



Connected Commuting

Research and Analysis from the New Cities Foundation Task Force in San Jose



Research report co-
created with:



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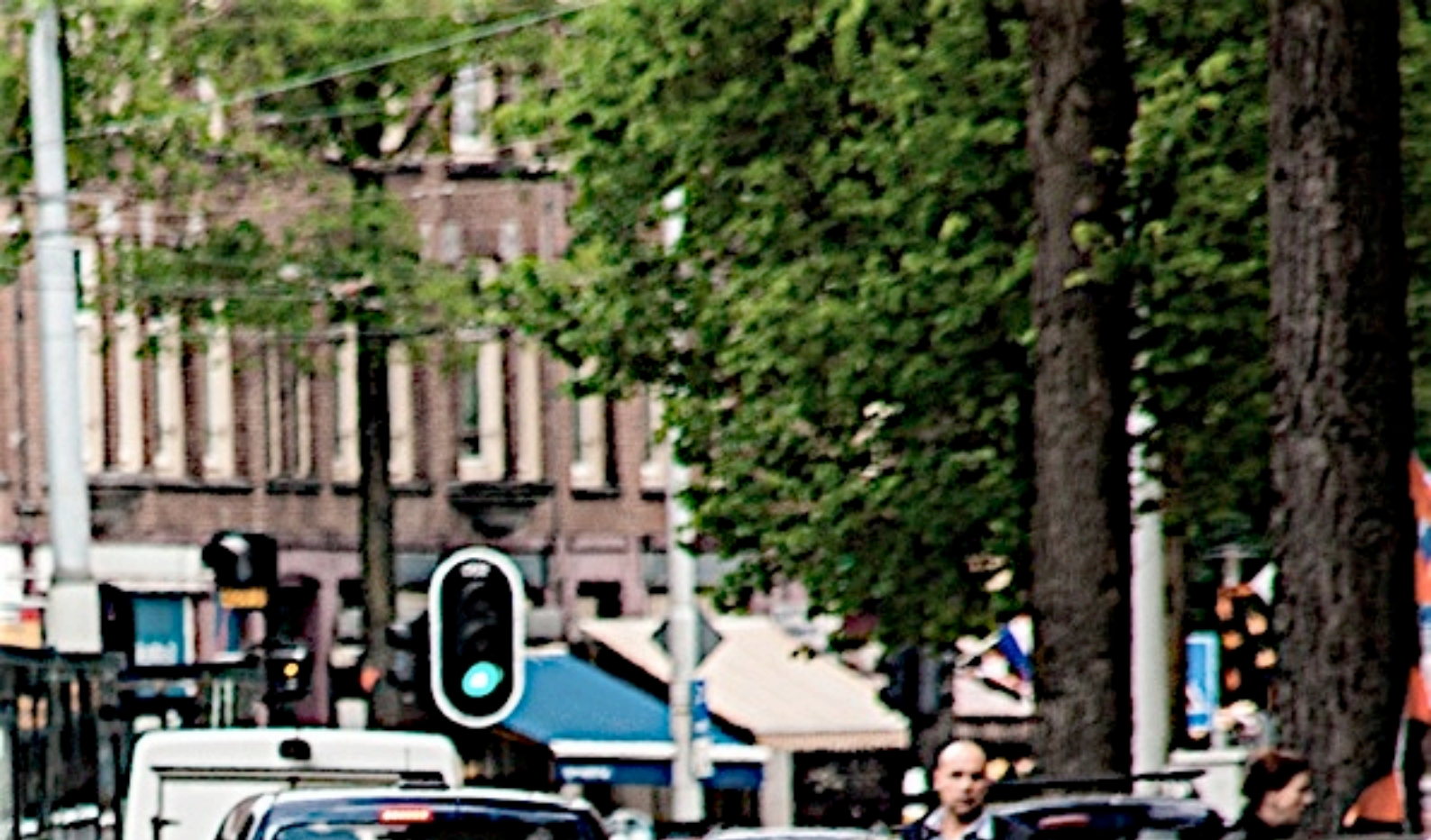
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Executive Summary



Urban traffic and the difficulties of commuting are among the most intractable problems that face cities across the world. Traffic congestion and commuting inefficiencies place a heavy strain on urban infrastructure, increase pollution, damage the environment, and lead to loss of resources, time and productivity. On a personal level, commuting has been identified as one of the most unpleasant urban experiences and is often associated with very high levels of stress.

The New Cities Foundation — a non-profit organization dedicated to creating more sustainable, dynamic, creative and just global cities — and Ericsson, the world's leading provider of communications technology and services and a Founding Member of the Foundation, have set up a Task Force on Connected Commuting, in partnership with the San Jose Department of Transportation, the University of California Center for Information Technology Research in the Interest of Society (CITRIS), and two start-up commuter-focused mobile applications, Waze and Roadify.

This study aims to look at the potential benefits of connecting commuters to one another through mobile phone apps. It seeks to compare experiences of connected and unconnected commuters, and examines the kinds of information commuters share with each other. **Can a new level of networking between commuters enhance the overall commuting experience?** Is the connected commute “better” than the non-connected commute? Is it more rewarding and less stressful? Is it shorter and potentially cheaper for the user? From a city perspective, is it more resource efficient? Finally, what aspects of existing tools based on user-generated data should be developed further to create more powerful positive impact for commuters? This study is an important milestone to capture the power of data generated by social networks.

The broader ambition of the Task Force is to develop new potential technologies, products and services to improve commuting, and completion of this study is an important step forward.

Main findings and Recommendations

Part I: Commuter Sentiment Analysis

1. Commuter comments collected by smartphone commuter applications provide valuable high-quality real-time data about commuter sentiment in relation to their commutes.
2. The existence of a general platform allowing users to share feelings about their commute could in itself contribute to a more enjoyable commuting experience by adding a conversational element, which users seem to value highly.
3. Government and/or employer programs should consider conducting sentiment analysis to help identify and prioritize their efforts to address commuters' frustration by time of day, day of week, locations and other topics of concern to commuters.
4. Trip planning applications should use historical analysis of commuter sentiment to provide route guidance based on positive user experiences on specific routes; these apps should also provide a feature that allows commuters to rate their travel experience, which can be used for further analysis.
5. Transportation and traffic management authorities should consider using sentiment analysis as a real-time, cost-effective metric for evaluating the impact of infrastructure investments. This method is more effective than traditional surveys.

Part II: Comparative Focus Groups

1. Public transportation commuters are different from car commuters.
 - Commuters using public transport see themselves as knowledgeable and experienced. They don't immediately see the benefit in receiving information from other commuters.
 - Car commuters, on the other hand, are looking to connect while in the car. Their "alone time" creates a prime environment for connecting and sharing.

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2. Within the group of public transport users, connected and unconnected commuters are similar.
 - Importantly, they are already connected to others physically while commuting, and this minimizes the need for connection through technology.
 - Both describe themselves as “experienced” and believe they “know what they’re doing.”
 - They use technology while planning routes, more rarely during the commute itself.

3. Within the group of car commuters there are slight differences between connected and unconnected commuters; in general, connected car commuters seem somewhat happier.
 - Connected car commuters describe themselves as “happy” / “content” / “excited.” Their biggest complaint is that they are “busy.”
 - Unconnected car commuters describe themselves as “neutral” to “happy.” Their main complaint is “fatigue.”

4. Unlike public commuters, car commuters recognize a need for technology at both the planning stage and during the commute.
 - For car commuters technology assistance is needed:
 - ▶ In the planning stage: deciding the mode of transportation or route.
 - ▶ Real time: re-routing around traffic and other incidents.

5. There is one key difference between connected and unconnected commuters: how they feel about sharing information with people they do not know while commuting.
 - Connected commuters are very open to sharing (and receiving) information from people they don’t know while commuting. They appreciate receiving information, and this makes them more interested in “giving back” information in the future.

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- Unconnected commuters have mixed to negative feelings, particularly about receiving information from those they don't know. They do not naturally trust crowd-sourced information and believe it may be wrong, or even worse, intentionally misleading.

6. Technology is integral to the future of commuting.

- Everyone (connected or not connected) uses technology on some level during or before their commute.
- There is a real opportunity to please commuters and enhance the commuting experience through future app technology.



Introduction



Introduction

In every major city, the inefficiency of daily commuting has a negative impact on society, the environment and the economy. Billions of trips to work and schools require unnecessary hours stalled in traffic. Delays in the United States alone cost commuters an average of 34 hours a year per commuter¹, and the 2012 Ericsson City Life Report found that urban commutes averaged nearly 2.5 hours in the 13 global cities it surveyed. This wasted time is not just an inconvenience for commuters; wasted fuel, carbon emissions and opportunity costs mean that in the United States traffic congestion costs over \$100 billion annually². Globally, these costs multiply; workers and students from Stockholm to Seoul cite daily commutes as a key cause of stress and missed time at work³. The remarkably negative impact of traffic congestion on the triple bottom line in developed and emerging societies alike positions it as one of the most important challenges facing cities today.

Traffic congestion has been met with many innovative solutions globally. Road space rationing in Brazil, car license plate quotas in China, and congestion pricing in the UK all aim to take vehicles off the road and motivate commuters to use public transit. Despite these efforts, however, more than 65% of urban commuters worldwide rely upon private vehicles⁴; further reductions in this ratio, should they come, are unlikely to overcome the rapid increase in sheer volume of cars on roads around the world. Steady increases in car ownership, especially in emerging markets, also limit the efficacy of gradual increases in roadway capacity. In fact, increasing the number of lanes and routes actually adds to the problem, by drawing more commuters onto the road. These policies have experienced only limited success because they focus on altering the supply and demand of road space, rather than rethinking the market for road space altogether.

Although governments have focused on roadway supply and demand, commuters would benefit from a simple increase in information regarding the supply and demand that already exists. The U.S. Department of Transportation estimates that half of all congestion is due to “non-recurring”

¹ Eisele, B. Lomax, T. and Schrank, D., 2011. *2011 Urban Mobility Report*. College Station: Texas Transportation Institute, Texas A & M University.

² *Ibid.*

³ Ericsson, 2012. *City Life*. Stockholm: Ericsson ConsumerLab

⁴ IBM, 2011. *Global Commuter Pain Survey: Traffic Congestion Down, Pain Way Up*. Armonk: IBM

events such as accidents and road work⁵ – precisely the type of events that commuters cannot predict but could incorporate into trip planning. Ericsson’s City Life Report observes that “providing real-time traffic and transport schedule updates” would eliminate the unpredictability of commuting and put city-dwellers at ease. In response, radio stations in Sao Paulo provide 24/7 coverage of traffic patterns and solicit commuter input for accurate updates.

Today, the ubiquity of smartphones and related technology means gathering and distributing information to commuters can be simple and effective. The following study aims to understand the potential advantages of smartphone technology for individual commuters. The selected pilot city for the study was San Jose, California — relatively typical in terms of average commute times and distances. San Jose ranks 22nd among large American cities in number of person-hours delayed (42 million annually), and 25th in congestion cost (\$842 million), suggesting that even modest improvement could have considerable positive impact city-wide⁶.

New Cities Foundation Task Force on Connected Commuting

The New Cities Foundation Task Force on Connected Commuting has taken a unique approach to improving the daily commuter experience. The Task Force has undertaken an important first step by looking at ways in which commuters who share the same daily route (whether by car or public transport) can share information with one another in real time via mobile apps such as Waze and Roadify.

Smartphones and social media platforms such as Twitter and Facebook are increasingly integrated into daily city life, and information can therefore be transferred among individuals more seamlessly than ever before. Waze and Roadify are two leading and widely-recognized

⁵ US Department of Transportation, 2006. *National Strategy to Reduce Congestion on America’s Transportation Network*. Washington D.C.: US Department of Transportation

⁶ Eisele, B. Lomax, T. and Schrank, D., 2011. *2011 Urban Mobility Report*. College Station: Texas Transportation Institute, Texas A & M University.

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transportation-focused mobile apps designed to enable commuters to share real-time user-generated travel information. Users communicate via short text messages in order to facilitate a more efficient and enjoyable commute for others. In the case of Roadify, users can also view route-specific comments that people have left on Twitter in relation to their commute.

The first part of the two-part Task Force study, undertaken by CITRIS, seeks to understand the pertinence of these user-generated messages or micro-blogs, looking at how this data and its analysis might be used to improve the commuting experience, both for individual commuters and from a system point of view. For example, transportation agencies and local governments could employ user-generated information that is localized and pertinent to create and exploit new connections among relevant actors involved in coordinating and improving commuter routes — making commutes shorter, more efficient, and generally happier.

Current trip-planning mobile applications allow users to take advantage of network maps when planning their routes, and offer real-time information on train and bus arrival times or heavily congested roads. Some trip-planning tools also allow users to publish comments that are shared with other users. The most intriguing function here seems to be the social communication aspect of these apps and how they can be effectively applied in the context of urban mobility. This function not only allows users to share relevant information with each other, but also offers valuable data that could ultimately help transportation agencies upgrade the way they structure their initiatives aimed at improving and streamlining commutes.

The second part of the study was conducted through focus group interviews that compared experiences of both private car and public transport commuters who were categorized as either connected (defined as actively sharing and receiving information from the social networking feature of the commuter apps) or unconnected commuters (not communicating or sharing through the commuter apps). The goal: to discover commuter preferences, behavioral trends, and compare overall commute experiences.

The New Cities Foundation serves as the primary coordinating body for the project. Ericsson's Research and Consumerlab teams worked with the New Cities Foundation to design the project, providing strategic guidance in articulating the central research question and in project

Introduction

implementation. After a careful exploration of several US West Coast cities, San Jose, California was selected as the pilot location for the project. The San Jose Department of Transportation — the key public agency partner in the Task Force — has been instrumental in providing the traffic and transport information necessary to understand local road conditions, and facilitated the involvement of appropriate transportation agencies. Waze (a trip planning app focused on drivers) and Roadify (an app for public transportation users) are the primary providers of the anonymized user data that was used to study commuter behavior and information-sharing. The University of California CITRIS conducted the analysis of the data.



Part I: Commuter Sentiment Analysis



Summary of Key Findings

The study discussed here is the first part of the Task Force's broader effort to develop innovative solutions to improve commuting. Undertaken by CITRIS, it used commuter sentiment analysis tools to understand and improve the commuting experience.

The study's main findings and recommendations are:

1. Commuter comments collected by smartphone applications provide valuable high-quality real-time data about commuters' sentiment in relation to their commutes.
2. The existence of a general platform allowing users to share their feelings about their commute could in itself contribute to a more enjoyable commuting experience by adding a conversational element, which users seem to value highly.
3. Government and/or employer programs should consider conducting sentiment analysis to help identify and prioritize their efforts to address commuters' frustration by time of day, day of week, locations and other topics of concern to commuters.
4. Trip planning applications should use historical analysis of commuter sentiment to provide route guidance based on positive user experiences on specific routes; these apps should also provide a feature that allows commuters to rate their travel experience, which can be used for further analysis.
5. Transportation and traffic management authorities should consider using sentiment analysis as a real-time, cost-effective metric for evaluating the impact of infrastructure changes. This method is more effective than traditional surveys.

Methodology

The CITRIS team compiled a full analysis report for the Task Force upon completion of the study (see full report [here](#)⁷). This paper summarizes the methods used during the analysis, as well as the subsequent findings and recommendations. The primary method used was Text Sentiment Analysis: a software program creates a reference dictionary that can recognize the emotional connotation behind specific words and phrases. The software pre-assigns numerical values to words frequently featured in user comments, using specific characteristics or contextual elements, such as positivity or negativity and/or the intensity of the emotion. For example, the word “happy” generally carries a positive sentiment, while the word “traffic” generally carries a negative sentiment. Based on these pre-assigned values, statistical calculations determine the overall positive or negative emotion of the body of text. The data set in this case was derived from a feature within Waze and Roadify that allows users to publish comments and share relevant traffic information with each other.

Data Analysis

Text sentiment analysis has previously been employed to evaluate longer texts such as consumer product reviews or blogs and forums, to gauge public opinion on certain topics. While some text sentiment analysis has been conducted on short texts, most notably tweets, this is one of the first reports on sentiment relating to transportation and mobility issues.

Data produced by Waze and Roadify has the unique ability to offer first-hand insights into the commuter experience in real-time. Compared to general forums like Twitter, which produce overwhelming and non-topic specific pools of data, these applications provide a smaller, topic-specific pool of data, simplifying the process of extracting and analyzing information.

⁷ http://www.newcitiesfoundation.org/wp-content/uploads/UCBerkeley_NCF_Report_Final.pdf

Waze Data Set

Waze is a driver-focused smartphone application that provides a platform for users to report traffic incidents with highly relevant information on specific travel routes. Real-time comments by users can alert other drivers about local traffic conditions, such as roadblocks or accidents (see image below). The reports are shared with Waze users who frequent the same route. For the purpose of this analysis, Waze provided 114,256 user reports from a specific geographic area within San Jose, California for the period of January 1, 2010 to February 29, 2012 (26 months).



Screen captures from the Waze app

When users submit a report, they are required to first choose a category. Those categories are: “traffic jam,” “police,” “accident,” “hazard,” “chit chat” and “other.” The first four categories are topic-specific. However, the “chit chat” category allows users to post comments with general travel-related information. Users can choose whether or not to publish comments.

Of the 114,256 reports, 15,131 contained optional comments added by users, representing approximately 13% of the original set of reports. Comments encourage users to provide more

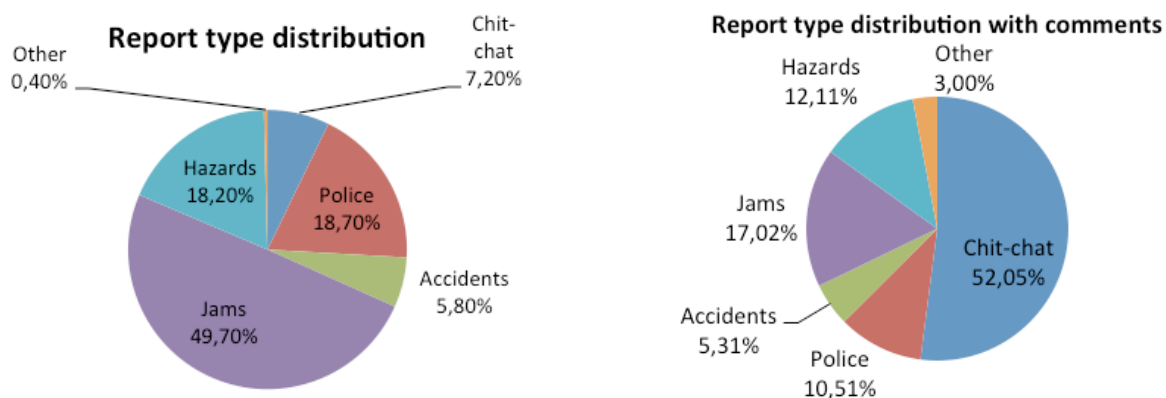
Part I: Commuter Sentiment Analysis

detailed and personal information regarding their commute and can therefore be more informative than reports.

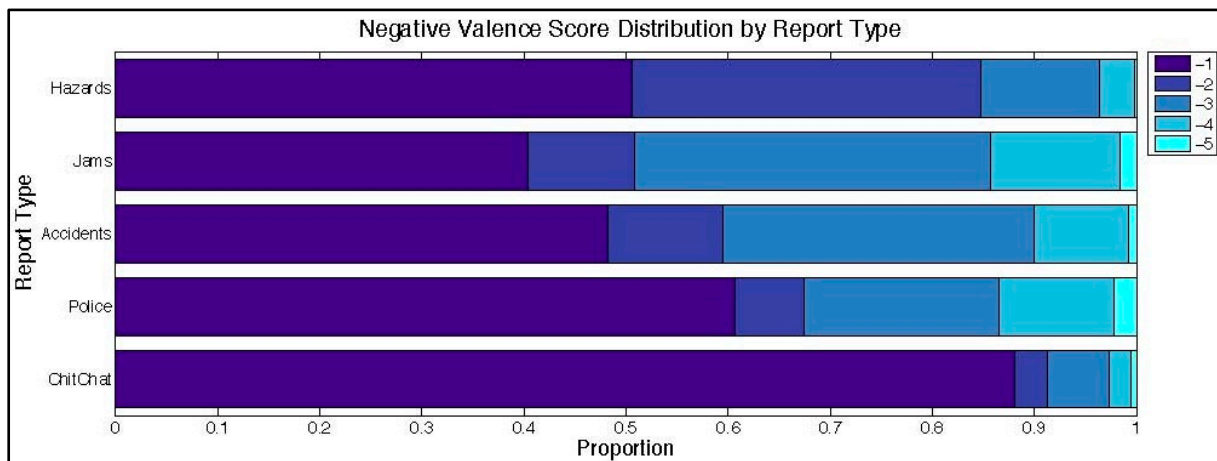
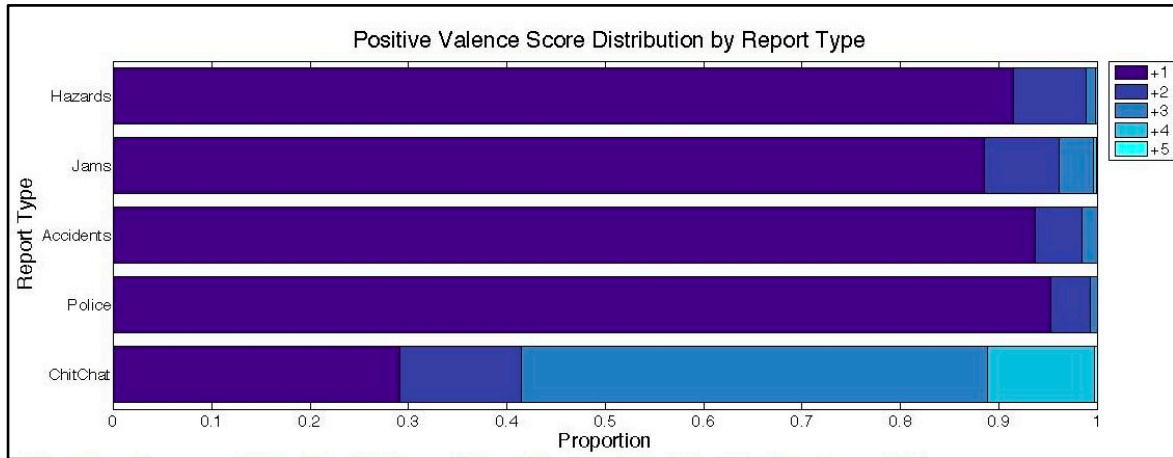
CITRIS analyzed the sentiments associated with these user comments, which were classified as either predominantly positive or predominantly negative. The comments were then analyzed to determine the distribution of positive and negative classification.

Based on the above information, the CITRIS report notes the following key findings:

Close to 50% of users selected “traffic jam” when making a report, followed by “police” and “hazard,” each with 20%; 7% selected “chit chat” and 6% selected “accidents” (see figure on left below). However, the distribution changes when users decide to publish a comment with their report, with “chit chat” receiving 52% of comments, “traffic jam” with 17%, “hazards” with 12%, “police” with 10% and “accidents” with 5% (see figure on right below).



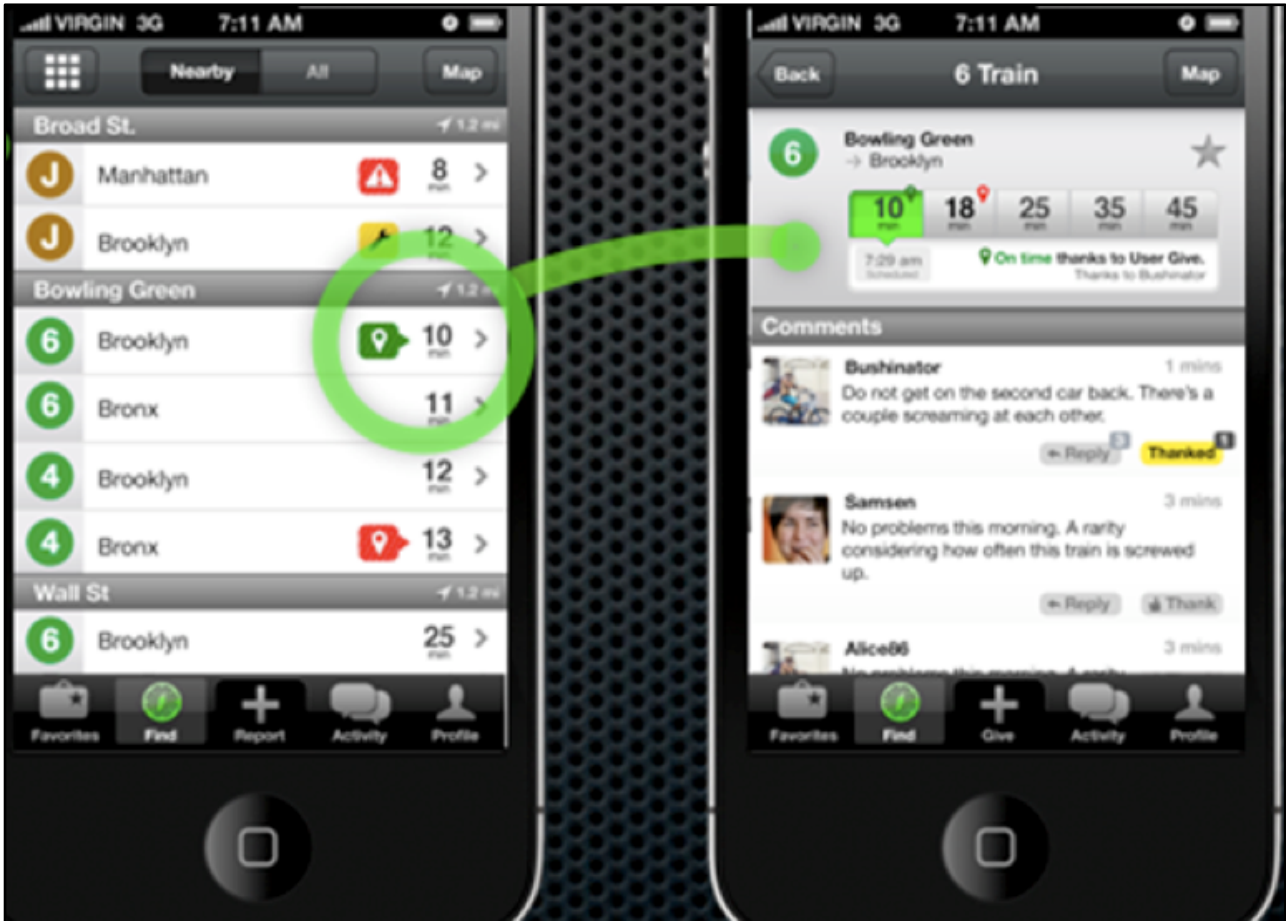
The word-cloud image displayed below captures the words most frequently used by Waze users when selecting the “hazard” category to enter a report. A word-cloud displays words in different font sizes as a function of how often each word is used in a given set of words; the more frequent the occurrence of the word, the larger the font size. This word-cloud illustrates the high degree of relevance of users’ comments with respect to the chosen category, indicating the



Roadify Data Set

Roadify is a public transport focused smartphone application that provides commuters with information about transit schedules, delays, and service alerts from official sources, while also allowing commuters to include their own commentary about local transit conditions. These rider comments are supplemented by filtered tweets that are relevant to users' particular route or line. While user comments provided by Roadify did offer some data, the data set was not large enough to be able to draw comprehensive conclusions to the same degree as the Waze data set. This is due to the relatively recent launch of the app in the San Jose area and a low user

The image below illustrates the user commenting functionality on the Roadify app.



Screen capture of the Roadify app

Although the recommendations presented here are preliminary and should ideally be further explored through analysis of larger data sets, the CITRIS report yields a number of interesting conclusions that brings the Task Force closer to understanding the effects of social networking on the overall commute experience. The following recommendations are intended to offer guidance as the Task Force members embark on the next phase of the project. The recommendations are therefore categorized according to the audience for which they are best suited.

Main Findings and Recommendations

Recommendations for Transportation Agencies

- The study concludes that **sentiment analysis is indeed a practical and applicable tool** for measuring commuters' emotions, and recommends its use for future analysis. This can be useful for understanding trends among commuters and how their emotions change according to their location, the time of day, the day of the week, and the feature or category of the app they use. For example, users might exhibit different emotions when they comment in the "jams" and "chit chat" categories. Public agencies should note that this type of social data can be useful to motivate users to use alternate routes or modes of transport, and should be encouraged to embrace social data more aggressively. For instance, services like 511.org in the U.S. currently only provide travel information, but could go beyond this to include social network data in the future.
- Given the high prevalence of negative sentiment associated with the word "traffic" during the evening commute, it is recommended that local programs aimed at improving commuting focus their efforts on diminishing congestion during the **evening**, as opposed to the **morning**, commute. It is generally recommended that programs be designed to focus on areas that have a high prevalence of negative sentiment among users. Additionally, future commuter services or transit tools might consider incorporating the measure of sentiment as an additional input when relaying relevant information to commuters. For example, in addition to providing weather-related information, commuter services could also include commuter sentiment as an extra layer of data when recommending an alternate travel path.
- Transportation **mobile app data is recognized as a highly valuable source of real-time information that should be used to advise transportation agencies on problem areas** where infrastructure repairs or improvements are necessary. Sentiment analysis of this highly relevant app data could be used in a variety

of situations, such as during an event at a particular location where there is an anticipated mass gathering.

Recommendations for App Developers

- It was determined that the simple act of creating a general forum — such as the “chit chat” category in Waze, where users can communicate in a more social manner, in addition to sharing practical information — **significantly increases the level of positive emotion expressed by commuters**. This function has great potential in terms of facilitating a more enjoyable commute. Voice commands and other tools can help guard against distracted driving.
- Text sentiment analysis suggests that app developers can incorporate more features to improve users’ commuting and traveling experience. For example, because it is possible to measure and map geolocalized frustration, commuters could be routed around these choke points. People often use time or route length as a metric for re-routing their travel path, but another possibility is to use social network tools to minimize frustration as a metric for route guidance. **Developers could offer a positive category** for users to choose from when publishing a report, such as “nice road,” “scenic train route,” or “pleasant drive,” to offset the negative sentiment often associated with the category “hazard” or “traffic jam.” This could be an effective method of improving the commute experience through the promotion of more positive reports and comments.

Conclusion: Part I

In an age where rapid urbanization is taking place at an unprecedented scale, the commute to and from work continually presents challenges for transportation agencies, city officials and related actors. City officials need to manage rapid urban growth in a way that maximizes quality of life and comfort for the city’s inhabitants. Organizing and planning transportation programs to facilitate a smooth and enjoyable commute are key factors in pursuing this goal.

Traditional solutions to the challenge of urban mobility, such as infrastructure improvements, remain very costly, and are vulnerable to budget cuts. In addition, massive projects such as new roads or new metro lines have long lead times from the identification of needs to project delivery. They fail to address short term pressures posed by rapid urban growth, for example in China and India. It is therefore imperative to seek new channels for improving the commute experience rapidly and effectively.

The pervasive use of smartphones presents a unique opportunity to organize improvement programs, and should be explored further by city officials and transportation agencies. Specifically, mobile applications such as Waze and Roadify that offer topic-specific social networking platforms are a potentially useful measurement tool that city officials and commuters could use to facilitate a more enjoyable commute. Their crowd-sourced data, which cannot be easily collected by automatic sensors, is highly relevant and could potentially lead to an increased dialogue between the city and its citizens. Indeed, transportation and mobility is just one example of the ways city management could use crowd-sourcing; public safety is another possibility.

The Connected Commuting Task Force study was conducted to analyze existing data produced by these mobile applications, to identify current commuter habits and experiences based on commuters' use of these applications. The unique feature of this study is that there has been very little research conducted on the relationship between social networks and mobility, and specifically how this relationship could be exploited to bolster the daily commute experience.

The Task Force report presents useful preliminary conclusions and recommendations; they will be instrumental to organizing, planning and implementing the next stage of the project, which will be to compare the experience of commuters who use these apps against those who do not. Although further analysis of a more comprehensive set of data is required, the Task Force has pinpointed areas that should be targeted and those that need further examination. For example, the study confirms that text sentiment analysis is indeed a useful tool for measuring commuter trends. Future analysis could look at whether these social network platforms can affect commuter sentiment enough to change commuters' behavior, and perhaps encourage them to use public transportation instead of driving.

Part I: Commuter Sentiment Analysis

The City of San Jose is in the process of building a transportation management center, due for completion in 2013. This study's insights highlight ways in which user-generated commentary could be a useful source of information for transportation authorities as they structure this new department, and give city officials a new medium to directly engage with commuters for their mutual benefit. How can city officials use the real-time information to manage traffic flows? Could they utilize these mobile apps to communicate information to commuters? Going forward, the task at hand will be to determine what future steps are necessary to implement such a tool into the city system to promote an improved commuting experience.



Part II: Comparative Focus Groups



The analysis of data related to commuter information-sharing provided insights into the sentiments and behaviors of connected commuters. However, to understand whether a connected commute provides a better commute experience, it was necessary to compare the experiences of connected versus unconnected commuters, and to identify the specific ways in which being connected enhances the overall journey. To do this, the Task Force conducted several focus group studies of San Francisco Bay Area commuters who commute regularly into San Jose and surrounding areas.

The research objectives of the focus group interviews were:

1. To understand how social networking tools affect the overall commuting experience.
2. To compare and contrast the commute experience of connected versus unconnected commuters — those who do or do not share or receive information with other commuters in their daily commutes.
3. To identify unmet needs to aid the development of new technologies and solutions.

Methodology

Four focus groups consisting of 4-5 commuters each were conducted in San Jose. The group breakdown was as follows:

- Two groups of commuters who do not use trip-planning apps containing a social networking feature
- One group of commuters who use the Roadify app
- One group of commuters who use the Waze app

The following criteria were used to select a representative group:

- Each group had 2-4 males and 2-4 females

- A mix of respondents aged 21 to 64 years old
- All commuted into the city of San Jose at least twice a week
- A mix of transportation used when commuting – such as using public transportation or driving a car
- All commutes exceeded 30 minutes in each direction
- Groups included a mix of commuting times
- Two of the four user groups used the Waze or Roadify app at least once a week on average and were open to continue using the apps
- A mix of education levels with a high school degree at minimum
- A mix of ethnicities

Summary of Key Findings

With regard to the first objective — understanding how smartphone apps like Roadify and Waze affect the overall commuting experience — the following trends were observed⁹:

1. Public transportation commuters are different from car commuters.

- In general, public commuters see themselves as very knowledgeable and experienced. Because of this, they don't immediately see the benefit in receiving information from other commuters.
- Many private commuters, on the other hand, are looking to connect while in the car. Their "alone time" creates a prime environment for connecting and sharing.

⁹ It is important to note that the observations and trends described below are specific to commuting patterns and behavior within the vicinity of San Jose and the surrounding Bay Area and may not be generalizable to cities with significantly different traffic or public transport conditions, or with less tech-savvy populations.

2. Within the group of public transport users, connected and unconnected commuters are similar.

- Importantly, they are already connected to others physically while commuting, and this minimizes the need for connection through technology.
- Both describe themselves as “experienced” and believe they “know what they’re doing.”
- They use technology while planning routes, more rarely during the commute itself.
 - ▶ They say they are satisfied with current real time information.
 - ▶ “I get updates at the station.” “There is an announcement of a train delay.” “A fellow commuter will tell me about an incident.”

3. Within the group of car commuters there are slight differences between connected and unconnected commuters; in general, connected car commuters seem somewhat happier.

- Connected car commuters describe themselves as “happy” / “content” / “excited.” Their biggest complaint is that they are “busy.” They are:
 - ▶ “Less stressed”
 - ▶ “Able to predict and know.”
- Unconnected car commuters describe themselves as “neutral” to “happy.” Their complaint is “fatigue.”

4. Unlike public commuters, car commuters recognize a need for technology at both the planning stage and during the commute.

- For car commuters technology assistance is needed:
 - ▶ In the planning stage: deciding the mode of transportation or route.
 - ▶ Real time: re-routing around traffic and other incidents.

- Note: private commuters do not only want to be informed of an incident; they want a solution (e.g. re-routing options). When new technologies are created, they should go beyond providing point A to B capabilities.

5. There is one key difference between connected and unconnected commuters: how they feel about sharing information with people they do not know while commuting.

- Connected commuters are very open to sharing (and receiving) information from people they don't know while commuting. They appreciate receiving information, and this makes them more interested in "giving back" information in the future. "I feel like I'm helping the world."
- Unconnected commuters have mixed to negative feelings, particularly about receiving information from those they don't know. They do not naturally trust crowd-sourced information and believe it may be wrong, or even worse, intentionally misleading.
- Unconnected commuters brainstormed ideas to help them over this hurdle. Here's what they say they want from app technology:
 - ▶ Profiles for users with experience ratings next to a login name
 - ▶ A way to see where the commuter giving the information is / was when sending the tip.
 - ▶ An ability to share information with others on your same route, or those that typically take that route (a route community of sorts).

6. Technology is integral to the future of commuting.

- Everyone (connected or not connected) uses technology on some level during or before their commute. Some simply use more technology than others:
 - ▶ Unconnected commuters are using technology such as: Google Maps, Apple Maps, SignAlert, 511.org, and more.

- ▶ Connected commuters are using all or most of the above, plus apps like Roadify, Waze, etc.
- ▶ In short, there is a real opportunity to please commuters and enhance the commuting experience through future app technology.

Detailed Learning by Type of Commuter

With regard to the second objective of comparing and contrasting the commute experience of connected versus unconnected commuters, the following sections provide deeper insights into the specificities within each subgroup of commuting individuals.

The Unconnected Public Transport Commuter

"We are commuting athletes."

See themselves as...

- Experienced commuters or, "commuting athletes".
- Because of this, they have their routes / routines / knowledge down, and are not particularly interested in what others have to say (they do not feel it will have an impact).

The role of technology

- Technology plays a significant role in their commute (especially for planning).
- They use multiple technology sources to plan (spending a lot of time before the commute). This adds significant time to commute (not in transit).

They value...

- This commuter values money over time.
- They spend significantly less per week vs. other commuters (\$21-80/week) and they are very happy about this!
- They are not very concerned with the length of time they spend on their commute.

Provocative ideas

- Their biggest barrier is not trusting the source.
- Explore positioning new technology in alignment with this commuter's perception of him / herself (e.g. this technology is the one used by experienced commuters / "commuting athletes")

The Connected Public Transport Commuter (Roadify users)

"I need options."

See themselves as...

- A mixed bag. Sometimes they use public transportation, sometimes private. They like options.

The role of technology

- The biggest benefit of technology is making their trip "more efficient." It saves them time, which is important to this commuter.
- Technology allows them to feel:
 - "Empowered"
 - "In control" / "Secure"
 - "Able to plan."
 - "Less stressed."
- Interestingly, these commuters do NOT limit Roadify to public transportation. Many used it for parking, etc.

They value...

- Saving time.
- Control. (Choices and options available).
- Note: Similar to unconnected public commuters, this commuter does not value sharing information with others. Unlike private commuters, they see it as irrelevant and can't see how it will be helpful to them.

Provocative Ideas

- Focus technology innovations on putting this consumer in control. Give him / her options and empower him / her to make the best choice for themselves.

The Unconnected Car Commuter

"Commuting is not generally a topic of my conversation [while driving]."

See themselves as...

- Normal

The role of technology

- Technology affects this commuter's experience in two important ways:
 - It can make the trip more efficient / convenient. "I don't know what I'd do without my phone and GPS."
 - It can allow him / her to connect with family and friends during the commuting experience. Note: this is something he / she would not do if using public transportation. "I think it's rude to do this on public transportation."

They value...

- The "alone time" they get in the car is:
 - "Meditation" / "Peaceful"
 - "My downtime" / "I listen to music."

Provocative Ideas

- This commuter is often making the best of a less than ideal experience.
 - "My commute is like finishing homework. You have to get it done, you don't like the process, but you appreciate it later."
 - "My commute is like cleaning the house. I want to get through it as quickly as possible. Sometimes I hate it, sometimes I appreciate it."
- Explore technologies that make the commute "feel faster."

The Connected Car Commuter (Waze users)

"I feel like I'm helping the world."

See themselves as...

- Relatively satisfied

The role of technology

- Technology brings them peace of mind and predictability, leading to less stress. It makes things:
 - "Predictable" / "It prepares you so you know."
 - "You have knowledge of what's ahead of you."
 - "It makes the trip smoother."
 - "It saves you time."

They value...

- Reducing stress and saving time.
- Helping others (if they have been helped via [Waze](#)).

Provocative Ideas

- Focus technology innovations on key benefits such as: "predictability" and "knowledge" – removing the mystery. The higher order benefit is "reducing stress."
- Consider communication features that celebrate the "do-gooder" inside each of them.

Ideas to Improve Commuting

To identify unmet needs and aid the development of new technologies and solutions, several ideas were presented to commuters to gain feedback on what is most important to them. There were no differences between public and private commuters in the features they preferred. However, public commuters said they would use these features when planning routes; private commuters said they would use them in real-time during the commute.

Features commuters found most important and useful:

- Voice-activated alerts via mobile phone, warning of an upcoming traffic incident or public transport service disruption.
- Real-time web and app-based comparisons of multiple routes or transportation modes and how long they would take.

- Recommended departure times to avoid being stuck in traffic and/or public transport delays.
- GPS navigation visible on car windshield.

In addition to the options above, commuters were asked what ideal feature or technology would improve their commute. The most important needs that surfaced were **“one-stop-shopping”** and **“proactive communication.”** One-stop shopping refers to the convergence of all traffic related information (car, public transportation, walking, biking, etc.) in one app. Proactive communication refers to predictions of their travel with real conditions as a way to pre-inform them about what conditions they can expect in the next ten minutes (with automatic re-routing options if necessary).

Conclusion: Part II

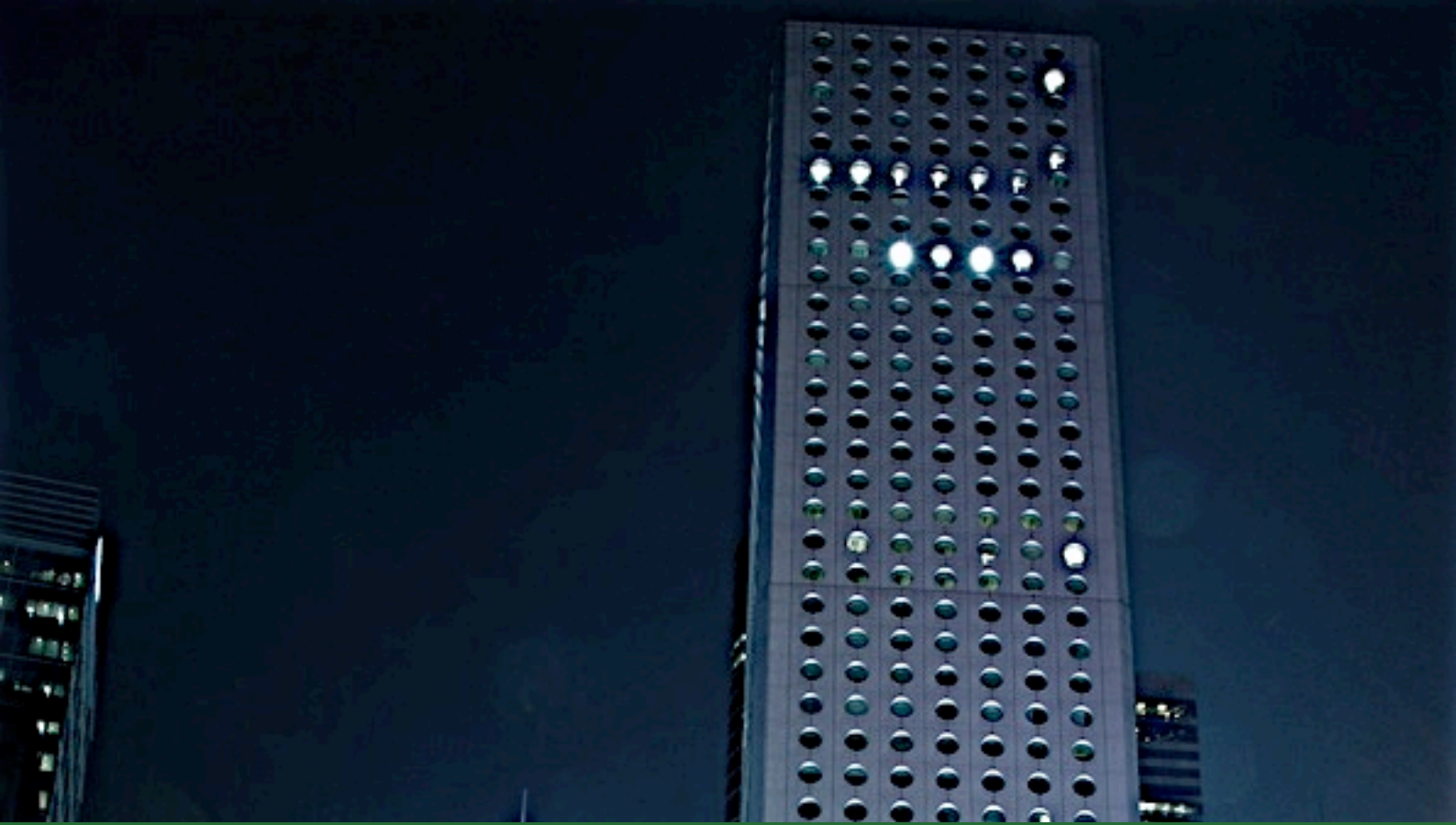
The focus group studies were noteworthy in terms of what they revealed about commuters' preferences, behaviors and experiences. Regardless of the mode of transportation that people use on a daily basis or their choice of technology in facilitating their commute, commuters generally value information that helps reduce uncertainty. In San Jose, commuters who travel frequently or exclusively using public transport are satisfied with existing official real-time alerts and notifications about service changes. They have little need to connect with other commuters via the social networking feature of the Roadify app during their commute. As regular commuters, they feel self-reliant in terms of knowing how to adjust their journey when faced with service disruptions, or can get the information they need from fellow passengers. While having access to trip-planning features is useful, being connected directly to other public transportation commuters provides less marginal value.

However, car commuters in the Bay Area said sharing information during the commute was a desirable and valuable added feature. Interestingly, its impact appeared to take two main forms. Commuters felt that having access to real-time information saved some time, but they also expressed satisfaction at helping others by sharing useful information. Both these elements

Part II - Comparative Focus Group

contributed to an improved commuting experience for Waze users compared with their unconnected counterparts.

Building on the observations in this pilot, further studies could quantify the marginal value of the “connected” feature as well as the resulting amount of time saved. However, with regard to the development of future technologies, we can already conclude that tools that commuters would find most helpful are ones that further improve the predictability of their commute, featuring real-time route alternatives in the event of an unexpected incident.



Connected Commuting Works



The study overall aimed to obtain a clearer picture of how real-time social networking between commuters can enhance the overall commute experience for public transport users and drivers, and the specific ways in which commuting can be improved in cities all around the world, drawing on this pilot. Thus part I of the study in the Connected Commuting Task Force investigated the sentiments exhibited by connected commuters (i.e. those who share and/or receive information in real time via smartphone social networking commuter apps); part II used focus groups to draw real-life comparisons between connected and unconnected commuters based on their experiences.

Taken together, they reveal that real-time sharing of information between commuters can improve the overall commuting experience in a number of different and interesting ways. First, as the user commentary data analysis illustrates, crowd-sourced commuter information-sharing can be a useful gauge of commuter sentiment for transportation agencies, with regard to specific routes or even particular traffic incidents. This could provide valuable feedback to local authorities, so they can improve infrastructure or programs to facilitate a better commute. Second, crowd-sourced data provides smartphone app developers with insights about additional features that could be incorporated to give commuters further options on alternative routes that mitigate frustration or stress. Lastly, the focus group results show that connected commuting is particularly useful for car commuters. Receiving real-time information from others saved time, and sharing information gave a feeling of satisfaction; both contributed to a more positive commute experience.

Although data from frequent users of public transport may provide useful information for city authorities, the social networking feature appeared less useful for the commuters themselves, who said were satisfied with existing real-time updates from official sources and/or fellow passengers, and were able to adapt their journey based on their own knowledge of routes. Thus being connected to fellow travelers does not necessarily offer significant additional value to public transport users. However, there may be significant differences in this respect between daily public transport commuters and new or infrequent public commuters.

For car commuters, while traditional forms of real-time traffic information (e.g. radio) are still valued, being connected to fellow commuters provides a clear added dimension of predictability to their journey, reducing stress and in some cases, saving time. An important area of future study

Connected Commuting Works

would be to quantify how much time is saved per passenger on average due to information gained from connected commuting. The measurement of time saved could serve as a proxy to calculate the reduced cost of fuel to passengers, reduced Co2 emissions, increased productivity, and so on.

The Task Force on Connected Commuting will seek to explore these issues further in the post-pilot phase of the project.



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