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Kevin Curran, University of Ulster, UK

GUEST EDITORIAL PREFACE

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Opportunities of Public Transport Experience Enhancements with Mobile Services and Urban Screens

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ABSTRACT

Public transportation is an environment with great potential for applying innovative ubiquitous computing services to enhance user experiences. This paper provides the underpinning rationale for research that will be looking at how real-time passenger information system deployed by transit authorities can provide a core platform to improve commuters’ user experiences during all stages of their journey. The proposal builds on this platform to inform the design and development of innovative social media, mobile computing and geospatial information applications, with the hope to create fun and meaningful experiences for passengers during their everyday travel. Furthermore, we present the findings of our pilot study that aims to offer a better understanding of passengers’ activities and social interactions during their daily commute.

Keywords: Design Intervention, Experience Design, Funology, Human-Computer Interaction, Mobile Technologies, Passenger Experience, Public Transport, Ubiquitous Computing, Urban Informatics

INTRODUCTION

Public transport infrastructure represents a unique urban space in the sense that citizens with diverse socio-economic backgrounds come together for extended periods of time at regular intervals, with usually little environmental stimulation. A passenger sitting on a vehicle is an ideal candidate to be entertained or informed about not only the next stop and the facilities available nearby such as commercial organisations or public service facilities, but also about the people sitting next to them. In addition, daily commuters are a congregation of local experts. How can this crowd be sourced in this situation of their daily commute and in meaningful and mutually beneficial ways?

Public transport is thus an environment with great potential for the application of context-aware services through the use of mobile ser-
TRENDs IN PUBLIC TRANSPORT

South East Queensland (SEQ) is Australia’s fastest growing metropolitan region. From 2006 to 2031, its population is expected to grow from 2.8 million to 4.4 million people (Queensland Government, 2005). The SEQ region includes land covered by 11 city and regional local governments. SEQ’s population is heavily urbanised and is generally concentrated in Brisbane and Toowoomba and at the Gold and Sunshine Coasts. By 2031, an additional 754,000 dwellings will be required, as well as supporting infrastructure and services. This will impose significant social, economic and environmental pressures on the region. Although most discussions in this paper are presented in the context of SEQ, it is relevant to many other regions in the world that are facing the same urbanisation trend.

Urbanisation also accelerates the growth of private car use in densely populated regions. Private cars will continue to be used into the future for the majority of trips in urban areas. However, with oil supply vulnerability, dependency on cars will cause financial stress to urban-fringe communities and vulnerable groups.

It is therefore important to highlight public transport as a more sustainable transportation alternative, which must be made more viable and attractive. In recognition of this need, our partner TransLink and the state government have improved and will further improve the public transport infrastructure and services.

- A strong busway network has been started in the Brisbane area and planned investments for more busways, new train lines and light rail systems are underway.

1. Identify new opportunities that arise from connecting data made available by real-time passenger information systems with social media applications.
2. Inform the design and development of multi-platform prototypes that are deployed across mobile devices, urban screens, and web applications.
3. Evaluate these prototypes in the field according to criteria of usability, usefulness and experience.
4. Understand the balance between the opportunities of these interactive services and locative media on the one hand and issues of identity, trust and privacy on the other.
5. Explore and assess the implications of deploying these technologies for the development of an integrated public transport infrastructure that meets the demands of a rapidly growing urban population.
The public transport fleet is being updated with visually stimulating vehicles that make people want to look inside and be part of the experience. However, even though newer buses provide more aesthetic appeal, better impressions of space, light, style, quality and comfort, it does take a long time for a current fleet to be updated.

Ticket sales management has been improved through the introduction of the GoCard, providing reduced cash leakage, greater accountability, faster passenger loading, more convenience for passengers, easier sales process for drivers, detailed revenue and passenger load reports.

A real-time passenger information system will be deployed by TransLink, which will enable more accurate journey planning based on where the buses are at the time of planning.

Despite these improvements in reliability and efficiency, the act of traveling on public transport usually remains a rather dull experience, which most commuters would not associate with fun. One exception are travels on Brisbane’s popular CityCat, a catamaran which provides travels on the Brisbane River so enjoyable that residents might even consider a trip purely for the enjoyment and not just to get from origin A to destination B. The ultimate aim of this study is to provide similar associations of public transport for enjoyment on TransLink’s buses and trains.

Long distance travel providers such as the aviation industry and train providers have recognised the importance of enhancing the travel experience by installing in-flight entertainment systems. However, these solutions are not directly transferable to local public transport because vehicles travel shorter distance, more frequently, with more passenger changes and turnaround. Within local public transport, the most innovative solutions so far have been installing passive TV screens, which show content such as news, weather, sports, general entertainment and a What’s On guide. However, it is usually largely left to the commuter to entertain themselves, e.g., by reading a book, newspaper or magazine, playing games on portable consoles, listening to music – mostly isolating activities, and more recently by using their powerful and smart mobile phones which allow users to do all of the above and much more, specifically social networking applications such as Facebook and micro-blogging such as twitter. Even though most public transport passengers are involved in self-isolating activities during various stages of commute, a study conducted by Stradling, Carreno, Rye, and Noble (2007) on 2250 participants in the city of Edinburgh shows that a significant portion of passengers enjoy or anticipate social interactions with others, including active interaction such as extending friendly gestures and making conversations, as well as passive interactions such as people watching and listening to chatter of other passengers.

While infrastructure and service improvements are largely well understood and well supported financially, the following question is far less well understood: How can introductions such as the GoCard (history data) and real-time passenger information systems in combination with the affordances of social data, ubiquitous mobile phones and public screens, innovatively enhance the experience of daily commuters?

**FUNOLOGY & EXPERIENCE DESIGN**

There are new opportunities afforded by the provisioning of real-time scheduling information to users through innovative design solutions on web systems, mobile applications and urban information displays. We will explore multi-platform design interventions to engage commuters and thus enhance their experience. Interventions will be considered for all aspects of their journey, starting with the planning, the waiting at the platform or bus stop, being on the vehicle during the journey, and the time after the journey. Instead of focusing on efficiency and speed of each of these steps, we will focus on making the experience more enjoyable and meaningful.
In addition, the planning, duration and post trip experiences will be contextualized as a cyclical process where the information from a previous trip can help inform decisions for the next trip. Data about sustainability such as energy saved by not driving is one example. By taking this approach, the project aims to think outside the square to create a user experience that stretches the way we think about what it means to be a public transport user.

Before the Journey

The TransLink website currently ranks number one among all Queensland Government websites, which is evidence that commuters are increasingly searching for public transport options as an alternative to using their cars. One million visitors look up the site each month, mainly for planning their journey.

Real-time passenger information systems such as the one deployed by our partner TransLink will allow future journey planners to calculate the fastest and most efficient trips. This can be done based on the current location of the TransLink’s fleet at the time of the request, as well as based on where the fleet is predicted to be at the time of travel. The latter takes into consideration real-time information of traffic congestions or other obstacles that might impact travel times. Furthermore, systems like these allow the real-time information to be accessed through various platforms so commuters can access it where and when it is needed, such as before going to the bus stop. Real-time passenger information systems are well understood and engineered, however, they are currently exclusively targeted at reducing waiting and travel times. What is far less understood is how different journey options can be planned, assessed, and distinguished on the premise whether they are going to be more fun rather than faster.

Initial applications are looking at either embedding portals to social networking sites, or creating novel social networking applications. Both approaches will exploit the real-time location information to add new value to social networking. In the former case, by enhancing existing social networking sites with real-time location information, a collective presence can be created online. Further benefits of this kind of application would be to inform individuals of friends who may be on closely-aligned trips, and to suggest impromptu gatherings on public transport by minor modifications of trip timing, for example by running to catch an earlier train, or waiting an extra half hour at work to avoid peak hour and chat with an old friend.

Furthermore, systems built on top of social networking sites may aim at enhancing the chances that a friend (or a friend of a friend) or a work colleague happens to be on the same bus (or is being avoided). In this way, real social interactions or casual business meetings could take place (or are purposefully avoided) while commuting. Using location data to maintain social networks is similar to the growing number of commercially available social mobile applications, including Google Buzz and Latitude, Foursquare, Brightkite, Plazes, Fire Eagle, Zkout, Rumble, etc. Systems that provide such functionality require the close interaction between the real-time passenger information systems, real-time sensing and social networking sites that need to be further explored, especially with regards to identity, trust and privacy. We hope to better understand how these elements and aspects can interact with each other.

With regards to the waiting time at bus stops and train terminals, currently, the situation in most public transport networks shows an emphasis on trying to reduce waiting times. However, some waits will always be unavoidable, and we consider the environments of bus stops, train stations and ferry terminal as opportunity spaces for the introduction of novel interaction technologies. The installation of public urban screens at these locations will be particularly relevant for the provision of real-time passenger information, but – in addition – for the provision of social, civic, or entertaining applications and content as well.

Yahoo! Inc. organised a well-received competition named Bus Stop Derby, at which...
72-inch touch screen displays were installed at 20 high-traffic bus stops in San Francisco for three months (Yahoo! Inc., 2011). During Bus Stop Derby, passengers waiting at stop are able to play games as a team to represent the corresponding suburb and compete with passengers at other suburbs. This suggested that transit nodes have great potentials for fostering social interactions and creating sense of community.

Another example would be to provide personalised news feed, i.e., news that are of interest to the group of passengers waiting at the stop. By enabling passengers to check-in and select their preferred categories of news with their mobile devices when they arrive at a stop, urban screens installed at the corresponding stops could then display news that is both relevant and of interest to the passengers. In addition, this system allows urban screens to have a much greener operation as they can now be switched on automatically whenever there is a passenger interested in utilising the screen.

While personal mobile devices have been the predominant platform for interaction away from the desktop in recent years, ambient and situated displays play an increasingly crucial role in ubiquitous computing. Advances in interaction technology, such as the availability of large-scale multi-touch wall displays, have led to an increased deployment of interactive displays in urban environments. CityWall is a large multi-touch interactive display installed in Helsinki, which displays information about events happening in the city. Peltonen et al. (2008) studied how large interactive displays get shared between multiple people and addressed issues such as crowding, teamwork and conflict management, as well as the questions of how content from personal mobile devices get shared on public displays (Peltonen et al., 2007). In addition, there is an increasing amount of research into non-standard urban interfaces such as, e.g., urban pixels (Seitinger, Perry, & Mitchell, 2009) or façade interaction (Dalsgaard, Halskov, & Nielsen, 2008).

While each of the services and technologies discussed here represent interesting approaches to interacting with information away from the desktop they focus on isolated modes of interaction. The EyeStop concept goes further in that it combines different display technologies (e.g., E-ink and LED displays) with different modes of interaction (web-browsing, timetables, ambient display, etc.) (Massachusetts Institute of Technology SENSEable City Lab, 2011). Our approach differs from the above in that our study follows a holistic approach using the concept of communicative ecology (Hearn, Tacchi, Foth, & Lennie, 2009) that considers the interplay between technical, social and discursive (content) components in the urban environment in order to inform the development of new design interventions.

During the Journey

On our daily public transport routes, we often come across the “familiar stranger” (Milgram, 1992), an individual we recognise from regular activities, but choose not to interact with. Springboard (Hung, Mamutura, & Matei, 2011) is a design idea for a mobile social networking application that features GPS tracking of passengers, a list of passengers on the same bus including their short profiles and a means to text them. The goal here is to eventually spawn real life interactions between passengers. However, some passengers feel quite comfortable being left alone enjoying their daily bus commute as personal idle time that allows them to think, reflect, meditate and relax. We are interested in achieving a better, more diversified understanding of the different objectives and requirements of public transport users in order to allow public transport to become more personable and customisable.

Previous research in ways to enhance the user experience in urban environments has led to applications such as CityWare (Kostakos & O’Neill, 2009), which utilises Bluetooth nodes at public locations and a link from a user’s Bluetooth device to their Facebook profile to present information about the people an individual encounters most frequently. However, this system does not fully exploit the environment of public transport where familiar strangers (Milgram,
1992) are together for extended periods of time at regular frequencies, with little environmental stimulation. These characteristics of the space offer opportunities to trial digital augmentation scenarios that foster social connections between individuals, or use ambient visualisations of historic presence data that do not require commuters to directly interact with each other.

Systems such as Cityware (Kostakos & O’Neill, 2009) aim to connect familiar strangers with each other by deploying nodes, e.g., at bus stops, that detect people’s Bluetooth devices. The time-stamped data is stored, analysed and made available through a Facebook application, where users connect their device’s Bluetooth ID with their profile and are presented with the Facebook profiles of the people they come across most often. Other Bluetooth based mobile applications include Bluedar (Eagle & Pentland, 2005) and the Lovegety (Iwatani, 1998), which aim at matchmaking familiar strangers in public places based on their profile information. All of the above have privacy concerns. Jabberwocky (Paulos & Goodman, 2004) on the other hand only enhances the visibility of familiar strangers but respects the boundaries. We have been working on visualising this data anonymously on a public screen near bus stops. The visualisation shows a virtual aquarium where passers-by whose bluetooth devices are detected are anonymously represented as Virtual Fish (Young, Foth, & Matthes, 2007), and their “familiarity” is illustrated through the formation of schools of fish (Figure 1). Further work in this area has the potential to explore affective designs that may visualise an indication of the emotional “state” of a bus represented by the occupants’ emotional state.

Entertainment and Web 2.0: Commuters are largely left to entertain themselves, e.g., by reading a book, newspaper or magazine, playing games on portable consoles or listening to music, all of which are mostly isolating activities. More recently, by using powerful and smart mobile phones, commuters can do all of the above and much more, all on the one device. Particularly popular in this context amongst young commuters is social networking. The innovation of this approach lies in its emphasis on the collective for these activities and investigating the impact it might have on commuters and the perception of their temporarily confined space during their travel. In this context, games, for example, provide a great potential as they are usually played for enjoyment and can be played by multiple players. In today’s aviation industry we can witness in-flight entertainment options including networked games, which can be played between two or more passengers.

Furthermore, popular multi-player location-based games played out on city streets and built up urban environments such as Foursquare.com and Gowalla.com allow players to unlock badges, find items, rank up, and interact with

Figure 1. Virtual fish display (© 2011, Ronald Schroeter. Used with permission)
other locals as they do their normal everyday activities around town. A new area of investigation is to look at how multi-player gaming concepts could be applied to public transport, which does not have a fixed longitude and latitude. Could this distinction have a positive effect on the social connections between passengers? How could they be designed to engage with commuters in a playful and useful, collective way?

On the other hand, transport-based games could exploit the fact that passengers are travelling on similar services on a regular basis to provide rewarding and surprising elements. For example, a route-aware doodle game can be designed to allow passengers to leave doodles for other passengers travelling on the same route to guess. Passenger who correctly guesses what the doodle is depicting will earn both the guesser and doodler points. The doodler can then collect the points or awards when they take the same route again in the future.

Besides gaming, we also want to explore ways of bringing Web 2.0 technologies into the public transport environment, in particular the generation and sharing of content and information. Undersound (Bassoli, Brewer, Martin, Dourish, & Mainwaring, 2007), for example, is a concept that provides a means of (anonymous) interaction between frequent travellers by enabling peer-to-peer music sharing over Bluetooth in the London Underground. Pursuing this idea further, our colleague developed Capital Music (Seeburger, Foth, & Tjondronegoro, 2010), a location-aware mobile application that allows nearby passengers to share information about music that they are currently listening to. Users are able to browse through songs currently being listened to by fellow nearby passengers, in the form of music album cover art coupled with metadata of the songs, such as song title, artist name, album name and genre. The application presents an interesting platform to encourage interactions among passengers with similar interest, i.e., listening to music while commuting. Users are able to comment or discuss about music that others are listening to, as well as indicating their approval of another passenger’s music selection with a “like” motion. Such indirect and interest-based communications draws some similarities to most web forums or discussion boards, which has been used effectively as a staple form of virtual interaction (Figure 2).

Similarly, all passengers on a particular bus can join a collaborative group to chat, share podcasts (Bassoli et al., 2007), ask for advice on tourist attractions, or signal intended destinations. In the later case, new applications can be created which utilise the real-time location information to not only display accurate scheduling information, but also assist in capacity management and on-demand public transport by allowing people to signal their intended trips in advance.

We will also examine the means by which commuters can leave digital traces that are linked, to the bus. Buses could be equipped with digital guest books for passengers to leave their “mark,” similar to what we can observe by the occasional graffiti on the back seats, but without damaging TransLink’s property. These could also be used to rate a bus or bus driver. Wiffiti.com, a social bulletin board on large flat urban screens where city dwellers can post text messages using their mobile phones, installed on a bus could enhance a sense of community of passengers. A more enhanced version called “Discussions in Space” has been developed by us (Schroeter & Foth, 2009). Such a system could link people waiting at a bus stop with other commuters “on the move” and on the bus. In addition to or as an alternative to advertisement, it could also provide a link between content generation processes by passengers inside the bus and how this content is conveyed on dynamic displays on the exterior surface of the bus to communicate with the outside. However, the effects of such tools in this environment have remained largely unexplored yet.

Furthermore, the Australian mobile penetration rate is predicted to reach 122% by 2012 (Grayson, 2008). This now near-pervasive availability of mobile devices has opened the door to new types of interactions and services. The notion of location-based services lies at the very heart of ubiquitous computing research.

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Researchers in this field have explored services ranging from electronic city guides (e.g., Cheverst, Davies, Mitchell, Friday, & Efstratiou, 2000; Paay, Kjeldskov, Howard, & Dave, 2009), education (e.g., Smith, Underwood, Luckin, & Fitzpatrick, 2007), location-based games, e.g., ciphersities.com, to location-based notification systems for police officers (Streefkerk, Esch-Bussemakers, & Neerincx, 2008). An innovative development in this context is the use of augmented reality in combination with mobile devices in order to overlay the city with an additional interactive information layer. For instance, iCam (Patel, Rekimoto, & Abowd, 2006), a location and orientation aware device has been used to demonstrate the annotation of real-world objects (without the necessity of static labels). Metro Paris Subway is an iPhone application that overlays real-world environments with additional information enabling service discovery and way showing (metroparisiphone.com).

After the Journey

Since the introduction of the new GoCard system for ticketing in South-East Queensland, it is possible to log each commuter’s travel history. This information is made available online to customers who registered their GoCard. However, currently it is only being used to tediously verify past trips, and no tools are provided to make this powerful resource more engaging or to share an anonymous version of it with the public so it could be analysed and visualised in either entertaining or meaningful ways. For example, the analysis of historic personal transport data could also be displayed on the basis of a commuter’s carbon footprint reduction compared to traveling by car. It could also indicate the level of expertise a person has on using public transport or the person’s level of knowledge about the city. Cabspotting. org for example traces San Francisco’s taxis as they travel throughout the Bay Area. The patterns traced by each cab create a living and always-changing map of city life. This map hints at economic, social, and cultural trends that are otherwise invisible. These and related opportunities for post-journey data analysis and comparison as well as associated issues of identity, trust and privacy provide novel areas of investigation.

A study by Montola et al. (2009) on gamify-ing i.e., applying achievement system to non-game activity (a digital photo sharing), shows great potentials in enhancing the experience, as well as keeping user motivated throughout the course of an otherwise mundane task for an extended period of time. Therefore, it
could be worthwhile exploring the influence of gamifying certain elements of public transport commuting to provide a sense of playfulness and to create stronger encouragement towards uptake of the service. One example is to award users with points and badges whenever they take public transport, based on the amount of carbon footprint they produce in comparison to using a private transport. This design can then be integrated into a public transport social network, where users could challenge each other to reduce the amount of carbon footprint generated from their daily commute.

**APPROACH**

The authors and their colleagues have developed, applied and tested a suite of action research methods for developing new media applications (Hearn et al., 2009). This approach considers study participants as co-investigators and agents of social change (Foth, 2006). Qualitative research (Patton, 2001) and user-centred design (Carroll, 2002) will operationalise this process and assist in the delivery and assessment of our Research Aims #1 to #5. The research methodology comprises an initial immersive phase utilising ethnography and cultural probes (I); two action research cycles which involve design studios utilising use scenarios and human-centred design methods (II) as well as rapid prototyping and testing (III); and a final evaluation (IV). Stages I, II, and III operationalise Research Aims #1 to #4 and Stage IV operationalises Research Aim #5.

**Research Sites**

QUT provides three dedicated shuttle buses to assist students and staff travelling between the Gardens Point and Kelvin Grove campuses for the purpose of attending lectures or attending to University business. The 391 service operated for QUT by TransLink is the study’s primary research site. QUT staff and students are able to travel free on route 391 but will need to show the driver their QUT identity card. Services operate all year round, excluding weekends, public holidays and the days between Christmas Day and New Years Day when the University is closed. The 391 timetable varies in frequency during the year. A 10-minute service is provided during university semesters, and a 15-minute service at other times. The 391 service stops at the following locations (Figure 3):

1. Kelvin Grove – Musk Avenue (close to the intersection with Victoria Park Road)
2. Kelvin Grove – Musk Avenue (close to the intersection with Carraway Street)
3. Gardens Point – Alice Street stop 95 (close to the intersection with George Street)

The first stop is the one used for scheduling departure times from Kelvin Grove. The second stop is a “hail and ride” or set down stop only. Apart from the stops mentioned, the buses do not make stops when travelling between the campuses. The 391 bus stops will be the points of installation for the deployment of three public screens. The first installation location at the corner of Musk Ave and Carraway St at the Kelvin Grove Urban Village has just been completed following approval and support from QUT Facilities Management, Brisbane City Council, and the Principal Body Corporate of the Kelvin Grove Urban Village (Figure 4).

The intercampus shuttle service possesses several characteristics that make it an interesting setting to conduct passenger experience experiments. Firstly, the entire journey takes about 5-10 minutes depending on traffic condition. The short journey duration negates the need to be prepared with self-isolating entertainment such as books or music. As a result, most passengers that do not travel with any companion will mostly be idle during some part of their journey, making them a good candidate to interact with our designs. Secondly, most passengers are carrying at least one smartphone or tablet device, used for checking emails, or browsing various websites throughout the journey. This provides a good user base for us to study and compare the impact on passenger experience if we introduce prototypes on mobile applications or urban screens. Thirdly, the shuttle includes a wireless access point enabling
all QUT staffs and students with Wi-Fi enabled devices to have free Internet access throughout the journey. The availability of Internet or data connection will provide an easy channel for us to deliver content or gather data from participants. Finally, most passengers taking the shuttle are regular users of the service, and therefore are capable to provide the information on the long-term impact of our new designs. In effect, the study is thus able to draw on the communicative ecology at the bus stops as well as inside the buses. Further, in addition to the 391 bus service, the study will collaborate with our partner TransLink for access to other services on the TransLink network in order to test the study’s design prototypes in different environments and transport modes such as trains or ferries.
Stage I: Immersion

Ethnography lends itself effectively to the immersive phases of the project where the goal is to establish an awareness for and knowledge of the existing communicative ecology of residents by identifying stakeholders and leaders, mapping and establishing relationships, contextualising information needs and building trust with participants (Kilduff & Tsai, 2003). Howard (2002, p. 569) argues that “qualitative methods tend to be best for generating theory and quantitative methods tend to be best for testing theory” (p. 569). In this sense, the qualitative nature of ethnography has proven to be appropriate for generating a rich understanding of the characteristics of the local research site during the initial project start-up phase, which is necessary to prepare for and inform the forthcoming systems design phase.

To gather baseline data at the beginning of the study, both statistical usage data provided by QUT Facilities Management and TransLink as well as qualitative data gathered from participant observations and on site (or on-board) ad hoc interviews will be collected and analysed with a view to address Research Aim #1: Identify new opportunities that arise from connecting data made available by real-time passenger information systems with social media applications. Following the aforementioned structure of Before, During, and After the journey, we will engage staff, students and visitors at the 391 bus stops, as well as on-board the 391 buses. In order to avoid a too homogeneous pool of study participants, other services in the TransLink network will be considered to achieve a more balanced and diverse representation of views and opinions. This initial data gathering process will be continued until a point of saturation is reached in the analysis where only few or no new ideas and aspects are contributed by additional interview and data gathering intervals.

Depending on the scope and scale of research themes and design inspirations that emerge from this data, a number of individual follow-up interviews as well as up to four focus groups will be conducted to map and refine the communicative ecology of the research site. For this purpose, convergent interviews (Dick, 1998) are suitable to elicit a deeper insight into problems, challenges and opportunities. Interviewees will be selected using maximum variation sampling (Patton, 2001) which ensures that a variety of views and opinions are considered. Once the needs of a variety of different public transport users are understood, they will be embodied by four to five Personas that are synthesised from the insights uncovered in the user studies. In keeping with Cooper (1999) and Hagen, Robertson, Kan, and Sadler (2005), the personas are captured in 1-2 page descriptions that include behaviour patterns, goals, skills, attitudes, and the context of the environment, with a few fictional personal details (name, hair colour, gender, etc.) to bring the persona to life. They represent different user archetypes and each one should have three or four key goals that help focus the design research. Not only does this ensure that the needs of the users are more accurately represented, it makes communication between different members of the design and development team more efficient.

Stage II: Design Prototyping

The aspiration of the design process is to engage commuters of public transport for a fun and enjoyable experience. All systems designed for use in social environments incorporate assumptions about how they will be used. Increasingly attention is being focused on how activities are represented in the practice of technology design. This attention stems from the recognition that the quality of thinking about any problem depends, in large measure, on the adequacy of the representational artefacts, such as use scenarios and cultural probes that are available to us to think with (Suchman, 1999). We will employ Cultural Probes (Gaver, Dunne, & Pacenti, 1999; Mattelmäki, 2005) as a method to elicit research data relevant for design in environments that are usually challenging to observe without the researcher’s interference potentially influences the participant’s course of action. Probes are functional products with open-ended functionality that support
user-led innovation and capture examples of social interactions. They offer an authentic insight into the user environment. Inspired by the IDEO Method Cards iPhone app, our study participants recruited from Stage I will be given access to a custom-made mobile device application that will act as a software-based virtual cultural probe. It combines the functionality and purpose of a variety of conventional objects such as disposable cameras, notebooks, audio recorders, maps, photo albums, and postcards to record aspects of their public transport experience. This approach will make the translation process from emerging themes to user needs and finally, design implications, relatively seamless. However, it is not enough for the findings to be understood by the researcher conducting the user study, the design implications must be communicated to systems engineers working at TransLink. In order to achieve this, techniques from scenario-based design will be drawn on. The results of the cultural probes exercise will inform the development and ongoing refinement of a portfolio of use scenarios specifically designed to capture important aspects of the use of context in public transport over time.

Use scenarios are concrete descriptions of activities that users do as part of their life that can be used to drive the ongoing design and evaluation of social media and ubiquitous computing systems. They are valuable research and design tools because, as narratives, they can move from general work process to detailed and specific interaction in a coherent and systematic way (Manning, 2003). Empirically informed use scenarios, such as those developed here, can function as vehicles for supporting the creative meeting between users and designers; they can indicate the usefulness of a system relative to the background of the public transport environment and they can be used to generate new metaphors and concepts that can drive the development of new kinds of social and mobile applications. While seemingly simple tools, empirically informed use scenarios and cultural probes are not trivial to produce, requiring a deep understanding of the environment they are representing. Producing scenarios to drive the design process is an iterative process. The scenarios will be developed from Stage I research and will then be continually evaluated against related social contexts and developing technology and refined throughout the project.

Stage III: Usability Testing

The scenarios will form the basis of the usability testing by describing how the user archetypes or personas engage with technology to achieve their social and cultural goals more effectively than current technologies allow. In this way the scenarios are ‘Scenario-Prototypes’ because they are design solution specific (Satchell, 2003). This sets them apart from the scenarios outlined by Cooper (1999), because the basis for design is incorporated within the scenario itself. The benefit of this method is that the prototyping and usability testing occurs as an extension of the analysis of user needs. This not only aids the development of the physical design by providing a template that we will use in his development work, it ensures that the final design stays true to the original user needs. A number of individual interviews as well as four focus groups will be conducted to refine the personas and use scenarios. Actual passengers will also be recruited to playtest prototypes in the field, in order to refine usability and design issues. As per the timeline, stages II and III will be repeated and refined starting in Year 2.

Stage IV: Impact Evaluation

The last stage of the research aspect of the project calls for a final holistic evaluation particularly in relation to Research Aim #5. Participatory evaluation methodologies have long been effectively used in a diversity of fields, including education, social services and health (Fetterman & Wandersman, 2005; Papineau & Kiely, 1996). The current study will use a variant developed specifically for ICT projects (Hearn et al., 2009). The final evaluation phase will be a continuation of the action research cycles already established but supplemented with social media data and respondent interviews. The method will incorporate a critical reflection workshop (Hearn et al., 2009), and will involve participants from TransLink, respondent populations as well as other transport stakeholders in the TransLink
network (e.g., ferry operators, bus drivers). As per Hearn et al. (2009), the workshop will include an overall analytical framework for assembling and interrogating the evidence base in terms of claims about the implications of deploying new technologies for the development of an integrated public transport infrastructure that meets the demands of a growing population in South East Queensland. Stage IV will thus provide a summative response to Research Aim #5.

PRELIMINARY STUDY

As a start for stage I of the study, we decided to immerse ourselves deeper into current commuting practice by investigating the micro activities or activities passengers perform when they are commuting between places. Since commuting is an inevitable daily routine, these micro activities will heavily influence the passengers’ experience.

Since the experience of public transport users is closely related to the micro activities (or inactivity) performed by them when they are at various stages of commute, i.e., before the journey, during the journey and after the journey, we have decided to take an activity-centred design approach for gathering feedback on current practice and eliciting requirements for creating design interventions. We conducted a preliminary focus group to gather a better understanding the activities performed by regular public transport users, and the feelings or experience associated with those micro activities.

The study has two main objectives: the first one is to gather a deeper understanding on the micro activities performed by passengers during commute. We are trying to find common patterns among different types of micro activity, as well as feelings and motives associated with them. Secondly, we are trying to understanding how passengers are affected, be it positively or negatively by these micro activities. Findings from the study will allow us to make informed decisions when designing systems that is intended to be integrated into people’s commuting practice.

Focus Group

We recruited 7 voluntary participants, 2 females and 5 males, for our study. All participants are regular public transport users whose age ranges between 20-30 years old, representing the dominant commuter age group that embraces technology (Acott, 2011). Participants are requested to write down activities that they do before, during and after their daily travel, one on each post-it note. Subsequently, they are asked to write down the feelings they have at the various stages in a similar fashion. Similar activities are then aggregated and arranged on a table, where the participants are asked to explain each type of micro activity. This is then followed by discussions on the possible reasons and anticipated outcomes for each activity. The same process is then repeated for all the feelings written down. Finally, we request participants to associate feelings to each activity. In the study, we have made the decision to ask the participants for their activities and feelings separately before creating any associations between the two. This is to help participants to think about their activities in a more objective manner, as well as to identify non-feeling inducing activities which they have grown accustomed to e.g., those that are routinely performed such as scrambling for tickets moments before bus arrives, or looking out for better seats on the bus while boarding. Similarly, the disassociation with activities while listing the feelings allows participants to attach a more comprehensive set of feelings to each activity. Even with this precaution in mind, some participants still find it hard to disassociate feelings from activities as they think their feelings toward certain activities is mutually dependent on other activities or external stimuli such as pre- and post-ride events.

Result and Discussion

Based on consensus reached by participants, five main types of micro activities are commonly performed while commuting: social, entertainment, observational, travel, and routine. Social activities are those that involve interactions between the passenger and others, either physi-
cally such as talking in person, and virtually such as talking on the phone or text messaging. In general, participants have positive feelings for social activities involving themselves, but could sometimes feel annoyed when the surroundings get noisy. Two recurring issues raised by most participants when discussing about social interactions while commuting is the awkwardness at the beginning and the end of a conversation because both parties ran out of common topics for discussions. One participant says: “It just feels weird and awkward to suddenly start talking to the guy besides you and then stop.” Almost all participants wish for a way to participate selectively in certain social interactions because they don’t always wish to interact with the persons sitting right next to them, but instead feels more inclined to interact with the person standing at the other end of the bus for example. This presents a good opportunity for virtual interaction systems such as a location- and route-aware chat room that allows users to initiate more casual interactions without embarrassment of rejections and worrying thoughts of upsetting a passenger by ignoring him or her.

The unnecessary stress and effort required in order to have quality social interactions made the entertainment-based activities prevalent among passengers. It is comparatively much easier to have quality entertainment with self-brought mobile devices. Common entertainment activities include listening to music, browsing websites and reading news, the isolating, consumptive nature of these activities also requires less cognitive load from passengers when compared to social-based activities. During the study, participants generally have neutral or positive feelings towards entertainment-based activities. Since entertainment activities are mostly isolating, it is worthwhile to explore interventions that could encourage sharing or interactions such as allowing nearby passengers to share news that they find interesting, or to share the movie that they are watching. For passengers who prefer to have personal time for meditation, contemplation, and self-reflection during commute, interventions could be designed to record their thoughts and allow them to browse through previous recordings.

When passengers are not involved in social interactions or immersed in entertainments, a lot of them tend to be observant about their environment such as looking at the surrounding scenery, taking pictures of the scenery, looking at other passengers, listening to conversations by other passengers, and observing interiors of the vehicle. As mundane as it might sound, participants feel good about these activities, claiming them to be a great source of information, inspirations and sense of discovery. One participant says: “I feel excited when I heard that there is a festival going on in the city.” These observational activities could be further enhanced by easy sharing of information using systems such as virtual message board that allows passengers to post interesting information, photos or events to everyone in close vicinity. These shared information and knowledge could then be used as icebreakers to foster personal interactions.

Often when we are travelling, especially at unfamiliar places, we tend to check the travel time or schedule, keep an eye at our surroundings, or check references at our map. These travel-related activities are necessary to facilitate a successful and efficient travel, but they often induce unpleasant feelings such as worried, panic and impatient among passengers. Most participants think travel-related activities and its related negative feelings could be avoided or minimised if the authority are able to provide better information and ample notification to prepare for events, such as offering real-time arrival information and broadcasting upcoming stop name when travelling. We can conclude that accurate and up-to-date travel-related information should be readily accessible by passengers during all stages of their journey.

In summary, participants are expecting improvements to the current public transport information system. The lack of accurate and up-to-date information is very much hindering passengers’ ability to have a well-informed, efficient and thus enjoyable journey. On the other hand, in this age of powerful mobile devices and
ubiquitous wireless Internet access, we have yet to come up with any significant improvements to the micro activities that passengers are able to do while commuting. Social interactions are few and far between; Entertainment is still self-isolating, and passengers who try to free their mind are still worrying about missing the stop. This study has identified various activities associated positive feelings that are due for improvements and we will investigate new design interventions to target specifically at these areas and evaluate the impact on passengers’ experience.

**CONCLUSION**

The pilot study explored the common practices among the most technology inclined public transport passengers, identified the issues that they are facing when dealing with social interactions while commuting, and established a better understanding of the prevalence of self-isolating activities on public transport. The findings from this pilot study will drive subsequent studies in this research, which aim to gather a thorough and comprehensive understanding of commuting practice and passenger experience, followed by the design and development of interventions to enhance the overall enjoyment while commuting with public transport.

While public transport authorities are striving to improve their service by proving real-time information, installing better infrastructures and upgrading to better vehicles, it is worth stressing that more attention should be given towards creating a more enjoyable and meaningful experience for people who uses the service on a daily basis. This will become an additional motivation for people to use public transport more for their daily commute. Many cities are experiencing heavy burden in their transportation systems due to the rapid increase in urban traffic. Therefore, making public transportations a pleasant and sustainable alternative to private vehicle will be an important agenda for years to come.

This paper was written in the hope that the dissemination of the underlying thinking and assumptions as well as hopes and aspirations of this research project will enable a level of constructive scrutiny that contributes to pushing the agenda forward.

**REFERENCES**


and communication technology of developing regional communities with information


Marcus Foth is the founder and director of the Urban Informatics Research Lab, and Principal Research Fellow with the Institute for Creative Industries and Innovation at Queensland University of Technology. Professor Foth’s research explores human-computer interaction design and development at the intersection of people, place and technology with a focus on urban informatics, social media, ubiquitous computing and mobile applications. Professor Foth has authored and co-authored over 80 articles published in journals, edited books, and conference proceedings. He is the editor of the Handbook of Research on Urban Informatics (IGI 2009), co-author of Action Research and New Media (Hampton Press 2009), and co-editor of From Social Butterfly to Engaged Citizen (MIT Press 2011) and Eat Cook Grow: Human-Computer and Human-Food Interactions (MIT Press 2012, forthcoming). He was the conference chair of OZCHI 2009 in Melbourne, and the 5th International Conference on Communities and Technologies C&T 2011 in Brisbane.
Ronald Schroeter is currently completing his PhD at the Creative Industries of the Queensland University of Technology. His research investigates forms of in-place digital augmentation, which refer to the ability to enhance the experiences of citizens in physical spaces through digital technologies that are directly accessible within that space. In particular, he’s been developing mobile phone and public screen applications in collaboration with urban planners which aid the online deliberation and civic engagement of local citizens, in particular young citizens. As part of his study, he has developed “Discussions In Space,” a fun, fast paced, short-text platform for collective expression and public discourse, which was deployed and studied in various urban contexts, including Federation Square in Melbourne. Before commencing his PhD he worked as a Senior Research Officer for the e-Science group at the University of Queensland. His main research interests are mobile phone applications, public screen interaction, group knowledge capture and sharing, Semantic Web technologies as well as computer supported cooperative work.

Jimmy Ti is a PhD student with the Mobile Innovations Lab and the Urban Informatics Research Lab at Queensland University of Technology. In his research, Jimmy investigates mobile interaction design and user experience engineering by leveraging various smart sensors and ubiquitous computing services. In addition, Jimmy is interested in context-aware mobile systems and ubiquitous computing platforms, especially how smart systems and services could be utilised to enhance social interactions and play in our daily life.
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