OneBusAway: Behavioral and Satisfaction Changes Resulting from Providing Real-Time Arrival Information for Public Transit

Brian Ferris
PhD Candidate, Computer Science & Engineering
University of Washington
Box 352350
Seattle, Washington 98195
Phone: 206-303-8220
Email: bdferris@cs.washington.edu

Kari Edison Watkins – **Corresponding Author
PhD Candidate, Civil & Environmental Engineering
University of Washington
5702 35th Avenue, NE
Seattle, Washington 98105
Phone: 206-250-4415
Fax: 206-685-0767
Email: kariwat@u.washington.edu

Dr. Alan Borning
Professor, Computer Science & Engineering
University of Washington
Box 352350
Seattle, Washington 98195-2350
Phone: 206-543-6678
Fax: 206-543-2969
Email: borning@cs.washington.edu

Resubmitted: November 14, 2010

5975 words + 6 figures (1500 words) = 7475 words

This work summarizes and updates an earlier paper: OneBusAway: Results from Providing Real-Time Arrival Information for Public Transit, in Proceedings of CHI 2010, Atlanta, GA, USA, April 10-15, 2010, © ACM, 2010. http://doi.acm.org/10.1145/1753326.1753597

ABSTRACT

Public transit systems play an important role in providing mobility, combating traffic congestion, reducing carbon emissions, and promoting compact, sustainable urban communities. The usability of transit can be significantly enhanced by providing good traveler information systems. OneBusAway is a set of transit tools focused on providing real-time arrival information for Seattle-area bus riders. This paper describes OneBusAway and the results from a survey of OneBusAway users that show a set of important positive outcomes: strongly increased overall satisfaction with public transit, decreased waiting time, increased transit trips per week, increased feelings of safety, and even a health benefit in terms of increased distance walked when using transit. The paper concludes with some design and policy implications of these results and plans for future research in this area.

INTRODUCTION

Public transit systems play an increasingly important role in the way people move around their communities. While there are significant benefits to using transit, many choice riders are reluctant to make the switch. Riders are often confused or intimidated by the complexity of large transit systems. Transit agencies often do themselves no favors by failing to provide information about the systems they maintain in simple, understandable ways. OneBusAway is a set of transit traveler information tools designed to take some of the uncertainty out of transit by providing real-time arrival information for Seattle-area bus riders.

The societal benefits of public transportation are numerous. Transit provides mobility to those who cannot or prefer not to drive, including access to jobs, education and medical services. Transit reduces congestion, gasoline consumption and the nation's carbon footprint (1). In 2007, public transportation saved 646 million hours of travel delay and 398 million gallons of fuel in the U.S., resulting in a savings of $13.7 billion in congestion costs (2). Use of public transportation reduced U.S. CO_2 emissions by 6.9 million metric tons in 2005 (3). While hybrid and electric vehicle technologies can reduce the carbon-footprint of single-occupancy vehicles, they cannot compete with transit in reduction of traffic and promotion of compact, sustainable communities.

Towards this goal, there are two principal reasons for providing better transit traveler information: to increase satisfaction among current riders; and to increase ridership, especially among new or infrequent transit users and for non-peak-hour trips. It has been shown that transit traveler information can result in a mode-shift to public transportation (4). This stems from the riders' ability to feel more in control of their trip, including their time spent waiting and their perception of safety. Real-time arrival information can help in both of these areas. Existing studies of permanent real-time arrival signage at transit stations have shown that the ability to determine when the next vehicle is coming brings travelers' perception of wait time in line with the true time spent waiting (5). In addition, it has been found that providing real-time information significantly increases passenger feelings of safety (6).

These issues are definitely relevant for users of the Seattle-area regional transit agency, King County Metro (KCM). A 2006 survey of KCM riders (7) identified key areas of dissatisfaction, including the top two: 26% of riders were dissatisfied with their wait time when transferring, while 19% were dissatisfied with personal safety when waiting for the bus after dark. In addition, 42% of riders said they had experienced problems with on-time bus performance in the past 3 months.

OneBusAway was created to address some of these issues and to expand upon existing transit tools in the region. Usage has grown primarily via word-of-mouth since its launch in summer 2008. As of July 2010, OneBusAway serves about 30,000 unique users each week, including 14,000 via iPhone application, 9,000 via Android application, 11,000 via website, 2,000 via phone, and 1,000 via SMS.

This paper presents results from a web-based survey of 488 OneBusAway users. It also presents results from a follow-up survey focused on changes in walking behavior when using OneBusAway. The results suggest a number of important positive outcomes for OneBusAway users: increased overall satisfaction with public transit, decreased wait times, increased transit trips per week, increased feelings of safety, and even increased distance walked when using transit. While OneBusAway is not the first system to provide tools for accessing real-time arrival information, this evaluation of the results of providing real-time transit information demonstrates the value of such tools and suggests a number of interesting avenues for future research. Finally, the results make a strong case for transit agencies to provide similar systems for their own riders.

RELATED WORK IN TRANSIT INFORMATION SYSTEMS

Displays that provide real-time arrival information for buses, subways, light rail, and other transit vehicles are now available in a significant number of cities worldwide, at rail stations, transit centers, and major bus stops. However, it is prohibitively expensive to provide and maintain such displays at every bus stop. With the increased availability of powerful mobile devices and the public availability of transit schedule data in machine readable formats, a significant number of tools haven been developed to make this information available on a variety of interfaces, including mobile devices. These systems are usually cheaper to deploy than fixed real-time arrival displays at a large number of stops. Further, these systems, especially on mobile devices, can support additional, personalized functionality, such as customized alerts.

One of the first online bus tracking systems, BusView, was developed by Daniel Dailey and others (8). Although not real-time information, more recently, Google Transit began providing transit trip planning for more than 400 cities around the world (9). It addition to providing information to transit riders around the world, Google Transit is also significant for establishing a de facto standard for exchanging transit schedule data: the General Transit Feed Specification (GTFS). Many of the transit agencies participating in the Google Transit program have also released their transit scheduling data in the GTFS format for third-party developers to work with, creating development ecosystems out of the public availability of this data, with many so-called “transit-hackers” working on innovative uses of transit data. The Portland TriMet third-party applications page (10) lists over 20 applications using Portland's transit data, many targeted at providing transit data on mobile devices and many of which use localization capabilities of these devices. Similar ecosystems exist in San Francisco and the Bay Area, Chicago, and other major cities.

A number of researchers have looked at how mobile applications might improve the usability of transit, both for the general rider (4, 5, 6, 11), and for targeted groups such as those with cognitive impairments (12, 13, 14, 15). The OneBusAway tool suite aims for general usability by providing a broad set of interface options, with particular focus on ease of access to information. OneBusAway does this via open-source code and the project team is simultaneously working to promote open access to transit data.

DESIGN PROCESS

Initial work on OneBusAway was started to improve the usability of existing tools. The regional transit agency has had real-time tracking capabilities for its buses since the 90s and provides web and SMS access to arrival information. The MyBus program at the University of Washington also provides similar tools (8). However, both these tool sets were difficult to use when riders were waiting at a stop, primarily due to providing no way to use posted stop IDs to quickly access information and the resulting complexity of information lookup. OneBusAway is financially supported by grants through the University of Washington and access to data is supported by the Seattle-area transit agencies (King County Metro, Sound Transit, Pierce Transit, Community Transit, City of Seattle, Washington State Ferries) and Dr. Daniel Dailey's AVL data stream.

The new set of tools provided by OneBusAway improved on these original tools in a number of ways. First, the proper mapping between stop ID and real-time arrival was constructed so that users could quickly access information using a stop's posted ID. Second, multiple interfaces were developed to promote greater access to information. In addition to a standard web interface (http://onebusaway.org), an interactive-voice-response (IVR) phone interface, an SMS interface, an iPhone-optimized web interface, and a text-only web interface were added so that a user could easily access information using a variety of devices. For a range of mobile devices, from a basic cellphone to a powerful smart phone, as well as a wide range of users, there was an appropriate interface available. There are even deaf-blind users of OneBusAway who access the information using SMS and a Braille display. Additionally, in September 2009 and February 2010 respectively, a native iPhone application and native Android application were released that include automatic localization of the information presented using the phone's GPS capabilities.

The standard web interface allows a user to search for stops by route, street address, or map area. Results are visualized on a standard map, as shown in Figure 1. Details like indication of direction of travel at a particular stop make it easier for a user to distinguish between multiple nearby stops, such as when two stops are directly across the street from each other. Real-time arrival information includes details about the route, destination, and time remaining until departure. In addition to the real-time arrival information, a full schedule in stem-and-leaf format is provided for each stop.

The text-only-optimized web interface and IVR phone system offer similar functionality to the web interface. Both interfaces allow a user to enter a stop ID to quickly receive arrival information, or to search for a stop using a search tree that narrows results based on the route, destination of travel, and street location of the target stop, allowing stop lookup without the stop ID. The IVR phone system works via a touch-tone phone interface with text-to-speech. Users can bookmark frequently accessed stops for quicker access in the future. The SMS interface is the simplest, only allowing the user to find real-time arrival information by stop ID.

These interfaces were informally evaluated in summer 2008 with several students and heavy transit users. After integrating feedback from these users, the OneBusAway website was launched with pointers to the various tools for accessing information. The design of the various tools, along with development of new features, has been further shaped by feedback from users. OneBusAway provides several feedback mechanisms (email, Twitter, blog, bug tracker) that allow users to make comments or suggestions about the tools. Because OneBusAway is open-source software, users have also submitted improvements of their own. An additional survey of

OneBusAway users was performed specific to usage of OneBusAway on the iPhone platform (16).

The implementation of OneBusAway is further described in the conference paper on which this paper is based (17). OneBusAway is open source and more information can be found at the code project site on the web, http://code.google.com/p/onebusaway/.

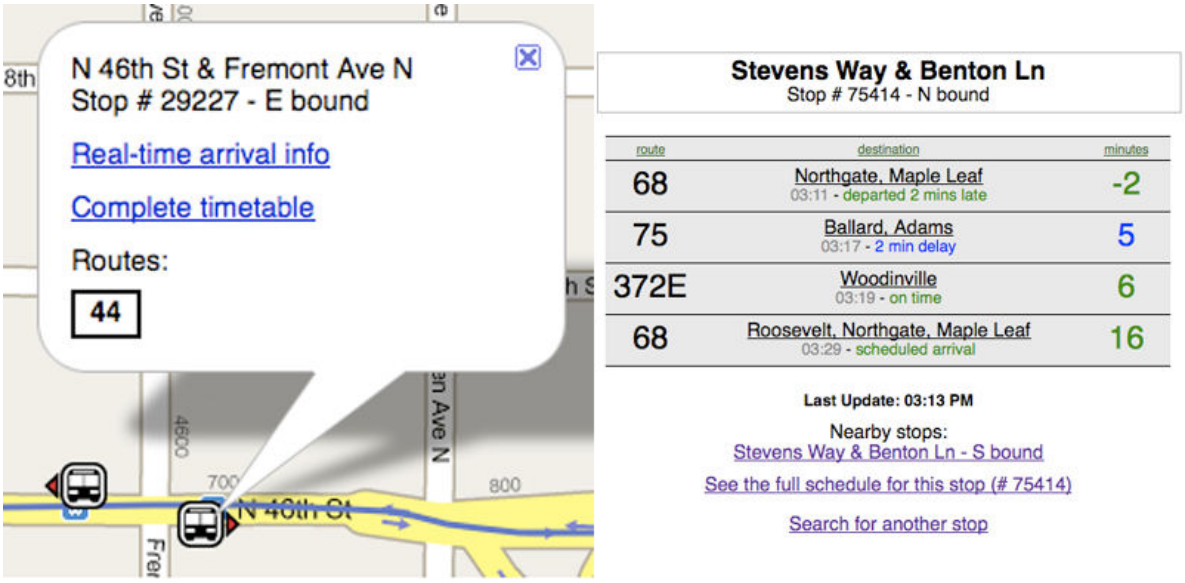

FIGURE 1 Example of the map-based interface (left) along with real-time arrival information for a single stop (right).

METHOD

To evaluate the effects of using OneBusAway, two web-based user surveys were developed. The primary survey queried users about their usage of OneBusAway and how OneBusAway had changed their overall perception of transit, including issues of satisfaction, utility, perceived wait time, frequency of travel, safety, and other factors, through a standard online survey. Survey participants were recruited through notices on the OneBusAway website, the OneBusAway Twitter feed, and Seattle-area blogs where OneBusAway had been mentioned in the past. The goal was to reach both regular and infrequent users of OneBusAway. The survey was anonymous, but users were invited to notify a special email address on completion of the survey to be entered in two $25 gift certificate drawings. A copy of the survey can be found at http://onebusaway.org/research.

A total of 488 respondents completed the survey during five days in August 2009. Basic demographic information about survey respondents was gathered, including gender, age, annual income, and number of children in household. Overall, respondents were 70% male. Age ranges of respondents included 18-24 (18%), 25-34 (55%), 35-44 (17%), 45-54 (7%) and 55 or older (3%). Annual household incomes were under $20k (8%), $20-40k (16%), $40-60k (18%), $60-80k (16%), $80-100k (18%), and over $100k (24%). A total of 13% of respondents reported having children in their household. In comparison to typical transit users in the region (7), the survey respondents are more predominantly male and younger, while income levels are comparable. The survey sample population is likely skewed toward OneBusAway users enthusiastic enough to take a survey. Even so, it is worth noting that the 488 respondents who

took the survey were nearly 10% of the daily OneBusAway user base of August 2009. At the time, the OneBusAway user base represented less than 2% of Metro's weekday ridership.

One interesting finding from the initial survey was that users reported walking more as a result. Given significant national concerns with health and obesity, and the value of walking for health, this issue was pursued in more depth. To do so, a shorter second survey was developed asking for specific details about connections between OneBusAway and changes in walking behavior. Of the 488 respondents from the initial survey, 193 entered the gift certificate drawing, providing us with email contact information. The follow-up survey was advertised to those respondents, who were again optionally entered in a second gift certificate drawing. A total of 139 respondents took the follow-up walking survey during five days in August of 2009, a response rate of 72%.

RESULTS

Usage of Transit and OneBusAway

Survey respondents were asked general questions about how often they rode the bus on a weekly basis and for what purpose. The results, in Figure 2, show that the majority of respondents (more than 60%) could be classified as daily riders, making 9 or more bus trips each week. For trip purpose, commuting to work is the most frequent response, though non-commute trips such as leisure, personal business, and shopping are frequent as well.

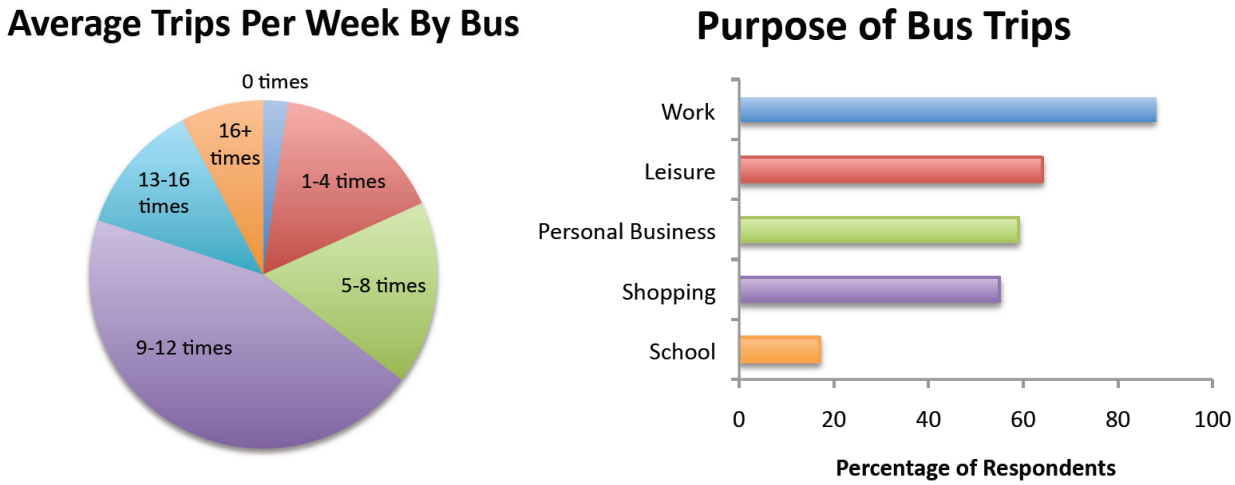

FIGURE 2 Average number of trips per week by bus and purpose of bus trips as percentage of total respondents.

The survey also asked which OneBusAway tools respondents used, if any. The relative percentage of total respondents for each individual interface is shown in Figure 3, with the iPhone-optimized and standard web interfaces dominating the usage. The relative ratios of users of the various tools in the survey show a reasonably close match with actual usage statistics from the server logs.

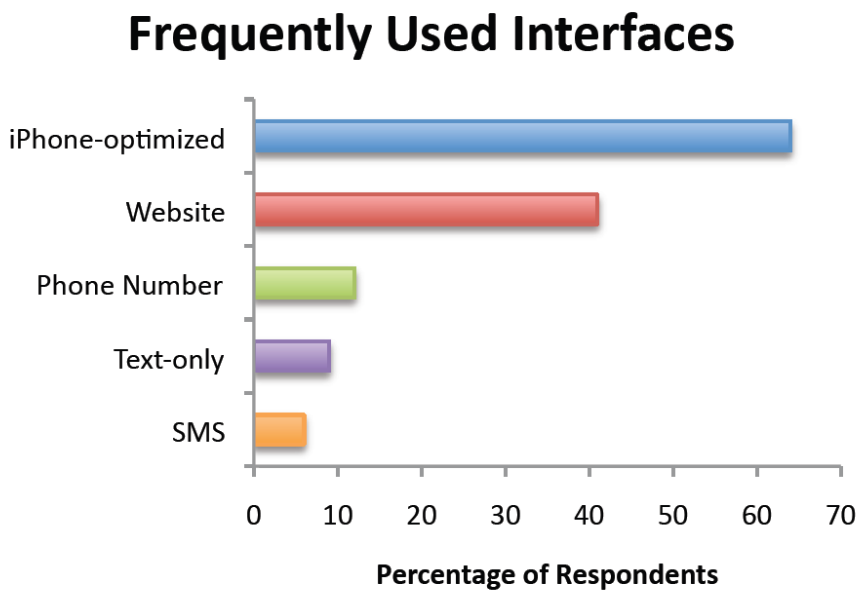

FIGURE 3 Percentage of respondents who frequently use each specified OneBusAway tool.

OneBusAway and Changing Behavior

Satisfaction With Public Transit

Survey respondents were asked whether their overall satisfaction with transit had changed as a result of using OneBusAway. The results (Figure 4) show an overwhelmingly positive change in overall satisfaction as a result of using OneBusAway, with 92% of respondents stating that they were either somewhat more satisfied or much more satisfied with transit. This is a remarkably strong effect from adding a relatively inexpensive technology to public transit.

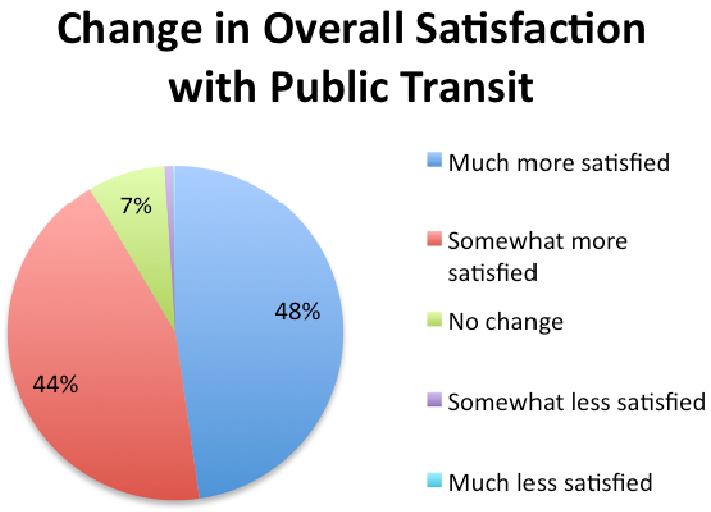

FIGURE 4 Change in overall satisfaction with transit as a result of using OneBusAway.

To get a better picture of user satisfaction with transit with regards to OneBusAway, respondents were asked to describe how their satisfaction had changed in a free-form comment. The 418 responses fell into a small number of key categories. The most common response, mentioned by 38% of respondents, concerned how OneBusAway alleviated the uncertainty and frustration of not knowing when a bus is really going to arrive. Typical comments:

> "The biggest frustration with taking busses is the inconsistency with being able to adhere to schedules because of road traffic. Onebusaway solves all of that frustration."

> "I no longer sit with pitted stomach wondering where is the bus. It's less stressful simply knowing it's nine minutes away, or whatever the case."

The next most common response, mentioned by 35% of respondents, concerned how OneBusAway increased the ease and flexibility of planning travel using transit, including which bus to take or when to catch it. Typical comments:

> "I can make decisions about which bus stop to go to and which bus to catch as I have options for the trip home after work."

> "It helps plan my schedule a little better to know if I can take a little extra time or if I have to hurry faster so I don't miss my bus."

Other responses included saving time (25%) and the general convenience of OneBusAway tools (10%) in comparison to existing tools.

In addition to the comments describing changes in satisfaction with transit, it was also found that satisfaction was significantly negatively correlated with age among respondents (χ^2=24.615, p=0.017). The younger the rider, the more satisfaction they have with transit from using OneBusAway.

Time Spent Waiting

Survey respondents were asked if there had been a change in the amount of time they spent waiting for the bus as a result of using OneBusAway. Among respondents, 91% reported spending less time waiting, 8% reported no change, and 1% reported an increase in wait times. Regarding the relationship between satisfaction and wait time, overall satisfaction with public transport was found to be highly correlated with decreased wait time amongst survey respondents (χ^2=40.467, p < 10^-5). These results are confirmed by the user comments, noted in the previous section, that list time savings as a major reason for increases in overall satisfaction.

Number of Transit Trips Per Week

In addition to changes in satisfaction and wait time, users were asked how their average number of weekly commute and non-commute trips has changed as result of using OneBusAway. The results, presented in Figure 5, show an increase in the number of trips taken by OneBusAway users, with more gains in non-commute trips.

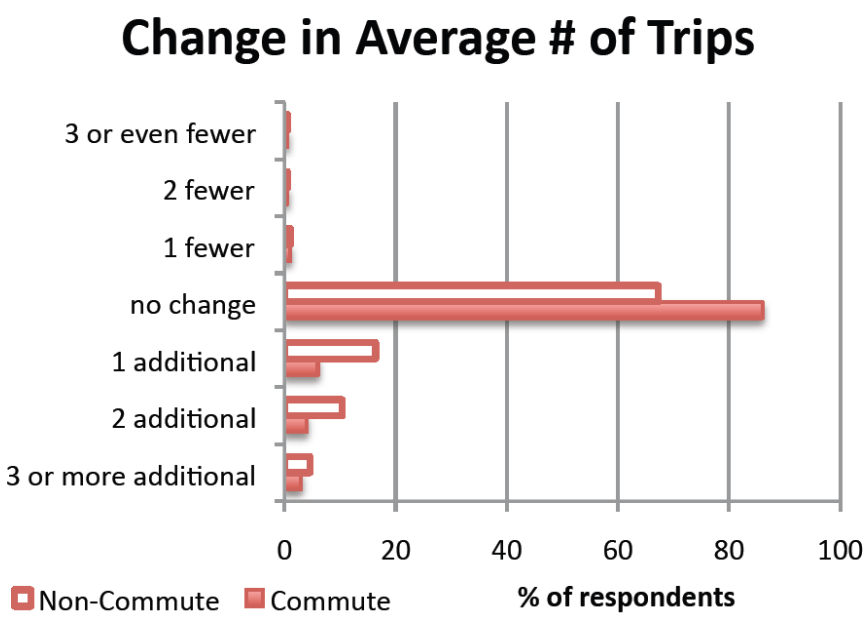

FIGURE 5 Change in the average number of trips per week among users of OneBusAway.

Access to Schedule Information

Respondents were asked how they typically find bus departure time information. While 16% of respondents reported using the published schedule provided by the transit agency either on paper or online, 73% of respondents indicated that they used OneBusAway to find out when the next bus will actually arrive, without consideration of the published schedule. The remaining 10% used some combination of the two, or else existing trip planning tools. This shift away from traditional static schedules has some important policy implications, presented later.

Perception of Personal Safety

Users were asked how their perception of personal safety had changed as result of using OneBusAway. While 79% of respondents reported no change, 18% reported feeling somewhat safer and 3% reported feeling much safer. This increase in the perception of safety when using OneBusAway is significant overall (χ^2=98.05, p < 10^-15). Additionally, safety was correlated with gender (χ^2=19.458, p=0.001), with greater increases for women.

Furthermore, respondents whose feeling of safety had changed were asked to describe how in a free-form comment. Of such respondents, 60% reported spending less time waiting at the bus stop as their reason, while 25% mentioned that OneBusAway removed some of their uncertainty. Respondents specifically mentioned waiting at night (25%) or at unsavory stops (11%) as potential reasons they might feel unsafe in the first place. Respondents also described using OneBusAway to plan alternate routes (14%) or to help decide on walking to a different stop (7%) in order to increase feelings of safety. Representative comments:

> "Having the ability to know when my bus will arrive helps me decide whether or not to stay at a bus stop that I may feel a little sketchy about or move on to a different one. Or even, stay inside of a building until the bus does arrive."

"Onebusaway makes riding the bus seem more accessible and safe. I can plan when to leave the house better and spend less time waiting at dark or remote stops."

These results are consistent with a 2006 King County Metro rider survey which found that 19% of riders were dissatisfied with personal safety while waiting for the bus after dark (7).

Walking to a Different Stop

Survey respondents were asked how likely they are to walk to a different bus stop based on information from OneBusAway. While 19% of respondents reported no change in their walking habits and 3% reported they were less likely to walk to a different stop, a full 78% reported they were more likely to walk to a different stop. This substantial response regarding increased walking was not expected in the original survey, which lead to a second survey to provide more detail about how and why walking habits had changed.

In the follow-up survey, respondents were again asked how likely they are to walk to a different bus stop based on OneBusAway information, and had an almost identical response (79% more, 19% no change, 2% less). They were next asked where they walk when they walk to a different bus stop. The results (Figure 6) show that the most popular choice was to a stop on a different route, while stops further along or ahead on the current route were picked less frequently. Respondents were also asked to classify why they walked to a different stop. Responses indicate that finding a faster route to their destination is the most popular reason. On average, respondents estimated that they walk 6.9 more blocks per week than before using OneBusAway (SD=8.2), with a median value of 5 blocks. The high standard deviation and multiple reasons given for walking suggest that this survey may capture multiple walking populations with different motivations to walk.

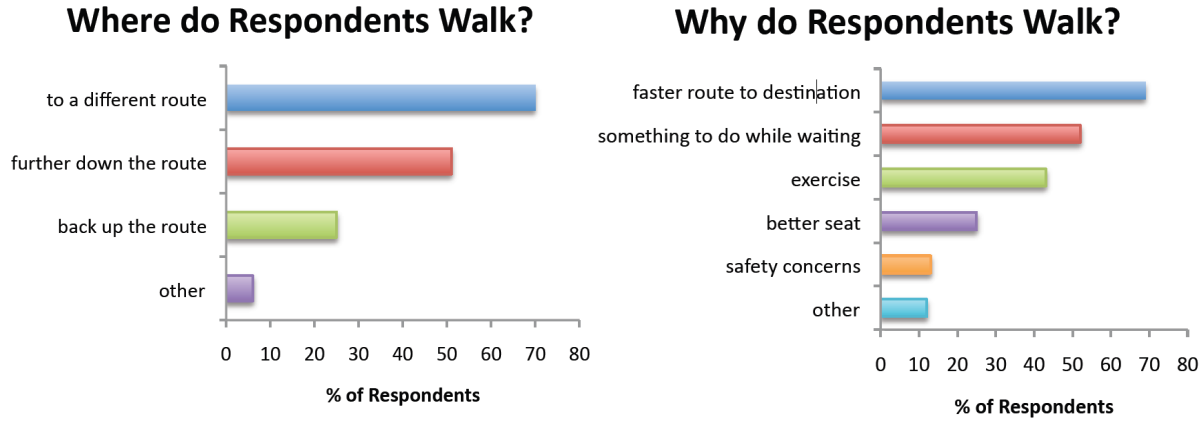

FIGURE 6 Where and why do respondents walk when they choose to walk to a different stop?

Several respondents commented about OneBusAway not only increasing their walking, but decreasing the stress involved with the walk, especially the threat of being passed by the bus while in between stops. As one explained, "Before OneBusAway, I played what I like to call Metro Roulette: start walking to the next stop for exercise, and hope my bus didn't pass me by. Now, though I miss out on the adrenaline rush elicited by Metro Roulette, I can make an

informed decision about whether or not to walk to the next stop..." Respondents also explained that OneBusAway lets them know the speed at which they must walk.

Multiple respondents also commented about their decision to walk the entire distance to their destination based on OneBusAway information. "If I know a bus is a long time away from arriving, I'll just walk to my destination if walking would be faster than waiting." This was particularly true in the case of transfers.

In the first survey, there were a tiny number of respondents who indicated they walked less due to OneBusAway than they otherwise would. In the follow-up survey, it was found that this result is due to respondents (26%) taking advantage of the real-time arrival information from OneBusAway to hop on a bus arriving shortly to save a trip of a few blocks that they would have otherwise walked.

DISCUSSION

A few important caveats should be noted before discussion of the results. First, the survey results are self-report, which can call into question the reliability of responses and limits the potential strength of claims to be made using response data. Second, there was no control group of users who have not heard of or used OneBusAway or other real-time arrival information tools, which limits the strength of claims to be made regarding changes in behavior resulting from the OneBusAway tool. Despite these limitations, the results from the survey, bolstered by qualitative comments from survey respondents, make a strong case for the value of systems such as OneBusAway. Survey respondents indicated a number of positive outcomes as a result of their usage of OneBusAway: increases in overall satisfaction with transit, decreases in wait time, increases in the average number of weekly transit trips (non-commute especially), increases in feelings of personal safety, and increases in likelihood of walking.

The reduction in wait time is especially interesting. This reduction is believed to be a combination of actual reductions in wait time, along with reductions in perceived wait time. Previous studies have shown that fixed real-time arrival signage induces reductions in perceived wait time for transit riders (5). In a follow-up study to the one described here, the difference between actual and perceived wait time was measured with and without mobile real-time information (18). The provision of mobile real-time information reduced both the inflated wait time perceived by waiting transit riders and the actual wait time they experience. But regardless of how much of the reduction in wait time is perceived and how much is actual, survey results show a strong correlation between reported reductions in wait time and an increase in overall satisfaction with transit.

The increase in number of trips per week is a potentially important finding for policy makers looking to boost usage of transit. Again, the exact increase is hard to quantify with only these survey results due to potential self-report bias, but the larger increase in non-commute trips makes intuitive sense as riders have more flexibility in this area to make gains in weekly ridership. Comments support the notion of more non-commute trips as well: "While my work usage was pretty much on a fixed schedule, OneBusAway has made impromptu trips much more convenient"; "The OneBusAway app makes me feel more comfortable with spontaneously changing trip plans"; and "Better able to fit in quick purchasing trips."

The survey results also indicated that for some of the users, feelings of personal safety play an important role in using transit, and that OneBusAway can help address concerns in this area. Despite the improvements brought by OneBusAway, there are some real opportunities for

addressing this issue further in a value sensitive way (19) to provide riders with additional tools and resources.

The reported increase in walking is notable, because there are health benefits from increased walking, independent of whether the users are walking for exercise or just to get to their destinations faster. As noted before, the self-reported number of additional blocks walked by respondents is probably not an accurate measure of actual walking. However, quantitative and qualitative results from the survey paint a strong picture that users of OneBusAway have the additional flexibility and confidence they need to walk to a different stop when they so choose.

People are also using OneBusAway in other unexpected ways. One user commented:"OBA makes [it] much easier to avoid standing room only busses by letting me know there's a follow up bus right behind the current full bus." Like predicted arrival time, the number of available seats on a bus is another important piece of information to make more visible in transit systems. The OneBusAway team has already talked with agencies about allowing drivers to note when their vehicles are full in an automated way so that riders can avoid a packed bus.

A significant number of survey respondents reported issues arising from the reliability of the underlying data feed, pointing to an area in which design improvements are needed for both OneBusAway and other applications for this domain. The underlying real-time arrival information used by OneBusAway is not 100% accurate, and tracking vehicles and predicting arrival times in dynamic urban environments with changing traffic conditions is an on-going area of work for both academic researchers and commercial vendors. Specific opportunities exist for presenting the inherent uncertainty of arrival information in an appropriate way to users. Routing information, timetables, and other machine-readable schedule data sets provided by transit agencies are not without flaws either. Options for addressing these occasional errors include providing users with targeted feedback tools, allowing transit agencies to crowd-source the correction of their data.

Policy Implications

Real-time arrival information using fixed signage is relatively accepted as a means to increase ridership by reducing rider anxiety, increasing the perception of reliability and presenting an image of a modern transit system (20). The results above suggest that providing transit traveler information using tools such as OneBusAway yields other positive outcomes as well. If these results hold on wider-scale evaluation, this would confirm that providing real-time arrival information on mobile platforms is a worthwhile investment for transit agencies, because the benefits to riders and the agency can far outweigh the costs.

In the transit service planning industry, 10 minutes is considered the barrier between schedule-based and headway-based service. A recent study found that at 11 minutes, passengers begin to coordinate their arrivals rather than arriving randomly (20), thereby needing a schedule. However, with the introduction of real time information such as OneBusAway, users more frequently refer to real time information than to schedules to determine when to wait at the bus stop. This is important because a significant amount of time is lost in attempting to maintain reliability for scheduled service due to the slack time planners must build into the schedule (21). With headway-based service, supervisors use real time transit data to maintain a certain amount of time between buses, rather than attempting to maintain a schedule, thereby allowing free running time and saving slack time (22). This savings in running time can reduce agency costs to provide the same level of service on a transit route.

In addition, the investment in website and phone-based real time transit information can also save an agency substantially in deployment costs. As an example, Portland deployed their Transit Tracker program in 2001 with information displays at stops, a webpage and more recently a phone system. The transit tracker signs at light rail stations and 13 bus stops in Portland cost $950,000 including message signs and conduit. The cost for computer servers and web page development was much cheaper at $125,000 (23). Given the widespread availability of cell phones and web access, providing real time transit information via a service such as OneBusAway could yield a substantial savings for an agency over constructing real-time arrival display signs.

Finally, the OneBusAway application joins a growing list of innovative transit applications running on a variety of mobile platforms, made possible by forward-thinking transit agencies that have made their routes, schedules, and real-time arrival information available via public APIs. For these reasons, other transit agencies should be encouraged to include real-time arrival information in their transit systems and to publish this data, along with static schedule data, through public APIs so that applications like the OneBusAway toolset can help make transit work better for the riders who use it every day.

Future Work

Although the results of the initial evaluation were encouraging, we are cognizant of the limitations of self-report-bias and lack-of-control-population. We are therefore currently running a new study, in which we recruited a set of users participating in a transit incentive program, who have not heard of OneBusAway and have given them instrumented programs to run on high-end cell phones that perform activity recognition, so that we can track their actual transit usage, walking and other travel behavior over time. These users will be compared to a control group, which has the same incentives but not OneBusAway. In another related study, we have surveyed mobile real-time information users at bus stops to compare their perceived and actual wait times to those riders without real-time arrival information (18).

In Autumn 2009, we also began to systematically apply the Value Sensitive Design theory and methodology (19) to OneBusAway, initially working toward a principled prioritization of potential projects to help ensure that our limited resources are best spent meeting the actual needs of the larger public-transit-using community. As an example, we are exploring mobile applications and interface specifically tailored to blind and deaf-blind users. The same technologies that allow us to pursue advanced location-aware mobile applications can help us build applications tailored to specifically address the usability issues faced by this group of transit users. Through this same initiative, we are exploring the opinions of bus drivers about real-time information and other potential transit tools.

CONCLUSION

This paper presents the results from a survey evaluation of OneBusAway, a set of tools specifically providing access to real-time arrival information for transit and improving the usability of transit in general. The results of this survey are that respondents have an overall increase in satisfaction with transit, make more transit trips on a weekly basis, spend less time waiting for transit, have increased feelings of personal safety when using transit, and often walk further when using transit. Further research is needed to quantify the impacts of mobile real-time information systems. However, the results of this survey show that the provision of mobile real-time bus arrival information has a positive impact on riders and is worth further implementation

by transit agencies. Transit agencies should be encouraged to continue the growing trend of opening up their data to third-party developers to support innovation applications such as OneBusAway.

ACKNOWLEDGMENTS

This research has been supported in part by a gift from Nokia Research Center and in part by the National Science Foundation under Grant No. IIS-0705898. Thanks to Hana Sevcikova for help with the statistical analysis, and also to all of the users of OneBusAway for providing valuable feedback and suggestions, both in formal surveys and in many other forums.

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