

EFFECTS OF ENVIRONMENTAL DESIGN AND POLICE ENFORCEMENT ON VIOLATIONS OF A HANDICAPPED PARKING ORDINANCE

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This study presents two experiments that evaluate strategies to reduce violations of a handicapped parking ordinance. The first experiment compared effects of upright versus ground handicapped parking signs on percentage of intervals in which cars were parked illegally. Introducing upright signs produced an immediate reduction in the percentage of intervals of inappropriate use of parking spaces. The second experiment examined effects of a police enforcement program on percentage of intervals of inappropriate use of parking spaces and frequency of inappropriately parked cars. Results showed consistent reductions in percentage of intervals of inappropriate use and number of inappropriately parked cars compared with a control site where no enforcement program was introduced. Implications of the research data for law enforcement and public policy are discussed.

DESCRIPTORS: law enforcement, handicapped parking, environmental design

An important aspect of community accessibility is the availability of parking spaces for persons with disabilities. Violations of handicapped parking ordinances prevent community access and therefore limit all aspects of community involvement for people with physical disabilities (Toomer, 1986).

Inappropriate use of handicapped parking spaces is a widespread problem. It has been identified in surveys as a concern in cities ranging from rural Viburnum, Missouri, to Los Angeles, California (Fawcett, Suarez de Balcazar, & Johnson, 1986). Parking spaces for people with disabilities are usually located close to main entrances and access ramps, and they should be wide enough to permit wheel-

chairs to unload (Department of Housing and Urban Development, 1980). These designated parking spaces are marked by painted yellow lines, a ground sign, and in some cases, an upright metal sign. Both ground and upright signs display the international access symbol—an outline of a person in a wheelchair.

Strategies to promote compliance with state and local parking ordinances involve manipulating antecedent and consequent events, such as parking signs and fines. Few studies have actually analyzed the discriminative function of handicapped parking signs. Jason and Jung (1984) compared the frequency of cars parked illegally in spaces marked with a ground sign versus an upright metal sign. The authors demonstrated that the upright sign was more effective than the ground sign, eliminating all violations during 1 week of data collection on a university campus. The long-term effects of the upright sign, however, were not evaluated beyond a period of 4 months.

Behavioral researchers have reported that discriminative stimuli, such as signs, may not be sufficient to maintain behavior changes for many behaviors important to community health and safety, including smoking reduction (Jason & Liotta, 1982), energy conservation (Winett, 1978), and compliance with highway speeding regulations (Van Houten & Nau, 1981). However, White, Jones,

This manuscript was based on the first author's dissertation submitted to the Department of Human Development at the University of Kansas. Preparation of this manuscript was supported in part by a grant G008006928 from the National Institute of Handicapped Research to the Research and Training Center on Independent Living at the University of Kansas.

We gratefully acknowledge the assistance of Ron Olin (Lawrence Chief of Police), Bill Rogers, Barbara Lumbley, the members of Independence in Action, and staff members of the local independent living center for their collaboration on this project. We are also grateful to Bill Hopkins, Mark Mathews, and Montrose M. Wolf for their valuable assistance and advice, and to Katie Fawcett for her feedback on observer instructions.

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Ulicny, Powell, and Mathews (1988) reported that warning signs announcing the amount of the fine can consistently reduce inappropriate use of parking spaces.

Researchers have effectively manipulated aversive consequences in attempts to promote compliance with a variety of state and local laws. Issues have included littering (Geller, Winett, & Everett, 1982), trash packaging (Stokes & Fawcett, 1977), city crime (Schnelle, Kirchner, Casey, Uselton, & McNees, 1977), and speeding (Van Houten & Nau, 1983; Van Houten *et al.*, 1985).

Two experiments were conducted to evaluate the effects of combinations of antecedent and consequent events—signs and police enforcement—in reducing violations of handicapped parking ordinances. The purpose of the first experiment was to compare the effects of two antecedent stimuli—upright versus ground parking signs—on the percentage of intervals of inappropriate use of handicapped parking spaces. In Experiment 2 we examined the effects of upright signs combined with police enforcement on inappropriate parking. Both studies were conducted in collaboration with a local citizens' group of persons with physical disabilities who participated in selecting sites for observation, collecting observations, and negotiating a police crackdown on violators.

EXPERIMENT 1

METHOD

Participants and Settings

Drivers who were parked in any of four parking spaces reserved for people with disabilities in two commercial parking lots were the target participants of this experiment. The parking spaces were located in front of grocery stores in a midwestern university town (Lawrence, Kansas, population 52,788). Each parking lot had spaces for more than 50 cars and two parking spaces reserved for people with disabilities. These spaces were identified by a yellow ground sign (1.8 m by 1.8 m) displaying the international access symbol. Informal interviews conducted with

members of a local advocacy organization of persons with physical disabilities indicated that these parking spaces were frequently used inappropriately. Pilot data collected during daily 1-hr observation intervals at each site over a 5-day period confirmed these informal reports.

Data Collection

At the beginning of the study, the managers of the two stores were contacted. They both gave permission for the researcher to observe the use of handicapped parking spaces in their parking lots.

A 1-min time-sampling interval-recording procedure was used to record the number of intervals in which a car was parked in each space. A trained observer recorded for 1 hr at each site. At the end of each minute, the observer checked whether a car was parked appropriately or inappropriately. Data were collected three times a week between 4:30 and 7:30 p.m. for 1 hr. Data collection hours were determined by previous pilot observations indicating these hours to be the busiest. Data were collected during the fall semester, while the university was in session. Follow-up measures were collected 2, 5, and 8 months after the introduction of the independent variable.

Four trained observers scored driver behavior at selected sites. The observers were located in parked cars in front of the target parking spaces. The presence of the observers was not apparent to drivers parking in the target spaces. When a car parked in one of the target spaces, the observer recorded whether the car was parked appropriately or inappropriately using the following definitions.

Appropriate parking. A car was considered appropriately parked in the designated space when the vehicle was stopped (not moving for at least 5 s whether or not the engine was running) and displayed a legal parking identification. Types of legal identifications are a license plate with a wheelchair symbol, a license plate with the words "Disabled Veteran," or a blue window tag with the white wheelchair symbol.

Inappropriate parking. A parking space was used inappropriately when a vehicle that did not

display a legal identification was parked in the designated space.

Observers were trained using instructional procedures (Suarez de Balcazar & Fawcett, 1985) and supervised practice. Observers were instructed to get out of the car to look for identification after the motorist stepped out if a legal identification was not in the observer's view.

Reliability

Measures of interobserver agreement were obtained by having independent observers record appropriate or inappropriate use of each parking space for 3 hr during each condition. An agreement was checked when both observers scored a space as being empty or when they scored a vehicle as either parked appropriately or inappropriately during the same interval. Reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements multiplied by 100. The average reliability for Site 1 was 96% and for Site 2 100%. Reliability was also calculated separately for appropriate and inappropriate parking intervals, excluding the intervals in which the spaces were empty. This reliability was 95% for inappropriate parking and 100% for appropriate parking.

Experimental Design

A multiple baseline design across two sites (Baer, Wolf, & Risley, 1968) was used to examine the effects of upright signs on the number of intervals of appropriate and inappropriate parking.

Ground sign. During baseline, each of the four parking spaces had a yellow sign with the international access symbol painted on the ground. Data were collected for 2 weeks at Site 1 and 6 weeks at Site 2.

Upright parking signs. The independent variable consisted of installing an upright metal sign in addition to the existing ground sign. The two upright signs installed at Site 1 were metal signs (25 cm by 35 cm) that displayed a white international access symbol on a blue background. Both signs were installed in front of each parking space, 2.1 m high on a column of the building. Identical

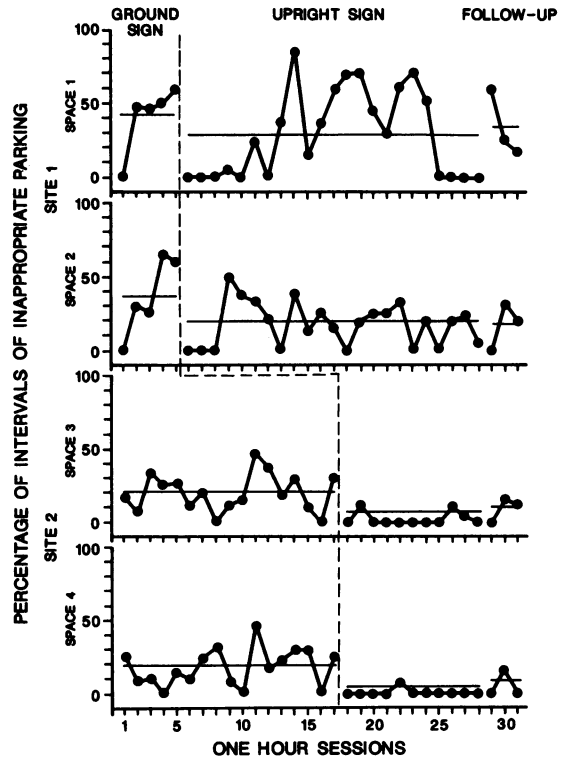


Figure 1. The percentage of intervals of inappropriate use of handicapped parking spaces before and after upright metal signs were installed in four handicapped parking spaces. Follow-up measures were collected 2, 5, and 8 months after the installation of upright parking signs.

signs were installed at Site 2. These signs were attached to a post, 1.2 m high, located in front of each parking space.

Follow-up. Follow-up measures were taken 2, 5, and 8 months after introduction of the independent variable.

RESULTS

Figure 1 shows the percentage of intervals of inappropriate use of the four parking spaces. At Site 1, Spaces 1 and 2, the average percentages of intervals of inappropriate parking during the baseline condition were 41% and 36%, respectively. After the signs were installed, the average percentage of intervals of inappropriate parking was 29% for Space 1 and 18% for Space 2. During

follow-up, the average percentage of intervals of inappropriate parking was 32% for Space 1 and 17% for Space 2.

At Site 2, Spaces 3 and 4, the average percentages of intervals of inappropriate parking during baseline were 20% and 18%, respectively. After the upright signs were installed, the average percentage of intervals of inappropriate parking was 4% for Space 3 and 2% for Space 4. During follow-up, the average percentage of intervals of inappropriate parking was 7% for Space 3 and 5% for Space 4.

Data were also collected on the percentage of intervals of appropriate parking. At Site 1, for Spaces 1 and 2 combined, the average percentage of appropriate parking was 19% during baseline and 24% after the independent variable was introduced. At Site 2, for Spaces 3 and 4 combined, appropriate parking increased from 16% during baseline to 20% after the upright sign was installed.

DISCUSSION

Upright signs produced an immediate reduction in inappropriate parking in all four parking spaces. These findings suggest that upright signs displaying the international access symbol are more effective than ground signs in reducing inappropriate use of parking spaces.

The greater effect of the signs at Site 2 may be due to the lower height of the signs at this site. Although business managers received specific information about the height of the signs, the signs installed at Site 1 were posted 0.9 m higher than specified by local standards. It is possible that at Site 1, the signs were less visible to the driver approaching the parking space.

During this experiment, observers did not report seeing persons with a visible disability using the parking spaces without a parking permit. No fines were delivered to violators of the parking ordinance. A second experiment was conducted to examine the effects of aversive consequences—fines—combined with upright parking signs on the percentage of inappropriate use of parking spaces and the frequency of illegally parked cars.

EXPERIMENT 2

METHOD

Participants and Settings

Drivers using any of seven parking spaces reserved for people with disabilities in three commercial parking lots in two midwestern cities participated in the study. Two parking sites in Lawrence, Kansas, different from the ones targeted during Experiment 1, were chosen for this experiment. A control site was selected in a medium-sized city (Topeka, Kansas, population 150,256) located 35 miles from the experimental sites in Lawrence. Each of the experimental sites had two parking spaces reserved for people with disabilities, and the control site had three such parking spaces. All parking spaces had a yellow ground sign (1.8 m by 1.8 m) displaying the international access symbol and an upright metal sign (1.2 m high) located in front of each space.

Several factors were considered in selecting these sites. First, informal interviews conducted with persons with disabilities from both cities suggested that these three sites were used frequently by people with disabilities and sometimes inappropriately by nondisabled drivers. Second, 2 hr of direct observation at each site confirmed the informal reports. A third factor was that the upright signs had been installed in these parking spaces for at least 1 year.

Data Collection

The first author trained two persons with physical disabilities to collect data. The same recording method used in Experiment 1 was used in Experiment 2. Observations took place between 4:30 and 6:30 p.m., for 1 hr, six times per week from Monday to Saturday. The number of cars using the parking spaces was also recorded.

Reliability

Measures of interobserver agreement were obtained in the same manner as described in Experiment 1. The overall percentage of agreement was 100% for each of the experimental sites and 96% for the control site. Interobserver agreement ex-

cluding the intervals in which the spaces were empty was 98% for appropriate parking and 95% for inappropriate parking.

Experimental Design

A multiple time-series analysis with a nonequivalent control site (Campbell & Stanley, 1963) was used to evaluate the effects of the police crackdown on the number of cars inappropriately parked and the number of intervals of inappropriate parking in spaces reserved for people with disabilities.

Baseline. All parking spaces were marked by a yellow sign displaying the international access symbol and an upright metal sign in front of the space. This condition lasted for 1 week.

Citywide police crackdown. The Lawrence Assistant Chief of Police initiated a police crackdown after discussing the problem with the first two authors and one representative of an advocacy group for people with disabilities. The assistant chief also reviewed data from Experiment 1. The citywide police crackdown program went into effect in Lawrence for 1 week. Parking tickets were issued by police officers to vehicles inappropriately parked in spaces reserved for people with disabilities. Approximately six regular police officers patrolled handicapped parking spaces in private lots an average of once every 2 hr for 12 hr of each day.

Police officers had no knowledge of which parking lots were being observed. During the crackdown, police officers issued a total of 60 tickets, with a fine of \$25 per ticket. Of those tickets, 54 fines were paid and six were dismissed in municipal court. Nine tickets were issued in the two experimental sites during the crackdown. During this and subsequent conditions, no police enforcement was in effect at the control site. The police crackdown was not publicized in the local media.

Reduced enforcement. Police officers were instructed to continue patrolling parking spaces without giving up other priorities. Occasional checks were conducted by police officers in parking lots during each week. The reduced enforcement procedure lasted for 1.5 years.

Follow-up. Follow-up measures were taken 1

week, 1, 5, 8, and 12 months after the 1-week citywide police crackdown was completed. Each observation session lasted 1 hr.

Social Validity Measures

To assess satisfaction with the two interventions, a survey was sent to the six managers of stores at which the interventions took place, the assistant police chief and six officers who participated in the enforcement program, nine persons with physical disabilities who were active members of a local advocacy organization, and 12 members of the board of directors of the local independent living center. These people were asked to rate the importance of the parking problem, willingness to support another police enforcement program, and satisfaction with the police crackdown. These three questions were rated on a 5-point scale.

RESULTS

Figure 2 shows the percentage of intervals of inappropriate use of reserved handicapped parking spaces for the two experimental sites and one control site. During the baseline condition, the average percentages of intervals of inappropriate parking for Sites 1 and 2 were 20% and 27%, respectively, and 22% for the control site. During the police crackdown, the average percentages of intervals of inappropriate parking for Sites 1 and 2 were 12% and 15%, respectively, and the control site had an average of 30%. During the reduced enforcement period, the average percentage of intervals of inappropriate parking for Site 1 was 11%, 8% for Site 2, and 25% for the control site. During follow-up, the average percentages of intervals of inappropriate parking for Sites 1 and 2 were 3% and 1%, respectively, and 30% for the control site.

Data on the frequency of cars using the parking spaces inappropriately were also collected. During baseline, an average of 3.6 cars were parked inappropriately at Site 1, four cars at Site 2, and 3.5 cars at the control site. During the police crackdown, an average of 1.5 cars were parked inappropriately at Site 1, 2.1 cars at Site 2, and 3.1 cars at the control site. During reduced enforce-

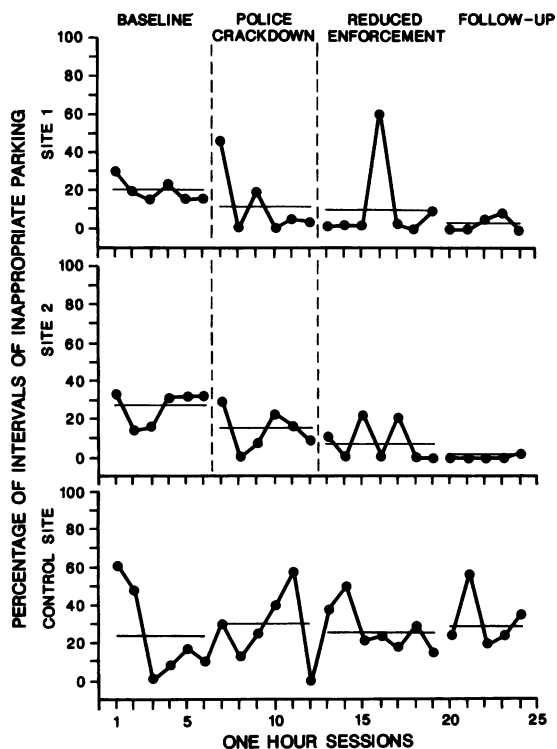


Figure 2. The percentage of intervals of inappropriate use of handicapped parking spaces before, during, and after a 1-week police crackdown was introduced at experimental sites. Follow-up measures were collected 1 week, 1, 5, 8, and 12 months after the reduced enforcement condition.

ment, an average of 1.0 car was parked inappropriately at Site 1, 0.7 car at Site 2, and 4.5 cars at the control site. During follow-up, an average of 0.6 car was parked inappropriately at Site 1, 0.2 car at Site 2, and 4.0 cars at the control site.

Measures of appropriate parking were also taken. During the baseline condition, the average percentage of appropriate use of parking spaces for Sites 1 and 2 combined was 15% and was 24% for the control site. After the intervention, the average of appropriate use was 20% for Sites 1 and 2 and 22% for the control site.

Social Validity Data

Overall, respondents indicated that inappropriate use of handicapped parking spaces was an

important problem (4.6 average rating on a 5-point scale) and that they were willing to support another police crackdown (4.3 average rating). In addition, respondents indicated an overall rating of 3.6 satisfaction with the police enforcement program.

DISCUSSION

Results from the experimental sites showed consistent decreases in inappropriate parking following the crackdown. The effects of the police enforcement program were maintained during follow-up. In the control site, where no police enforcement program was introduced, inappropriate use of handicapped parking spaces and the frequency of cars parked inappropriately remained at similar levels during all experimental conditions. These findings suggest that the discriminative function of the upright handicapped parking sign can be enhanced by introducing appropriate consequences (fines) for illegally parked drivers. Slight increases in appropriate parking were also observed. Observers reported that on three occasions a person with a visible disability was parked without the legal identification required; these events were recorded as inappropriate parking.

GENERAL DISCUSSION

The results of the first experiment suggest that upright signs are more effective than ground signs in reducing the percentage of parking violations. The signs' effects were more durable at the second site, where the upright signs were located at the driver's eye level and presumably were more easily seen. Although the use of upright signs can decrease inappropriate parking, there is still room for further improvement.

The second experiment showed that the police crackdown was effective in reducing inappropriate use of handicapped parking spaces. Had the police crackdown been publicized in the local media, however, the effects may have been greater. The local consumer advocacy group recommended against publicity for fear of alienating community members

who might later support their long-term plans for improving community conditions for independent living. A cumulative effect of police enforcement may have produced better compliance during the reduced enforcement condition. Results of these two experiments demonstrate that a combination of upright parking signs and police enforcement is an effective and feasible strategy for reducing inappropriate use of handicapped parking spaces.

The discriminative function of upright handicapped parking signs seems to be enhanced by the presence of police patrols. Although few drivers directly experienced the aversive consequence of a fine, many more may have seen police cars patrolling handicapped parking sites and ticketing violators. Van Houten and Nau (1983) and Van Houten et al. (1985) indicated that the effectiveness of police enforcement procedures may be a function of the density and visibility of punishment.

This study intended to facilitate consumer participation in the research process. A nine-step consumer action guide (Suarez de Balcazar & Fawcett, 1985) was prepared to help consumers address the problem of violations of handicapped parking ordinances in their communities. This guide includes instructions for assessing the levels of parking violations and suggests steps to solve the problem by involving consumers, store owners, and police officers. The consumer action guide is disseminated to independent living centers and consumer advocacy organizations across the country.

Two cost factors were considered in this study: the cost of upright parking signs and the cost involved in the police crackdown. Each handicapped parking sign costs approximately \$15, plus about \$50 for the post and installation. According to the Assistant Chief of Police, the police enforcement program did not produce any extra cost for the police department, because it was conducted during regular patrol hours and at usual patrol areas. Of the 60 tickets issued during the crackdown, 54 tickets were paid, producing \$1,350 in revenue for the city. The enforcement program had to be discontinued, however, because of the need to redeploy police resources in other enforcement areas. In-

creased personnel or alternative enforcement agents, such as people with disabilities, may be required if handicapped parking is to be enforced continuously.

Finally, after the study was terminated, results were presented at local (Suarez de Balcazar & Fawcett, 1985) and state levels (Fawcett & Suarez de Balcazar, 1985) to influence policy recommendations. Three policies were adopted at the local level: (a) property owners are required to install upright signs, (b) the police department is to conduct periodic enforcement of handicapped parking, and (c) the fine is to be increased up to \$250 for repeated violators. At the state level, the legislature adopted a policy requiring all designated parking spaces to be clearly marked by an upright sign and all new or relocated handicapped parking spaces to meet the specification requirements of the American National Standards Institute (Department of Housing and Urban Development, 1980).

To conclude, the two experiments described in this paper suggest that the problem of inappropriate use of handicapped parking spaces can be addressed by arranging antecedent and consequent events, such as upright signs and police enforcement. This paper also presents a model for conducting applied interventions by selecting a problem of social importance, developing procedures to address it, conducting experimental evaluations, and developing instructional materials for consumers and policymakers to use in replicating the procedures and effects in other local communities.

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Received July 30, 1987

Initial editorial decision October 2, 1987

Revisions received January 21, 1988; March 30, 1988

Final acceptance May 5, 1988

Action Editor, Ron Van Houten