IMPROVING TRANSIT INFORMATION SYSTEMS

ARLINE L. BRONZAFT, PH.D.
Herbert H. Lehman College

STEPHEN B. DOBROW, PH.D.
Fairleigh Dickinson University

ABSTRACT

This article discusses the needs of mass transit users for information on how to make efficient use of bus and subway systems. While informational aids play a significant role in determining the rider's satisfaction with a system, they are generally given a low priority by planners. Even the two most common system aids, maps and route timetables, have been the subject of surprisingly little users needs research. Studies of orientation problems in transit systems are reviewed, including research on wayfinding difficulties for riders of the New York City subways. The research and development process which led to the design of a new New York Subway map is described, along with suggestions for further work in this area.

Alas I had not used the subways in two decades . . . the lines had been shuffled around, and the maps were especially designed for incomprehensibility even when they weren't covered with graffiti. I managed to get lost, to overshoot my mark, and to have to ask my way back.
It was incredibly embarrassing and I have rarely used the subway since [1].

The above quote from Isaac Asimov's autobiography *In Joy Still Felt*, describing a subway trip he took in 1969, explains why he deserted public transit and leads one to wonder how many others have been similarly disgusted because they could not decipher the arrows, signs, symbols and overall graphics of transit maps.

Although safety, reliability and comfort outrank a legible information system in most priority lists of what consumers expect from a good transportation system, adequate information tools will still make the "top ten." One could

argue, moreover, that inadequate information aids contribute to feelings of discomfort and insecurity. When passengers are unsure about where to go to get their train, they behave hesitantly and reluctantly. Such feelings make one uncomfortable about using public transit. Thus, poor information tools indirectly influence those other factors—safety, reliability—that citizens cite as important if they are to be attracted to public transit.

Before passengers get on the train or bus, where they can evaluate the comfort, safety and reliability of the vehicle, they will need information to guide them to the proper bus or train. The first contact a transit rider makes with the system is through a map, sign or bus schedule. Thus, it is the information tool that makes the first impression. Overly complex or confusing information as well as no information at all can "turn off" potential riders before they even try the system, or lead to such a traumatic experience that they may be inhibited from trying again. It is, therefore, essential that transit agencies provide consumers with effective information tools.

Transit operators have developed a broad range of consumer information and communication mechanisms and techniques to inform current and potential transit users of existing transit services and to create a disposition and motivation in them to patronize transit. The goals of information systems are to guide people through the transit system and to encourage additional use by current riders and "new" use by non-riders. As part of increased efforts to retain and attract ridership, informational programs are currently being undertaken by transit properties across the country. The marketing focus of improved information tools was cited by Ben Morris in *Marketing the New Mass Transit*, who believes the primary goal of the system maps is ". . . to promote ridership in general and to increase off-peak ridership, increase awareness of the transit system . . . promote tourist use . . . and help improve transit's image." [2] Similarly, Larry Coffman in *Information Services Advertising and Other Communication Programs* sees the transit map as ". . . a primary sales tool that should present a comprehensive and persuasive picture of the services the transit system has to offer." [3]

However, despite the growing interest in information aids, they maintain a low position on the list of transit concerns and the marketing arm of a transit agency does not have sufficient clout to elevate the status of information aids in the eyes of top management.

THE USE OF INFORMATION AIDS

Instruments used to relay information about transit to the public are commonly termed rider information aids. These aids promote awareness of transit services and hopefully provide present and potential transit patrons with precise, accurate and thorough information on how to utilize these services. Included among these are signs and information displays on vehicles, pocket and

posted schedules, system maps, bus stop and station signs, and related materials. Despite the fact that these aids are in nearly universal use, there is little consistency in the basic properties of these items from operator to operator, and little research on effectiveness. Most research in mass transit has concerned itself with the operational and financial aspects of transit, in general, or of specific transit systems. Only limited interest has been shown in determining the information needs of the transit user. Thus, for the most part, maps, signs, timetables, etc. have been developed with miminum, if any, input from riders themselves. Furthermore, there is little, if any, understanding on the part of operators that riders using the system differ in abilities to understand information aids and in the amount of information needed for their transit requirements.

INFORMATION NEEDS OF RIDERS

The most common trip purpose on mass transit systems is the journey to and from work, accounting for about one-half of the total number of transit trips [4]. Such riders generally make the same trip, at the same time of day, over the same route five days a week. Other than making sure they get on the right vehicle, the recurrent transit information requirements of these riders are very low. They need only information concerning changes in their particular work-based travel patterns, either when they shift jobs or residence, or when the transit system shifts routes or schedules. On the other hand, the potential rider who is not a regular user of the system or a regular user who is making a non-regular trip has a very high information requirement and accounts for 50 percent of ridership. The trip being contemplated may be the first of what is intended to be regular trips to work or it may be a non-work trip for any of a variety of purposes. Such trips could involve travel along large areas of the transit system including transfers between vehicles and modes. These trips may appear quite formidable for the occasional rider.

In our study we asked subjects, new to New York's vast subway system, to travel through it assisted by a transit map and existing station aids; subjects reported feeling very insecure about their train selections [5]. They blamed the inadequacy of the graphics for these feelings. In fact, one subject drew an analogy between his subway trip and Kafka's book *The Castle*. Transfer points were especially confusing and the map they were using was not clear in conveying this information.

It could be argued that educational programs to improve map-and-schedule-reading skills should be introduced into the school curriculum. Additionally, drivers should be instructed to call out stations or bus stops. However, even if the suggestions were possible and affordable, there is still an important need to design maps and schedules which are better suited to the skills and abilities of the various clienteles they are meant to service. If we are to attract new riders now and interest existing riders into making new trips, then we must pay

attention to information aids. We can't expect riders to attend map-reading classes nor can we expect drivers to be able to provide them with all the necessary information. In addition, people like to be able to be in control of their activities. There is greater confidence in concrete materials that one can refer to continuously, as reinforcement is needed. People would rather have control "of their own destinations."

Potential transit patrons wishing to make a transit trip must know:

1. the routes serving their origin and destination,
2. schedule times for their trips,
3. fares (particularly if exact change is required),
4. possible boarding locations,
5. how to identify the transit vehicle which they may take,
6. how to get trip information if they are lacking it.

Such information becomes more difficult when transfer points are involved, when vehicles at the same boarding stop follow different routes and when vehicles skip stops at certain times of the day. When trips become more complicated, more information is needed and with these more difficult trips, the related bits of information must work together in a coherent fashion.

Similarly, when the system of transit routes follows a simple grid, less information is needed because of the inherent rationality of the system. However, when routes and streets twist and turn, the transit system structure is not as readily obvious and information aids become even more important. With more information transmitted, a high degree of redundancy and reinforcement are called for. For example, if all buses on First Avenue ran the full length of the street, then a simple statement could convey this fact. However, if some of the First Avenue buses run along Second and Third Avenues for part of the run, then providing information becomes a more challenging task. Vehicle signs, bus stop signs, maps, schedules, etc., must all function in a cohesive manner, comprising a complete information system. Each component has a specific value of its own and, together with the other components, acts in synergy to form a comprehensive transit information system which can provide needed information to a broad spectrum of potential transit patrons.

INFORMATION AIDS RESEARCH

The Urban Mass Transportation Administration has made some efforts in assisting transit operators in producing improved information aids by publishing the *Transit Marketing Management Handbook* which is a compendium of aids used in the United States, Europe, Canada and Mexico [6]. There seems to be an increasing awareness on the part of transit agencies to provide riders with maps, pamphlets, schedules, bus stop signs and other information aids to assist them in their travels. However, it is still not known

how effective these aids are in helping people understand how to use the respective transportation systems.

There are only a few studies in the transportation field that have attempted to investigate consumer input in the design and use of transit information tools. A 1964-1969 Washington, D.C. study, *Transit Information Aids Mass Transportation Demonstration Project*, surveyed bus riders and non-riders on what information they would like added [7]. The results of this survey led to the development of new bus markers, bus route indicators and timetable folders. However, no marked increases in ridership were noted after installation of new aids nor did respondents in a follow-up telephone survey indicate the need for less transit information now that revised information aids had been provided.

UMTA in its study, *User Information Aids*, asked individuals in a laboratory setting to rate the usefulness of different information aids in planning trips and to actually plan trips using maps and pocket schedules [8]. While this study provided some data on which aids individuals prefer and how successful they were in using them, detailed analyses of trip planning behavior were not carried out. Results of the study did show, however, that subjects preferred pocket schedules and bus stop information over electronic route finders and signs on the front of the bus. Subjects also considered a schematic map easier to use but chose a detailed map when riding in a new or unfamiliar area.

A more exacting study of transit trip planning was conducted by Everett, et al. [9]. In a laboratory setting, students were asked to make transit trips from stated origins to designated destinations. They used bus route pamphlets from seven different cities. They were asked questions on which buses to take, arrival times and fares. The average overall performance for all the pamphlets was less than 50 percent with responses ranging from 24 percent to 53 percent to specific questions. Everett concluded that efficacy of route pamphlets was quite low and recommended systematic research to investigate consumer use of information aids in field settings. More recently Robinson reported on the design and results of a transit demonstration project that had an evaluative framework including onboard surveys of transit riders, a non-user survey and a survey of bus operations [10]. The result of this two-year project was the design of a rider-oriented bus stop sign for Milwaukee county. The task-force on this project also reported that additional aids, other than the bus stop, were needed to convey more information on frequency and terminals.

Garland, et al. tested the effect of transit map color coding and street detail on transit trip planning performance in Fort Worth, Texas [11]. Color coding was found to improve trip planning accuracy when the map had a high degree of street detail. Without color, however, less street detail allowed for better planning. Since their college student sample experienced difficulty in planning their trips, the authors hypothesized that a less educated sample would find the task even more difficult. As a result, they called for more map reading instruction in the school curriculum.

DESIGNING NEW YORK CITY'S SUBWAY MAP

Recognizing that New York City's eight million residents and nearly sixteen million annual visitors depend on the New York City subway map and its accompanying aids to travel a system of 240 miles and nearly 500 stations, Bronzaft, Dobrow and O'Hanlon decided to test the effectiveness of the then existing subway map and its visual graphics in guiding riders through the New York subway "maze" (see Figure 1) [5]. They asked twenty individuals, new to the city, to use the map to take four trips through unfamiliar parts of the subway system. While the subjects were informed that they could use other graphics (signs, route diagrams) within the subway system to assist them in their travels, they were told not to ask anyone for information.

None of the twenty subjects were able to plan "acceptable" (direct or indirect routes) solutions for all four segments, only three planned "acceptable" solutions for three of the trip-segments and overall only 46 percent of the trip-segments were rated "acceptable." Only six of the subjects used the legend of the map or the reverse side of the guide at least once, and only one individual used these portions in a systematic fashion. The subjects also reported on the difficulty of coordinating the map with other information provided in the system. The authors recommended that the New York subway map be redesigned, that better system graphics be developed to complement the information provided by an improved map, and that subway orientation aids be tested on transit riders. These suggestions were acted upon almost immediately (see Figure 2).

The authors were invited to serve as members of a committee that was set up in 1976 to design a "new" New York City subway map. We viewed our role on the committee as one in which we would promote map design features that reflected the findings of our study. We especially stressed the need to test out map elements on the riding public for whom the map was being designed. The committee, composed of graphic designers, transit employees, and citizen activist members as well, met regularly for the next three years.

The committee's first product, developed after a year of meetings and discussions, used three colors to designate train routes with major emphasis placed on transfer points. This interim version and the existing 1972 Massimo Vignelli map were tested on subjects who were asked to write down the train or trains they would take to a set of ten designated stations from ten different starting points. In order to test different features of the map, e.g., transfer points, trip segments of varying difficulty were used. Some trips required only one train while others required two or more. Groups familiar with the subway system, as well as those who used the system infrequently, served as subjects. Half of the 180 subjects used the Vignelli map in completing the questions while the other half were tested with the newly designed version.

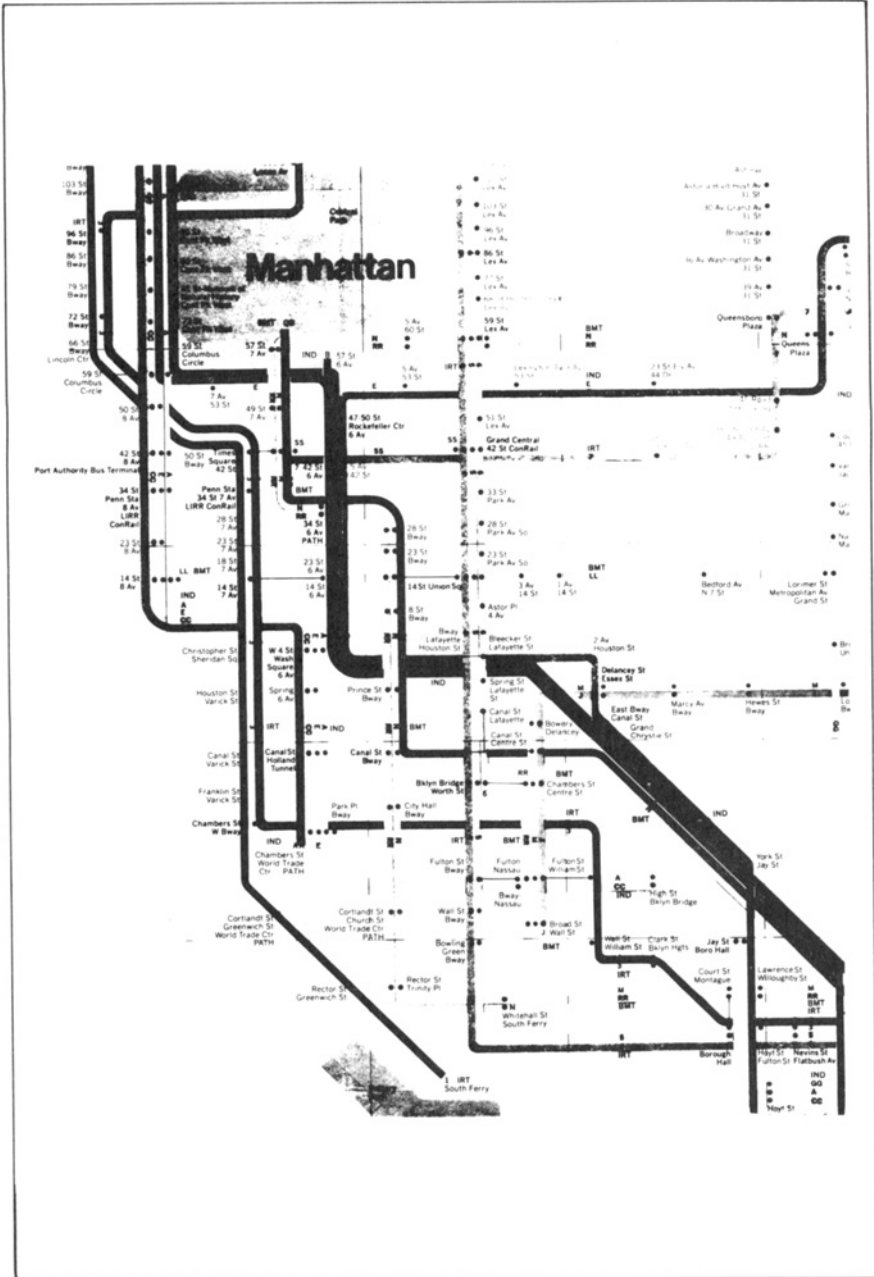Train sequences used by the subjects for each trip were classified as

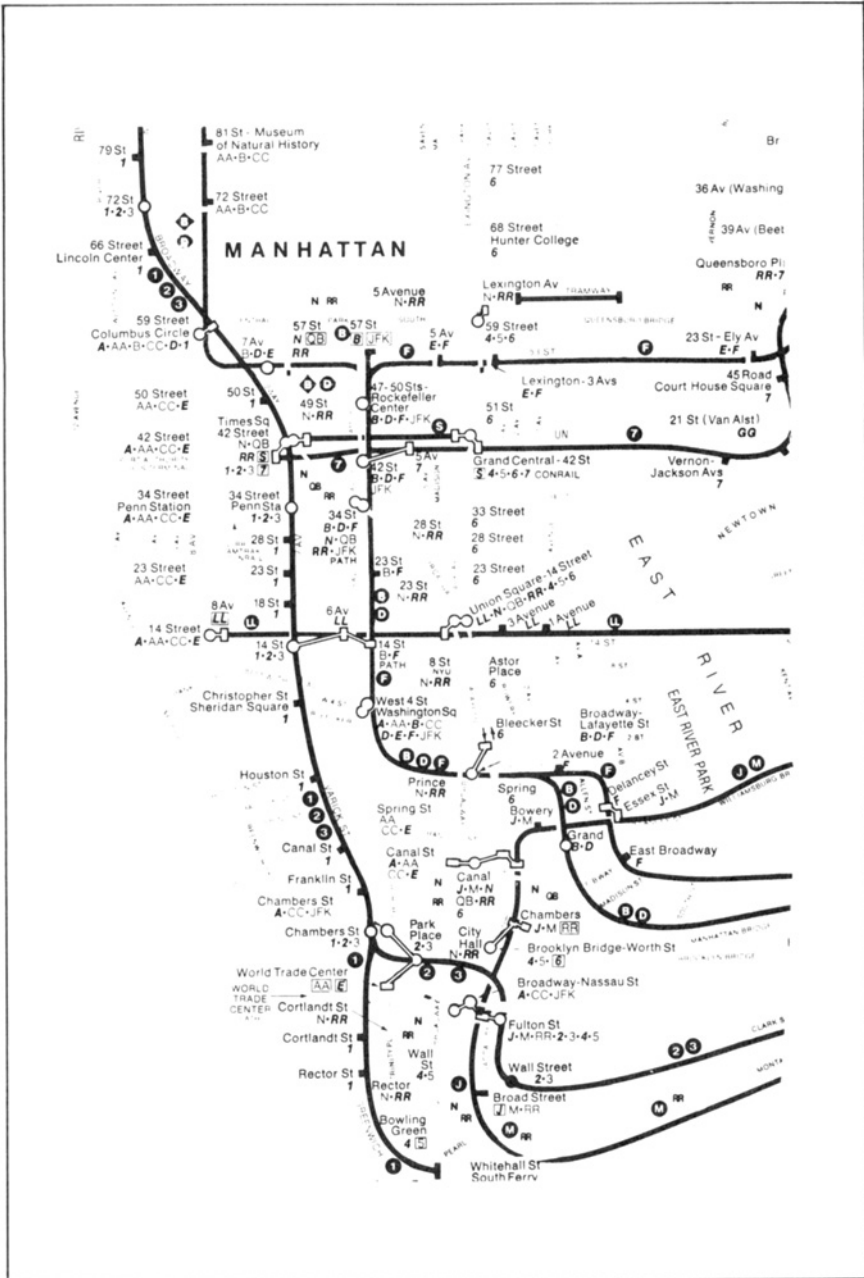Figure 1. New York City Subway Map — Massimo Vignelli.

Figure 2. New York City Subway Map — Revised Version.

direct (shortest route or fewest trains taken), indirect (long, round-about way but correct), or mistaken (sequence of trains taken could not take subject to desired station). Ten points were given to direct trips, five to indirect ones and zero for mistaken answers. The highest score one could obtain was 100 points with all ten trips being direct ones.

For the group of subjects most familiar with the system, the mean scores on the Vignelli map did not differ significantly from the mean score for the new design. Subjects with some knowledge of the system scored significantly better with the new map. Mean scores for individuals unfamiliar with the system indicated no significant difference between the two maps. It was surprising that the subjects familiar with the system and the Vignelli map as well did not do better with Vignelli's map. Overall the new map appeared to yield higher test scores.

However, success with the new map was somewhat limited and it was decided to "go back to the drawing board" and produce a second version. What resulted was the use of one color to designate all routes with appropriate color bullets along the side of the route denoting letter or number of that route. This map was put on display for transit riders to comment on. Three thousand questionnaires were completed by viewers and their responses were analyzed by the map committee. While certain features of the new map, such as the geographic approach in contrast to the earlier schematic presentation of the Vignelli map, were well received, the limited use of color to identify routes was criticized.

Further revisions were made, giving weight to the transit riders' suggestions, and an eleven-color map to be coordinated with station decals and car destination signs was unveiled in 1979. In presenting this map to the public, the authority did not claim it would make subway riding easy (the system is too complex) but it did believe it would serve as a useful tool in conjunction with the other aids. While no further formal evaluations have been conducted, newspaper and magazine reviews, passenger comments and an award from the American Public Transit Association have spoken to the success of New York's latest transit map.

TESTING MAP DESIGNS ON DIFFERENT CLIENTELES

It had been noted earlier that different information tools may have to be designed to meet the needs of different clienteles. Older citizens, who are very dependent on public transit, may need larger print on time schedules and more simply written text. Thus, when new timetables were being developed for the Metropolitan Suburban Bus Authority in New York, one of the authors (A.B.) developed a questionnaire to test the ability of senior citizens in understanding and using these timetables. A group of senior citizens not familiar with the

transit routes being tested, but who were frequent transit riders, were asked to answer questions on fare structure, transfers, time schedules and train connections on the newly prepared bus timetables. A second group of seniors completed the questionnaire using the "old" version of the timetable. The results of the study showed that senior citizens were better able to answer travel questions after studying the newer timetable. They commented that they liked the large print but the general layout and style of this version seemed to contribute to their higher scores as well.

INFORMATION AIDS—NATIONAL CONCERN

The importance of evaluating transit information materials was underscored at a conference of Transit Consumer Concerns conducted by the Transportation Research Board and the Urban Mass Transportation Administration in 1978. The participants, including consumers as well as university researchers and transit operators, recommended that UMTA serve as a clearinghouse so that it could share information on effective information tools. UMTA could also provide resources for evaluating information strategies and techniques.

Thus, transit properties nationwide must be encouraged to place greater emphasis on the development of information aids. Too few cities have actually tested out their information schedules, maps, destination signs, etc., on passengers. It is not known whether "great-looking" aids can actually do the job of guiding riders successfully through their transit systems. The recommended clearinghouse could provide standards for evaluating different techniques so that a transit agency interested in adopting a technique used by another operator would have some idea of its success.

TOWARD AN INTEGRATED
ORIENTATION SYSTEM

While it has been suggested that successful design elements and techniques be disseminated among transit properties, adopting a proven design feature is not enough to ensure a useable information tool.

All elements in the information network need to be fully integrated and coordinated. For example, New York's designation of bus stops, particularly in the outer boroughs, does not yet come up to the standards of its maps. A good bus map can tell you the streets along which the bus runs, but it can't find the stops for you. The map may tell you what bus route you need, but it can't help you read the route number on the bus.

Selecting the manner (location, size, technology) in which route signs on the bus display information is an important part of a fully coordinated information

system. For example, recent technology has encouraged the use of electronic-dot matrix signs without determining whether they can be easily read by passengers. Can these signs be seen by waiting passengers in the glare of the bright daylight? Is the electronic sign large enough for people to read and is the information still understandable when some of the dots are missing? Is information properly conveyed when the sign has cycled this information in bits and pieces as electronic signs do? Even with conventional signs, the issues of size, color, placement and manner in which information is presented are critical.

CONCLUSIONS

1. Transit information aid elements must be user-tested.
2. A clearinghouse that will classify, categorize and assess information aids should be set up nationally.
3. Transit information aid elements must form a coordinated information system.
4. Efforts to provide a clearer indication of the effectiveness of materials used to navigate transit systems should result in improved public information systems and should increase patronage.

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Direct reprint requests to:

Arline L. Bronzaft
Department of Psychology
Herbert H. Lehman College
Bronx, NY 10468