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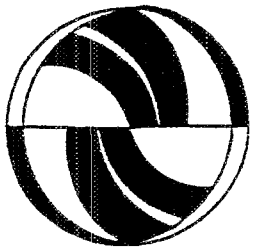

Attitudes of Visually Impaired Persons Toward the Use of Public Transportation

Reginald G. Golledge
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Attitudes of Visually Impaired Persons Toward the Use of Public Transportation

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Attitudes of Visually Impaired Persons Toward the Use of Public Transportation

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Abstract: This article reports on a survey of the use of buses in Santa Barbara, California, by 55 persons who are visually impaired (including those who are blind and those who have low vision). Findings on users' frustrations, potential use of technological aids for travel, and perceptions of and attitudes toward the characteristics of bus services are presented. In addition, differences in the responses of those to whom household cars were and were not available are analyzed, and suggestions for dealing with the participants' major concerns are provided.

The study reported in this article investigated possible ways to make the public transportation system (Metropolitan Transit District, MTD) of the Santa Barbara, California, area, namely, bus transportation, more accessible for use by persons who have low vision or are blind (hereafter called visually impaired). In this area, different forms of regularly scheduled and personalized systems are available (including buses, EZ lift vans, Dial-a-Ride, and privately operated and institutionalized van pools). Admittedly the Santa Barbara population (about 180,000 in the contiguous built-up area) does not have the same range of public transportation opportunities available as would be found in larger cities that have suburban rail systems, trolleys or light-rail systems, subways, and so forth. However, the authors' aim was to develop a procedure for evaluating a population's felt needs and comparing these needs with assessments of the advantages and disadvantages of the types of services offered, and the Santa Barbara area is large and complex enough to do so. Similar studies have been undertaken in other medium- and small towns in the United States, but many of their findings are included in technical reports that have limited circulation (see, for example, Hunter-Zaworski & Hron, 1993; Lifespan Associates, undated).

Preliminary estimates from the 1990 census suggest that approximately 4 million people in the United States are severely visually impaired and cannot drive or have difficulty reading signs or printed matter. The census defines "vision disabled" people as those who are unable to read ordinary newsprint. It was estimated elsewhere (Santa Barbara Braille Institute, 1994) that about 1.2 million people are registered as legally blind in the United States and that about .07 percent of the California population is legally blind.

As part of the process of understanding the needs of people who are visually

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impaired for safe, reasonable, and equal access to public transportation, it is first necessary to pay some attention to the problem of what it means to be a nondriver (Coburn, Martin, Thompson, & Norstrom, 1992; Corn & Sacks, 1994) and, in this regard, build on the findings of Corn and Sacks (1994). For many users of public transportation, driving is still an option, although, of course, many people in the general population cannot afford to own and operate vehicles. For many people who are visually impaired, the only feasible alternative to using public transportation is to walk, which obviously restricts their activities and gives some a sense that the quality of their lives is diminished.

The research reported here was driven by the notion that attempts to increase the use of public transportation by people who are visually impaired will not be successful until it is known what negative feelings are produced by limitations on mobility and what causes these limitations. Only then can the possible value of providing assistive devices that can partly compensate for negative situations be assessed. The second objective was to determine the characteristics of public transportation that are most acceptable or unacceptable to travelers who are visually impaired. Other concerns were to examine the degree to which more and better information can compensate for perceived problems, to find acceptable mechanisms by which this information can be dispensed, and to evaluate people's responses to the possible availability of different information systems.

Technical travel aids

For decades, devices to assist the mobility of travelers who are visually impaired have been developed and refined. Brabyn (1982, 1985, 1995) presented excellent reviews of many of these devices, including obstacle avoiders and navigation aids.

Obstacle avoiders

Two examples of obstacle avoiders are the Mowat Sensor and the Sonic Guide. The Mowat Sensor is a handheld electronic device that relies on vibrations provided by a sonic beam when it is reflected from a nearby surface to warn of an obstacle's presence (with a range of less than 6 feet). It is often used in traveling in hallways of buildings or for shorelining in shopping malls or continuously built-up areas.

The Sonic Guide relies on a reflected ultrasound beam that is received binaurally via receivers built into a pair of eyeglasses. After training, the traveler is able to perceive and interpret signals from various types of surfaces (such as vegetation, glass, cement, wood, and metal) in a range of less than 20 feet that helps him or her define obstacles and other environmental features.

Navigation aids

A number of navigational (guidance) aids that are designed for personal use have been available since the 1980s. Examples include the following:

1. tactile maps (Tatham & Dodds, 1988; Wiedel, 1983)
2. disposable tactile strip maps (Golledge, 1991), similar to those produced by the American Automobile Association for car drivers, but printed tactilely on chemically treated capsule paper
3. guidance systems using global positioning systems (GPS), such as Arkenstone's Strider (Fruchterman, 1995) and Personal Guidance System (Loomis, Golledge, & Klatzky, 1993,

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1995), both of which use a GPS and a voice synthesizer to provide information on routes and landmarks to travelers, but in substantially different ways.

The NOMAD is a self-contained automated auditory-tactile information system. This system is especially useful in planning trips (Parkes & Dear, 1990).

New devices

The most recent devices suggested for assisting travelers involve the use of infrared signage placed directly on buses (as in recent San Francisco experiments; see Crandall, Bentzen, & Myers, 1995), in terminals, or on nearby streets. These are auditory signs (such as Talking Signs) and, according to recent evaluations of pilot studies in downtown San Francisco (Bentzen & Mitchell, 1995; Crandall et al. 1995), are both useful and popular.

But not all the new devices are useful or acceptable to travelers who are visually impaired. For example, a system that provided route and current bus-location information distributed via cable television networks was tested in Ann Arbor, Michigan (personal communication with J. Nystuen, Department of City and Regional Planning, University of Michigan, Ann Arbor, April 12, 1995), but was soon discontinued. Smart Travel Kiosks (Southworth & Isaacs, 1994), which have been tried in Los Angeles, have had some success in making information available to all travelers, but these kiosks need to be tested further with travelers who are visually impaired. Technologies like the latter two have not yet progressed beyond the trial stage. Given that experiments such as these are taking place, the question is how best to fit such technology to the needs of a specific targeted group of travelers. Thus, the final section of this article addresses this issue.

Method

Participants

As was mentioned earlier, an estimated .07 percent of the population of California are legally blind (Santa Barbara Braille Institute, 1994). In the absence of nationally collected information on the whereabouts of people who are visually impaired (privacy considerations limit the public availability of such data), and assuming that slightly more than half these persons would use public transportation (Svendsen, 1994), the authors estimated that about 14,000 random digit-dialing calls would have to be made in the Santa Barbara area to net a modest goal of 50 participants. Instead, they contacted four local agencies whose clients include people who are visually impaired: the University of California at Santa Barbara (UCSB) Disabled Students' Program, the Santa Barbara Braille Institute, the local branch of the State Department of Rehabilitation, and the local bus service (MTD). These agencies agreed to distribute a call for potential participants, who contacted the survey office directly; participants from two of the agencies represented about 50 percent of their clients. To reach the most people, the authors offered the survey by mail (in large print or braille), telephone, or in-home interviews.

The final sample consisted of 55 individuals—24 from the local branch of the State Department of Rehabilitation, 10 from the MTD, 11 from the Santa Barbara Braille Institute, and 10 from the UCSB program. Fifty-three percent of the participants preferred mail (large-print) surveys; 33 percent, telephone surveys; and 15 percent,

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in-home interviews; none requested a survey in braille.

Demographic characteristics

With regard to demographic characteristics, 62 percent of the participants were female and 38 percent were male. The participants were fairly evenly distributed among four age groups: 20–39 years, 21.8 percent; 40–59 years, 20 percent; 60–79 years, 29.1 percent; and 80 years or older, 29.1 percent; thus, 58.2 percent of the participants were aged 60 or over—a bias that is consistent with national trends for visual impairment (U.S. Census of Population, 1990). The majority (93%) were legally blind; the other 7 percent were visually impaired to a lesser degree (with visual acuities ranging from 20/30 to 20/110). The average age at the onset of blindness was 42 (standard deviation ± 31). Only 16.7 percent of the sample used braille.

Three participants still intermittently drove a car, and 10 participants lived in households in which private cars were available (usually driven by family members). In addition, the participants were highly educated; 20 percent had postgraduate training, 16.4 percent had attended four-year colleges or universities, 23.6 percent had attended junior colleges, 25.5 percent had high school diplomas, and 14.5 percent had less than a high school education.

The authors did not record information on the participants' race or ethnicity and do not know the ethnic composition of the total population in the local area who are visually impaired. However, it seemed that almost all the participants were Caucasian.

Restrictions

Of the 55 participants, 60.4 percent agreed that they had no serious restrictions other than problems resulting from visual impairment that would affect their use of public transportation. However, 38 percent required a special aid to move around freely enough to board a bus, 29 percent found it difficult to stand even for short periods (56.4 percent had no serious problem walking), and 23.6 percent had great difficulty climbing stairs. In addition, 71 percent had difficulty reading transit schedules, and 93 percent agreed that their greatest difficulty was reading signs or vehicle route numbers.

Assistive devices

Of the 55 participants, 60 percent stated that they required only a long cane (to sweep the surface being traveled), crutches, or a walker to navigate or travel, and almost 20 percent used a short cane (carried in front of the body to warn them of obstacles, but not long enough to contact the ground in a sweeping motion to guide travel and warn of ground-level obstacles and irregularities); only 1 participant used a dog guide. In addition, 23.5 percent used spotting telescopes (primarily to pick out route numbers on buses or to read street signs), and 15.4 percent referred to typed, brailled, or handwritten signs on cards that described their routes and the buses or bus stops they would use on a trip. Other assistive devices, such as laser canes, Mowat Sensors, Sonic Guides, audiotaped directions, tactile maps, magnified copies of schedules, and rote-learned verbal instructions for following paths, were occasionally mentioned.

The survey

The survey consisted of three sections. The first section addressed background questions: age, sex, educational level, zip code, cause of disability, number of

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disabilities, age at diagnosis of visual impairment, estimate of visual acuity, use of braille, access to a household car, driving status, distance in blocks to the nearest bus stop, and constraints on mobility stemming from a disability.

The second section focused on travel and periodic activities. Questions were asked about time spent in setting up out-of-home trips, waiting times when using buses compared to other modes of travel, the primary activity for which travel assistance was needed, the frequency of use of public transportation, the average travel time for various trip purposes (such as shopping, social activities, agency services, and work), the extent to which travel was shared, three reasons for using public transportation, the types of assistance (human or other) used for selected trip purposes, and the mode of travel used for each trip. This section thus focused on the activities of participants. The results were published elsewhere (Marston, Golledge, & Costanzo, 1997).

The third section (which is the focus of this article) examined the participants' knowledge and perceptions of and attitudes toward the use of public transportation. The first set of questions probed the participants' knowledge of available MTD offerings, degree of independence when traveling, frustrations related to any level of dependence, and frustrations and limitations of not driving; the ease and safety of using the MTD; and the degree (if any) to which they viewed the necessary use of public transportation as undignified or socially constricting. The second set of questions examined the perception of difficulty (or ease) when pursuing travel-related activities, such as obtaining information on schedules; transferring from one vehicle to another; getting on and off buses; recognizing the vehicle to be boarded; finding out where they were en route; using the fare system of tickets, tokens, or cash; estimating the arrival or waiting time at pick-up points; and learning where connecting vehicles can be found. The third set of questions concerned the participants' assessments of the potential usefulness of personal and technical aids to travel and travel planning, including broadcast radio or television messages, voice-synthesized or human-operated information hot lines, E-mail messages, auditory signals and messages in terminals and bus stops (Talking Signs and Verbal Landmarks), and large-print schedules available at the bus terminal or on a bus.

In the fourth set of questions, the participants were asked to evaluate the usefulness of a variety of assistive devices, and even if they did not know what functions they performed, to respond on the basis of how useful they thought certain types of devices (such as computer-based or sonar-based devices and tactile maps or diagrams) would be. The fifth set of questions were related to their concerns when using public transportation, including safety or fear of crime, timeliness, crowding, care or civility by operators and drivers, frequency of service, and adequacy of service area. The sixth set of questions were designed to uncover the existence and degree of frustration the participants felt with regard to the characteristics of the bus service, alternative behaviors when "things go wrong" (such as missed connections), and the types of information (auditory and printed messages) in terminals and on board vehicles. In the final set of questions, the participants were asked to think about what would constitute an ideal public transportation system

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from their viewpoints and to evaluate whether current actions by some transit agencies (including auditory maps and signs and personal guidance systems) would be compatible with their desires. As part of the general debriefing, they were asked to list up to three things they would like to see in a public transportation system that would encourage them to use buses more extensively.

Responses to most of these questions were scaled on a single variable 5-point Likert scale (for example, ranging from "not at all useful" to "extremely useful"). All the participants were paid for completing the survey, which usually took about one hour.

Data

Since most of the data consisted of scale scores, the results were tabulated, and relative and cumulative response frequencies were calculated. It quickly became obvious that there was a strong bimodal tendency in the data and that attempts to use measures of central tendency would give spurious results, which meant that statistics based on central tendencies would not be useful diagnostic tools. Thus, the strategy adopted was merely to report percentage responses and to comment on them.

The bimodality in responses proved to be the result of two differentiating variables: access to a household car as an alternative to using public transportation (buses) and the frequency of using buses (between high users, who used buses two or more times per week, and low users, who used them infrequently, or less than once a week). The group who had access to household cars and the infrequent-user group were similar, the difference being the one person in the sample who used a dog guide. The woman who used a dog guide stated that for most of her activities, walking with the dog was adequate, but for an occasional longer trip, she took a bus. Nevertheless, the authors examined the differences between the responses of the two dominant groups. Only the important empirical results of Section 3 of the survey are reported here.

Results

Daily effects of vision loss

For questions on the participants' opinions, perceptions, and attitudes with respect to the daily effects of visual impairment on not driving, navigation, and use of transit, the participants chose the answers, ranging from 1 ("strongly agree") to 2 ("agree") to 3 ("uncertain") to 4 ("disagree") to 5 ("strongly disagree"), that best fit their attitudes. In terms of the responses of the total sample, the following results appeared to be the most important:

- Most of the participants (67%) were dependent on others for transportation, and 78 percent reflected high degrees of frustration from this dependence.
- The majority of the participants were familiar with the range of transportation services for disabled people in the local community, but only 58 percent agreed that what was available suited their current needs.
- Almost all the participants (93%) agreed that using the MTD buses was safe and there was no fear of crime; this view was the opposite of that expressed by subway travelers in New York City (Miller, 1983).
- The majority (64%) agreed that information on public transportation was easy to obtain, but thought that the information was *not* easy to use.

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- Less than 10 percent thought that using public transportation was undignified for nonwork trips.
- Almost all the participants (90%) agreed that not driving was a significant disadvantage in today's environment, and 73 percent agreed that not driving limited their choice of a residence.
- Approximately half the sample agreed that using public transportation did not affect their independence; that is, they could continue to have independent lifestyles even without individualized travel modes. Only 44 percent agreed that having to use public transportation restricted their social lives. And even fewer (33%) agreed that a reliance on public transportation isolated them from society in general.
- The majority (62%) agreed that not driving had a negative impact on the quality of their lives, and more than 70 percent agreed that they felt frustrated by being nondrivers.

Attitudes toward public transportation

This set of questions asked the participants to evaluate the degree of difficulty they thought they would experience when using public transportation. Again, a 5-point scale was used, ranging from 1 ("never difficult") to 2 ("sometimes difficult") to 3 ("difficult") to 4 ("often difficult") to 5 ("always difficult"). The same format was used here as in the first section: The participants selected the answer that best indicated their views. The major results were as follows:

- The majority (72%) experienced little difficulty finding which route to take (possibly because of the simplicity and linearity of the Santa Barbara Transit system), but 70 percent thought that finding where to board was "sometimes difficult."
- About half the participants indicated that it was "difficult" or often difficult" to recognize which vehicle to take.
- Even though there was a bias toward elderly people in the sample, 72 percent agreed that they had no difficulty boarding or leaving a standard bus.
- More than half (54%) the participants had difficulty estimating where they were when they were traveling.
- Much of the on-route activity, such as communicating with the driver about where to stop, dealing with a crowded vehicle, signaling an approaching driver to stop, and getting to and from the nearest bus stop, were seen at worst as being "sometimes difficult."
- Most of the participants (85%) agreed that it was difficult, often difficult, or always difficult to find pick-up points for different modes of transportation, and 75 percent admitted that they had difficulty learning the intervals between connecting services.
- Most of the participants (89%) said it was always or often difficult crossing a street to find a transfer point.

Usefulness of relevant information

The next two sets of questions focused on how useful the participants found various types of assistive technologies and devices as aids to planning and making trips. The possible responses, on a 5-point scale, ranged from 1 ("extremely useful") to 2 ("very useful") to 3 ("useful") to 4 ("not very useful") to 5 ("not at all useful"). The results were as follows:

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- Two-thirds (68%) of the participants stated that standard printed schedules were "not very useful." However, they did not warmly support alternatives that had been the focus of experiments in different areas of the country. For example, only 24.5 percent said it would be useful to have continuous information via a cable television channel about bus routes, bus locations, and arrival times at various locations. In addition, 56 percent regarded a transit-district computer-operated information hot line to be "not very useful" or "not at all useful," while other suggested remedies (such as radio messages giving information on the arrival or location of buses) were deemed "not very useful" by 75.5 percent.
- The traditional way of offering information on schedules to the sighted public (printed signs at bus stops) was judged "not very useful" by 71 percent of the group; 69 percent preferred to get their information on routes and times audibly from bus drivers or operators of vehicles. The availability of timetables and schedules only at the main bus terminal was seen to be useful by less than 10 percent of the participants, and distributing schedules to potential users by mail was regarded as "not very useful" by 66 percent.
- Other suggestions consistent with today's technology (such as E-mail access to schedules) were judged "not very useful" by 79 percent of the participants. Large-print schedules available on buses fared a little better, but 57 percent rated them as "not very useful."
- The most heavily supported means of obtaining information about transit operations were auditory messages (64%) and various types of talking signs (67%).
- Only 31 percent of the participants agreed that tactile route maps would be useful, and only 33 percent agreed that tactile maps of the urban area would be useful for planning trips.
- The majority (73%) regarded telephone hot lines with *human operators* as being "very useful" or "extremely useful," compared to 44 percent who regarded computer-assisted or voice-mail information services to be "very useful" or "extremely useful."
- The majority (67%) agreed that it was "very useful" or "extremely useful" to have auditory prompts available at transit stops scattered throughout the urban area.

Frustration with Facilities and Services

The series of questions involved the participants' concerns about the existing public transportation system. Again, a 5-point scale was used, ranging from 1 ("extremely frustrated") to 2 ("very frustrated") to 3 ("frustrated") to 4 ("not very frustrated") to 5 ("not at all frustrated").

With respect to the participants' frustration, 43 percent were either "very frustrated" or "extremely frustrated" with the difficulties they had obtaining information on bus schedules. Frustration was also evidenced by 58 percent when they could not travel independently but had to rely on others to go places; 60 percent felt frustrated having to request rides after missing bus connections, but only 21 percent felt frustrated when they had to accept offers freely made by others under these circumstances. Some participants (31%) were "very frustrated" or "extremely frustrated"

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having to explain to others why they were unable to get to a place (for example, to keep an appointment or to attend a social gathering) because of transportation difficulties. With regard to traveling, the results were as follows:

- Approximately 50 percent experienced frustration about not being able to exit vehicles (particularly crowded ones) within the time allotted for the sighted population to exit them.
- Maps designed to tell people where they are (such as maps with pointers saying "You Are Here") produced some levels of frustration (38%) when they were poorly located and oriented, and 47 percent agreed that it was frustrating when such maps had no auditory output associated with them.
- The poor clarity of voice announcements on vehicles or in terminals produced frustration in 52.5 percent of the participants.
- Significant amounts of frustration were experienced when signs were poorly located or illegible or when elevators were located in hard-to-find places. The participants often regarded features that add to the diversity of the architecture or design of an environment (for example, plants and benches) as obstacles that caused them considerable frustration.

The Ideal Situation

The final series of questions asked the participants to indicate their beliefs about the importance of a variety of features of a public transportation system in terms of how well these features would ideally suit their needs for transportation. Again, a 5-point scale was used, with responses ranging from 1 ("very important") to 2 ("somewhat important") to 3 ("important") to 4 ("somewhat unimportant") to 5 ("very unimportant"). The results were as follows:

- The majority (63%) said it was very or somewhat important to have volunteers guide disabled persons through their first few uses of a transit system and that such guides should be available when needed.
- About 46 percent thought it was very important, somewhat important, or important to have housing-relocation services that would help people who are visually impaired find housing within easy access of bus stops.
- More than 70 percent agreed that it would be very or somewhat important to have braille or spoken messages on arrival times available at bus stops.
- To help them make decisions while in transit, 63 percent thought it was very or somewhat important for vehicles to give visual and audio information about their current locations on routes.
- About 59 percent regarded it as important to have early warning systems to alert drivers that people with disabilities are waiting to embark at pickup points.

The participants were then asked to state up to three reasons why they used public transportation. The dominant reason was that the service meets their needs, such as by having convenient routes and convenient pickup times. However, many participants indicated that they really had no alternative to public transportation for many trips. A positive factor stressed by the participants was the courtesy and assistance offered by the bus drivers in their local areas.

Access to Household Cars

Of the 55 participants, 43 had no access to household cars, 10 used this mode of travel for some trips, one person walked

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with a dog guide most of the time, and one did not respond to this question. Usually, the car was driven by a household member, but 3 participants occasionally still drove in their neighborhoods. Some important differences included these:

- Most of the participants (74%) with no access to household cars used public transportation two or more days a week. Of those who did have access to household cars, 89 percent used public transportation less than once every two weeks.
- Overall, 60 percent of the total sample expected to wait more than 15 minutes for a bus. But, non-car users expected to wait less time for a bus than for a ride in a car or another vehicle. Obviously, the participants thought that arranging for a ride either by car or van took considerable time; sometimes van travel must be booked 24 hours in advance. For those with access to household cars, 62 percent expected to wait more than 30 minutes for public transportation. Those who were privately driven to destinations had an image of bus travel as being time-consuming and inefficient.
- For the participants without access to household cars, the primary activities for which they needed travel assistance were shopping (40%), education (17.1%), medical services (14.3%), work-related activities (8%), and non-family social events (8%). Those with access to household cars reported that they used this mode of travel most for shopping (30 percent), medical services (30 percent), and work-related activities (20 percent).
- Access to household cars apparently gave the participants more freedom in where they could choose to live. On average, persons in this group lived more than five blocks from the nearest transit stop, compared to fewer than three blocks for those with no access to household cars. The patterns of preference and perceptions were similar when the total population was divided into high-frequency users of public transportation (generally non-car users) and low-frequency users (usually those who had access to household cars).

Discussion

In this survey, 50.9 percent of the participants regarded their local bus service as their primary mode of travel; 18.2 percent relied more on access to household cars; 12.7 percent relied on walking; 7.5 percent relied on easy-lift vans; and the remainder relied on institutional shuttles, retirement-home shuttles, or friends' vehicles. When asked what would be the most significant things that had to be done to improve travel for them, the participants gave a variety of answers. However, the majority of their responses can be categorized as the provision of auditory, tactile, or large-print information on schedules, waiting times, en-route locations, and bus locations in crowded terminal areas. Auditory information included access to human operators on telephones, access to auditory information at transit stops and in the main terminal, and regular and clear announcements by drivers of the nearest cross streets at bus stops.

Although many transit systems have policies of providing information in these alternate modes, the policies are not always implemented. This situation places a substantial burden on travelers who are visually impaired who have no other reliable means of determining where they are. It is often difficult to count stops because many

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bus stops are bypassed at certain times of the day when travel is light or to pick up environmental cues to locations. What is left is reliance on an internal sense of timing (which can vary dramatically according to traffic conditions or momentary or more extensive distractions, such as other passengers who are talking) or estimates of time and distance.

The participants thought that large-print schedules would be of great value and that they should be available either at the central terminal or on the buses themselves. Many participants agreed that the identification number on the buses should be larger, since they cannot see route numbers at a distance or even when they are near buses. Other participants indicated that a major benefit would be some type of signaling device at bus stops to alert drivers to the fact that persons with disabilities are waiting to be picked up.

Some participants agreed that street crossings at points where bus connections are made should have auditory pedestrian signals and crossing lights, since it is dangerous to cross busy streets when traffic is heavy without such traffic-control devices. Other participants suggested that when multiple buses converge at particular stops, devices for indicating clearly which bus is located at which pickup point would be "extremely useful" (a service previously performed by on-street transit personnel). Experiments in San Francisco (Bentzen & Mitchell, 1995) found that auditory messages activated by a push button on a remote handheld device or by Talking Signs on the vehicles or at pickup points have great promise and were lauded by those who used them.

Some participants said they felt extremely uncomfortable when, on boarding buses and not immediately finding seats, they were thrown off balance by the buses taking off before they could find secure handholds or seats. This fear was also noted by I. Cohn, Department of Optometry, University of California at Berkeley, in a personal communication to the authors (E-mail message, October 17, 1995), who reported that 60 percent of the bus travelers interviewed in the Oakland, California, area, stated that they had fallen on a bus because of unexpected acceleration. Cohn suggested that increasing the sensitivity of drivers to the special needs of disabled people, especially those who are visually impaired, could ameliorate this problem.

Considerable support was also offered by the participants for the use of auditory signs. Bentzen and Mitchell (1995) showed that these signs can be placed on buses, at transit stops, or in terminals and can be activated only by receivers carried by certified users. San Francisco has already experimented with such Talking Signs on buses and its local rail system (Crandall et al., 1995). The results of these experiments (particularly users' assessments of the technology) indicate that Talking Signs could foster the use of public transportation by people who are visually impaired by easing their fears and feelings of frustration.

The participants made a number of other suggestions as well. These suggestions included providing information on locations on buses, posting drivers' names so that more direct and personal communication can take place, and requiring drivers to wait for disabled people who are trying to catch transit vehicles at particular stops.

The results of this survey generally confirm and build on those reported by Corn and Sacks (1994) regarding the effects of not being able to drive cars. Since many of

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the participants in this survey were elderly, nondriving posed no serious threat to their activity patterns, but there was evidence that those who were used to traveling in household cars experienced considerable frustration (including increased travel time, increased waiting time, and higher self-assessed levels of frustration) when faced with such situations as missing a connection or being unable to understand onboard or in-terminal announcements. These responses seem to be allied to the levels of concern and frustration found in Corn and Sacks's geographically more widespread sample.

Conclusion

There have been few studies of the activity patterns of disabled people, in general, or of visually impaired travelers' activity patterns, attitudes toward public transportation, and evaluations of the usefulness of various assistive devices that are being developed or tested for use in public transit systems (but for related research, see Bentzen, Jackson, & Peck, 1981; Bentzen & Mitchell, 1995; Jackson, Peck, & Bentzen, 1983; Kirchner, McBroom, Nelson, & Graves, 1992). The few studies that have been conducted have been commissioned by federal agencies or specific cities or counties (see, for example, Coburn et al., 1992; Lifespan Associates, undated). The results are available in technical reports, some of which are distributed by the Easter Seals Project Action committee.

For the most part, however, the results of this survey can be directly compared to few others at this time. Now that the U.S. Census is beginning to collect and process some data on disabilities, representative background data should soon be available that will allow for interregional and interurban comparisons. Unfortunately, attitudinal and perceptual information will still have to be collected via surveys and interviews. Perhaps this study will provide future researchers with some idea of the types of meaningful responses that can be obtained that may help solve the problems of access to and use of public transportation by visually impaired travelers.

People who are visually impaired may not need many physical adaptations to transit systems' equipment and infrastructure. Traveling for this population means moving through a world without many or all the visual cues available to sighted travelers. The lack of access to visual cues, such as signs at bus stops, bus numbers, and street signs, were the main barriers to equal access to transportation reported here. In short, the main need of people who are visually impaired is access to more and better *information*. Additional auditory messages could also help other persons to use public transportation, particularly newcomers and tourists, those who have difficulty reading schedules, those with poor spatial cognitive ability, and children. Finding acceptable ways to help all these populations expand their use of public transportation should be of the utmost importance.

The findings of this study point to the following useful areas for further research:

1. Determining the safest and most effective ways to cross streets (as when switching bus lines or changing from one to another mode of travel) or simply to get to a destination. Such studies could involve expanding the research on auditory signage that is being conducted in San Francisco, under the auspices of the Smith-Kettlewell Eye Institute and various local government authorities.

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2. Investigating why many bus drivers are reluctant to call out information on locations as they approach bus stops and the feasibility of auditory tapes or synthetic speech devices that would automatically provide this information.
3. Researching the types of systems that could be economically placed at bus stops to alert drivers that persons who are disabled are waiting to board.
4. Finding ways for persons with visual impairments to get clear information on public transit schedules and timetables.
5. Exploring more completely the activity patterns of people who are visually impaired so their travel needs can be determined. For example, in Santa Barbara, more buses are needed in the late evening and on Sunday.

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