merely told that they would be shown different ex-

Figure 1. Information, practice, and actual trip purpose effects on response latency.



perimental signs to see which was the best. When seated in the trailer, each subject was told that pictures of different situations would be shown and that to each situation he or she must pick one or the other alternate routes. No mention of signs or types of signs was made, and no practice slides were given.

The second variable, intention, was represented by the trip purpose, business or vacation. The business condition was obtained by telling subjects to imagine that they were driving to see a client in Washington, D.C. For the vacation condition, the subjects imagined that they were headed to a beach near Washington.

RESULTS

The hypotheses that drivers' route choice preferences are significantly influenced by their expectancy of the situation and by their intention or trip purpose remain unsubstantiated. Although 74 percent of all the subjects preferred the tunnel route, there was no significant difference between those given practice and full information and those given no practice and minimal information. In like manner, no significance was obtained for route choice differences between either actual or instilled business trip purposes and vacation trip purposes.

In determining the relationship between a subject's route preference in the experimental situation versus the actual route choice situation, a person's experimental route preference in the mobile lab appeared to be very highly related [$\phi(84) = 0.37$, $p < 0.001$] to a person's route choice in the actual, real-world situation. This result indicates that subjects most likely had brought their attitude or set into the experimental situation and were unable to respond differently. In this particular case, the drivers had already decided which route they would take, and this preformed intention was followed through in the experimental situation.

Figure 1 shows the significant response latency results. The hypothesis that response latency would decrease with increased expectancy (full information) was overwhelmingly supported [$F(1, 96) = 68.5$, $p < 0.001$]. This indicates that increased expectancy, although not affecting the decision of which route is taken, significantly affects the speed of that decision. By giving the subjects a preview of the types of signs they were to see, by allowing them to practice their responses, and by providing the subjects with full information concerning the alternate route system, the experimenter significantly increased the subjects' speeds of response in the experimental session.

With the data at hand, an attempt was made to equate the full and minimal information groups on the amount of task practice received even though the latter group received no formal practice session. To assess the effects of expectancy without the influence of the four practice slides given to the full information group, we adjusted the average scores of each subject to equate the groups on practice effects. Because those in the full information group had four practice slides, the last four latencies of each subject were eliminated from the group's averaging procedure. Because those in the minimal information group had no practice slides and because their first four experimental slides were equivalent to the practice slides of the full information group, the first four latencies of the minimal information group were eliminated from the group's averaging procedure. Both groups then were averaged among 8 instead of 12 latency scores/subject and were equated on this factor. With the practice effects accounted for in this manner, the decision times were considerably reduced; however, what was more important was that the amount of route information given to the subject remained a significant determiner of decision time.

The hypothesis that driver intention in the experimental setting will significantly influence reaction time was not verified. No significance was noted when subjects were told to imagine that they were on a business or a vacation trip. However, when subjects were regrouped according to their actual trip purpose, significant results were obtained [$F(1, 60) = 5.00$ $p < 0.05$]. These results indicated that those actually on a business trip tend to react significantly faster than those on a vacation trip. Because the correlation between age and trip purpose was insignificant, one cannot attribute the significant difference between vacationers and those on business to the possibility that vacationers consisted of older people who naturally reacted more slowly. The obvious conclusion then is that, with respect to the measure of reaction time, trip purpose cannot be simulated in the laboratory. Significant differences between those actually on business trips and those actually on vacation trips could not be replicated by instructions to the subjects.

The facilitative function of expectancy in the decision-making process found in this research strongly supports the model proposed by Allen, Lunenfeld, and Alexander (3). Because expectancy decreases reaction time and because expectancies can be structured potently for the navigational or macroperformance level of driving, the time saved in this level of performance provides for less interference in the levels of control and guidance and safer maneuvering can result. In addition, the results of this study have implications for the interpretation of past and future studies that require subjects to assume roles different from their roles before testing. Because there is no guarantee that instructions given to subjects will affect their behavior in the intended manner, experimenters must take heed when placing volunteers in hypothetical experimental situations.

REFERENCES

1. B. G. Knapp, J. I. Peters, and D. A. Gordon. Human Factor Review of Traffic Control and Diversion Projects. Federal Highway Administration, Final Rept. FHWA-RD-74-22, July 1973.
2. J. L. Anderson and G. D. Peterson. The Value of Time for Passenger Cars: Further Theory and Small Scale Behavioral Studies. Stanford Research Institute, Menlo Park, Calif., Contract CPR11-8028, Sept. 1964.
3. T. M. Allen, H. Lunenfeld, and G. J. Alexander. Driver Information Needs. HRB, Highway Research Record 366, 1971, pp. 102-115.