*SEAT BELT USAGE: A POTENTIAL TARGET
FOR APPLIED BEHAVIOR ANALYSIS*

E. SCOTT GELLER, JOHN G. CASALI, AND RICHARD P. JOHNSON

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Results of 1,579 observations of cars entering or exiting campus parking lots showed direct relationships between seat belt wearing and the intrusiveness of the engineering device designed to induce belt usage, and between device intrusiveness and system defeat. For example, all drivers with working interlocks or unlimited buzzer reminders were wearing a seat belt; but 62% of the systems with interlocks or unlimited buzzers had been defeated, and only 15.9% of the drivers in these cars were wearing a seat belt. The normative data indicated marked ineffectiveness of the negative reinforcement contingencies implied by current seat belt inducement systems; but suggested that unlimited buzzer systems would be the optimal system currently available if contingencies were developed to discourage the disconnection and circumvention of such systems. Positive reinforcement strategies are discussed that would be quite feasible for large-scale promotion of seat belt usage.

DESCRIPTORS: behavioral community psychology, transportation behavior, driver safety, engineering vs. behavioral technology, normative data

There is much evidence that wearing seat belts in automobiles reduces injuries and saves lives (e.g., Bohlin, 1967; Campbell, Note 1; Tourin & Garrett, Note 2). For example, it has been estimated that the use of seat belts by all accident victims could have saved as many as 25% of the 57,000 persons killed on U.S. highways in 1972, and could have significantly reduced or prevented the injuries of 50% of the 4 million crash victims in that year (Proceedings, 1973). Thus, the value of wearing seat belts is obvious, especially given the estimate that U.S. children born in 1972 have more than a 50-50 chance of injury sometime in their life due to an automobile accident (Kahn, 1973).

Prompted by the injury reduction and life-saving effects of seat belt usage, government legislators mandated the inclusion of seat belts

in all U.S. automobiles marketed since 1968 (Stowell & Bryant, Note 3). Lap belts and shoulder belts are termed *active* as opposed to *passive* restraint systems, because the vehicle occupant must emit certain behaviors (such as buckling the belt) in order to be protected. Passive restraint systems currently available include dashboard-mounted air bags (which automatically inflate upon impact) and passive shoulder belts (which automatically position around passengers with the closing of car doors).

Field observations of accident victims and automobile drivers have indicated consistently low usage of active restraints. For example, Clark (Note 4) reported that for 185,544 North Carolina accident victims during 1973, only 14.5% were wearing a seat belt at the time of the accident, and similar low rates of seat belt wearing were documented in 1974 and 1975, (i.e., 14.5% and 13.2%, respectively). Observations of automobile occupants while driving have shown similar low rates of seat belt usage; e.g., 10.6% of more than 21,000 observations in North Carolina (Highway Safety Research

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Center, 1976), 17% of 1,625 Virginia drivers (Stoke, Note 5), and 18.5% of 84,682 drivers among 16 major cities (Stamler, 1978).

Because of the extremely low usage rate of seat belts, the U.S. Congress of 1977 approved a recommendation of the Department of Transportation to require air bags or passive belts for front-seat passengers of 1982 standard- and luxury-size cars, 1983 intermediate- and compact-size cars, and 1984 subcompact- and mini-size cars (Stamler, 1977). However, this mandate for passive restraint systems does not lessen the value of active restraints. The 1977 ruling requires passive restraints only in the front seat of passenger vehicles; and more than a decade will pass before a majority of the cars on the road will have front-seat, passive restraints. Furthermore, air bags that fully satisfy the 1982 standard provide adequate protection in only frontal impact collisions. That is, the air bag is not designed to deploy in side and rear impacts; and even if the bag does deploy under nonfrontal angles of impact, the bag alone is unable to keep occupants without safety belts from being thrown around inside the vehicle or from being ejected from the vehicle.

The passive shoulder belt system (as currently found on the Volkswagen Model "L" Rabbit) is also less protective than active lap and shoulder belts, because in nonfrontal impacts occupants can slide underneath the belt, and the passive shoulder belt may position itself in uncomfortable and/or inappropriate body locations, especially when small children ride in the front seat (cf. Woodson & Black, 1978). Given that standard lap and shoulder belts are more protective when used than are passive restraints, and that the active system is currently the only protective restraint available for back-seat occupants, there is an urgent need to develop and implement techniques for increasing the rate of seat belt usage.

Large-scale efforts to promote safety belt usage have included legal, educational, and engineering approaches. Exemplary of the legal approach was the legislation implemented in

Ontario, Canada in January 1976 that required automobile occupants to use active passenger restraints. Survey estimates prior to implementation of the legislation showed that approximately 17.0% of 6,040 Canadian drivers wore their lap belts. Two months after implementation of the legal mandate the percentage of seat belt wearers dramatically increased to 76.8% of the 6,354 drivers directly observed (Pierce, Toomer, Gardner, Pang, & Orlowski, Note 6).

Prior to the passage of Canada's mandatory safety belt law, a comprehensive public education campaign to encourage safety belt wearing was initiated and evaluated in Ontario, Canada (Cunliffe, DeAngelis, Foley, Lonero, Pierce, Siegel, Smutylo, & Stephen, Note 7). Signs, billboards, radio and TV advertisements, school programs, films, slide shows, and pamphlets were disseminated city-wide to encourage safety belt wearing. Baseline observations of stationary traffic indicated 17.4% seat belt wearers among 5,583 drivers. Six months after the multimedia educational program was initiated, the rate of restraint usage was only 17.2% of 6,040 drivers, suggesting that the educational/prompting program had no effect on seat belt usage. Similarly, in a well-controlled large-scale experiment, Robertson, Kelley, O'Neill, Wixom, Eiswirth, and Haddon (1974) found absolutely no effects of TV prompting on seat belt wearing.

Engineering approaches to encourage the application of active restraints have included ignition-interlock systems, and buzzer and light "reminders." The interlock system, requiring that front-seat belts are fastened before the car can start, was included in all cars manufactured in the U.S. from early 1974 to late 1975 (Stowell & Bryant, Note 3). However, the interlock system was banned after only one year, probably due to negative public reaction (cf. Robertson, 1975); and instead cars were equipped with buzzer and light "reminder" systems to motivate seat belt usage. Some of these systems are termed "unlimited," referring to the fact that the buzzer and/or light operates until the front-seat occupants make the appropriate escape response (i.e.,

fasten their seat belts). Other buzzer-light systems are "limited" and operate for only a short time (e.g., 3 to 8 sec) if front-seat belts are not buckled, and thereby represent a prompting strategy rather than negative reinforcement (as implicated by the unlimited systems).

A review of the literature revealed only two field studies that attempted to compare the behavioral impact of different mechanisms to induce seat belt usage. Robertson (1975) observed 58% belt usage of 2,101 drivers in 1974 cars (all with interlock systems), 28% usage of 5,951 drivers in 1973 cars and 25% of 2,085 drivers in 1972 cars (all equipped with a buzzer/light system which was either limited or unlimited), and 23% of 3,456 drivers in 1972 cars with no seat belt inducement system. Also, out of 326 persons who reported (via a questionnaire) that they had unlimited lights and buzzers in their cars, 70% had been observed wearing their seat belts; of 818 reports of interlock systems, 50% were belt users; and of 1,061 drivers who reported having limited reminder systems, 33% had been observed wearing their seat belts (Westefeld & Phillips, Note 8). Although interlocks and unlimited reminders were relatively effective in encouraging seat belt wearing, it is probable that several of the more intrusive systems were disconnected or circumvented. Robertson's methodology could not provide this information; but from their questionnaire data, Westefeld and Phillips did report the following percentages of defeated systems: interlock = 48%, unlimited light and buzzer = 36%, and limited light and buzzer = 8%.

The present research also attempted to assess the behavioral impact of interlock and reminder systems. Advantages of our study over the two previous investigations summarized above were that: (a) we directly observed both seat belt wearing and the type of engineering system in the vehicle to induce seat belt usage; (b) we assessed on-the-spot whether the interlock or reminder system had been defeated; and (c) we distinguished between seven possible systems (i.e., limited light, limited buzzer, limited light

and buzzer, unlimited light, unlimited buzzer, unlimited light and buzzer, and ignition interlock).

METHOD

Participants and Setting

Participants for this study were sampled from the staff and students of Virginia Tech, a large southeastern university of approximately 20,000 students. Drivers were observed as they entered and exited two large campus parking lots, one for students and the other for faculty. Approximately 25% of the vehicles entering and leaving these lots during observational periods were randomly surveyed. A total of 1,827 drivers were observed and 74.8% of these accepted the questionnaires that were offered. Of those receiving questionnaires, 42.9% completed and returned them. Of the 1,827 drivers observed, 70.8% were male and 29.2% were female.

Procedure

Two undergraduate research assistants independently collected data at each of seven parking lot entrance/exits. For six consecutive weeks, observations were made from 9:00 a.m. to 12:00 p.m. and from 1:00 p.m. to 3:00 p.m., Monday through Friday. These times corresponded to periods of moderate traffic flow. As a vehicle approached a given entrance/exit, two observers (wearing orange safety jackets) displayed the back of their clipboards on which was boldly printed "Driver Survey." After a vehicle had stopped, these observers approached the vehicle and independently recorded the driver's sex and whether she or he was wearing a seat belt. While observing seat belt usage, one observer inquired as to the type of system in the car to induce belt usage and whether or not it had been defeated by disconnection or circumvention. A questionnaire which duplicated the information obtained from the behavioral observations was handed to the driver, and she or he was politely requested to complete the questionnaire at home and return it by placing the questionnaire

in the attached envelope and dropping it in campus mail. During each observation period at least one of the authors rotated between observation sites to oversee the research activities.

RESULTS

Of the 1,827 vehicles observed, the two data recorders were in complete agreement on 1,579 cars (i.e., 86.4%) with regard to sex of driver, the type of seat belt inducing system, whether or not the system had been defeated (i.e., disconnected or circumvented), and whether or not the driver was wearing a seat belt. Only data from the 1,579 cars with 100% agreement on each observational component were analyzed. Self-report of restraint use was substantially greater (i.e., 54% of 586) than observational data (i.e., 24% of 1,579), although it may be that seat belt users were more apt to return a completed questionnaire. Also, a portion of this disparity may be attributed to the result that 83% of the drivers reported that they were traveling less than five miles when observed, and some of these drivers may have had their seat belts fastened if they had been traveling further. In fact, Fahner and Hane (1973a, 1973b) showed with self-report data that seat belt usage did increase as a function of distance traveled. On the other hand, Fahner and Hane (1973b) and Waller and Barry (Note 9) found discrepancies between observed and reported seat belt use that were similar to the present findings. The remainder of the results reported herein are based on the observational data.

Overall, 379 of the 1,579 drivers (24%) were observed wearing a seat belt of some type. Of these, 256 of the 1,113 males (23%) were wearing a seat belt, compared to 121 of the 466 females (26%). Of those vehicles with belt inducement systems ($N = 769$), 41.6% included devices that had been defeated by circumvention (e.g., a lap belt buckled behind the driver) or by permanent disconnection. Figure 1 displays percentage of systems defeated as a function of

the type of system. In general, the more intrusive the system, the more likely it was defeated.

Figure 1 also depicts percentage of belt wearing for intact and defeated systems, and illustrates substantially greater belt usage for vehicles with working devices (54.3% of 499) than for vehicles with defeated systems (15.9% of 320). In fact, the incidence of seat belt usage was almost identical for vehicles without devices (16.0% of 810) and vehicles with defeated devices.

A chi-square analysis tested the relationship between belt use and the seven device categories, and indicated a marked dependency between seat belt usage and system category ($p < .001$). As depicted in Figure 1, unlimited buzzers and ignition interlocks (when not defeated) resulted in 100% seat belt usage. However, the interlock and other systems which included an unlimited buzzer were frequently disconnected or circumvented; and when the system was defeated, seat belt usage was as low as it was in vehicles with no engineering system to induce seat belt wearing.

DISCUSSION

As discussed earlier, it appears inevitable that active restraints will remain in passenger vehicles in conjunction with passive shoulder belts and/or air bags. Therefore, in order to realize optimum occupant protection, an increased usage rate for seat belts is necessary. The experiment reported herein showed that the intrusiveness of the engineering reminder system installed in vehicles to promote seat belt usage influenced both the probability of seat belt wearing and the probability that the reminder system had been disconnected or circumvented. Thus, when ignition-interlock systems and unlimited buzzers were in effect (as intended by the car manufacturers) drivers were always wearing their seat belt, but a majority of these systems (a mean of 62%) had been defeated. Similar findings were also shown earlier by Robertson (1975) and Westefeld and Phillips (Note 8), but only the present research used direct obser-

Fig. 1. Relationships between the intrusiveness of the "reminder" system installed in vehicles to induce seat belt wearing and percentage of: defeated systems, seat belt usage when "reminder" systems are defeated, and seat belt usage when "reminder" systems are not defeated (i.e., intact).

variation to categorize the reminder systems and to determine whether the system had been defeated.

Because the public has opposed government regulation of seat belt usage (Proceedings,

1973), because limited buzzer and light systems are ineffective in prompting seat belt wearing, and because the escape behavior prompted by interlock systems and unlimited buzzers is more

apt to result in system defeat than in belt wearing, alternative measures for increasing seat belt usage should be explored. It is possible to implement contingencies for discouraging the disconnection of existing reminder systems (e.g., by requiring vehicles to have a working system in order to pass state inspection), and this may indeed increase belt usage if the reminder systems are unlimited buzzers and/or ignition interlocks. Although even with this addition to a state inspection mandate, it would be possible for vehicle occupants to escape control by the system by buckling their belt behind them; and under such an obvious attempt at governmental control, circumvention responses would be likely, as predicted by psychological reactance theory (Brehm, 1972).

The undesirable side effects of the punishment and negative reinforcement contingencies implicated by existing legal and engineering approaches toward inducing seat-belt usage (e.g., system disconnection and circumvention) would be virtually eliminated if seat belt wearing could be positively reinforced on a large scale (cf. Skinner, 1971); and it is our opinion that long-term, positive reinforcement contingencies for encouraging seat belt usage on a large scale are feasible. Suppose, for example, that buckled seat belts resulted in the illumination of a light above the vehicle's license plate, and that certain rewards were contingent on a "behavior manager" in the community observing a lighted license plate (and perhaps subsequently observing actual belt wearing). The "behavior managers" could be police officers, parking lot attendants, tollbooth operators, and/or cashiers at drive-in windows of banks or fast-food restaurants; and the rewards could be, respectively, reductions in fines for traffic violations, entrance to a special "fast" traffic lane, discounts on parking charges, or inexpensive trinkets which promote the "goodwill" safety concern of stores, banks, or fast-food chains. Such a community-wide strategy for promoting transportation safety would require extensive, interdisciplinary cooperation between engineers, behavioral scientists, educators,

manufacturers, politicians, and businessmen (cf. Johnson & Geller, 1980). A necessary prerequisite for such collaboration is a clear demonstration that community-wide reinforcement procedures for seat belt wearing are acceptable to drivers, merchants, and community officials; are cost effective over long periods of time; and that increases in seat belt wearing due to positive reinforcement will generalize across environmental settings. Thus a challenge for behavioral community psychologists is evident!

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