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Editor's Note

Alison Tan

In this issue of JOURNEYS, we look at how the Land Transport Authority (LTA) of Singapore and other transport agencies and professionals around the world apply innovative and creative solutions to improve transport for their people.

There is no doubt that technology is a key enabler of many innovations. However, beyond technological innovation, we also examine how those of us in the land transport business apply myriad creative tools and novel ideas to address constantly evolving challenges. From commuters' changing demographics and demand for greater mobility choices to greater education on why sustainability matters, innovation is essential across disciplines. We are all pursuing innovation not for the sake of it, but with a bigger end in mind—to meet the needs and aspirations of our commuters, now and in the future.

First, we feature LTA's TrafficScan system, and examine how technology and an innovative use of the taxi fleet as probe vehicles have enabled LTA to bring real-time travel information to motorists. Next, we take a stroll down memory lane and review some of Singapore's policy innovations through the lens of behavioural economics. We look at how behavioural economics can provide alternative perspectives into Singapore's road pricing policies, as well as the "first-of-its-kind" Vehicle Quota System, which effectively controls vehicle population growth at a pre-determined rate.

In many cities around the world, particularly in Europe, innovative use of technology (e.g. smartcards, GPS tracking systems and the internet) has boosted the popularity and success of bike-sharing systems, providing an alternative mobility choice. Peter Midgley of global Transport Knowledge Partnership (gTKP) reviews the major bike-sharing systems in some European cities, including issues involved and factors to consider for successful implementation of such systems.

The increasing popularity of cycling brings us to the issue of conflicting demands for road space. Paul Barter of the Lee Kuan Yew School of Public Policy in Singapore

highlights innovative street management concepts that allow street space to be shared between vehicular traffic and other more vulnerable users, such as pedestrians and cyclists. Slowing down traffic, where appropriate, seems to be the key to enabling different road users to share the space amicably.

Finally, it is important to ensure that the younger generation—the transport stakeholders of tomorrow—understands the rationale of our transport policies and the impact of today's transport choices on the future well-being of their cities. LTA and UITP share their experiences and the initiatives they have undertaken to reach out to young people and tap on their creativity and energy to shape the future land transport system.

Last but not least, I would like to thank the authors for their contribution and I hope that you will enjoy reading their views and insights.

TrafficScan—Bringing Real-time Travel Information to Motorists

CHIN Kian Keong and LEE Chin Wai

Abstract

The TrafficScan system is an advanced transport system that provides motorists with real-time speed information on major roads in Singapore. This paper discusses how the Land Transport Authority of Singapore leveraged on technology and an innovative use of a taxi dispatch system to gather traffic data on the roads. The data is processed to give traffic speed conditions on the road network and these can be accessed online by motorists to plan their routes for a smoother journey. First launched in 1999, TrafficScan was subsequently enhanced to enable more data to be collected and improve the accuracy of traffic speeds reported by the system.

Introduction

Traffic speed is an important piece of traffic data. For traffic engineers, it complements other traffic data in reflecting the performance of the road network and warning of possible traffic incidents on the roads. For motorists, speed information reflects the driving experience. It is easily understood, unlike other traffic data such as traffic volume and density which are more difficult for them to relate to.

There is thus a need to develop more efficient and cost-effective ways of collecting traffic speeds over a wide area.

However, the collection of traffic speeds over a wide area and on a sustained basis is prohibitively expensive. Prior to 1999, the Land Transport Authority (LTA) of Singapore collected traffic speeds by either using loop detectors embedded under the road surface or conducting manual travel time surveys. Both methods have their disadvantages.

The installation of loop detectors is disruptive to traffic flow. These inductive loops are also easily damaged during road opening and resurfacing. Moreover the quality of the data depends on the number and coverage of the detectors, and the speeds obtained are spot speeds rather than travel speeds over the length of road. Travel time surveys, on the other hand, are both time-consuming and resource-intensive. Hence, the number of roads and the time periods surveyed are limited. Moreover, this method adds to traffic congestion and environmental pollution. There is thus a need to develop more efficient and cost-effective ways of collecting traffic speeds over a wide area.

The "Floating Car Data" (FCD) method offers a solution to collect speed data automatically through the use of highly distributed probe vehicles. These vehicles are usually equipped with Global Positioning System (GPS) communication modules. The FCD method follows a basic model: collecting data automatically from individual vehicles, aggregating the data at a central processing centre, extracting useful information, and redistributing the information to motorists. However, the adoption of FCD method has been rather slow, until more recently. This was due to the relatively high communication cost for data transmission as well as difficulty in bringing together a sufficient number of widely distributed probe vehicles.

In Europe, there were several FCD projects such as the OPTIS (OPtimized Traffic In Sweden) project in Sweden and the Taxi-FCD system in Germany. However, these were mainly small-scale trials or pilot projects employing few probe vehicles. The Taxi-FCD system established by the German Aerospace Centre in 2001 involved 2,300 taxis spread over 5 cities, while the OPTIS trial in 2002 had only 220 probe vehicles.

More recently, in August 2008, China Mobile launched a pilot project in Guangzhou in collaboration with Siemens Mobility Division. The system obtains information on traffic situation based on the positional data of 17,000 taxis transmitted via GPS. China Mobile then offers the traffic information to road users through its own hotline and via text messaging.

The TrafficScan System

The TrafficScan system, based on the FCD method, was first developed by LTA in January 1999 to automate the collection of traffic speeds on major roads in Singapore.

What distinguished TrafficScan… was that it made use of existing fleet of 11,000 taxis on the roads, which instantly gave LTA a large pool of probe vehicles widely distributed over the island.

What distinguished TrafficScan from the early FCD projects was that it made use of existing fleet of 11,000 taxis on the roads, which instantly gave LTA a large pool of probe vehicles widely distributed over the island. These taxis were equipped with GPS receivers that captured the taxis' positions, speeds and directions. The data was transmitted to TrafficScan via the taxi operator's taxi dispatch system using Mobitex wireless communication.

TrafficScan collected data whenever taxi drivers bid for taxi booking jobs (known as "job-bid data") and when it polled taxis for data in areas with insufficient job-bid data. The data was processed by TrafficScan and translated into traffic speeds for major roads in Singapore. This information was then made available online through LTA's website.

In May 2004, LTA set up the one.motoring website to serve as a one-stop online portal for all matters pertaining to motoring and road transport. The speed information from TrafficScan is now aggregated with other

traffic information in the i-transport platform[1] and disseminated through the one.motoring website (www.onemotoring.com.sg). See *Figure 1* for the system diagram.

The one.motoring website uses an interactive map of Singapore to display real-time speed information on major roads, together with other traffic information such as road works, accidents and incidents on the roads. This allows motorists to make more informed travel decisions and plan their routes to enjoy a smoother journey. *Figure 2* is a screenshot of the interactive map.

Figure 1: Information flow in TrafficScan

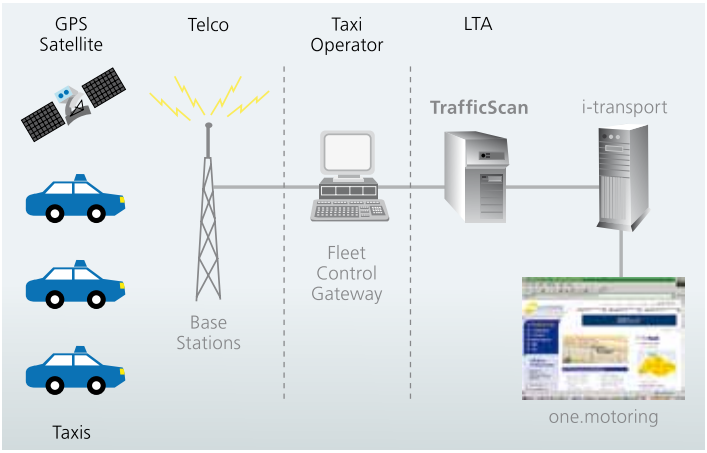


Figure 2: Interactive map on one.motoring website

Enhancing the System

In 2003, the taxi operators decided to migrate their wireless communication system to General Packet Radio Services (GPRS) which provides higher bandwidth at a lower cost. The use of GPRS greatly increases the amount of taxi data that can be collected by TrafficScan and thus, the potential for greater accuracy and reliability of TrafficScan speeds. To take advantage of this development, LTA worked with Steria Asia Pte Ltd in 2005 to enhance TrafficScan to improve the accuracy and availability of real-time traffic speeds.

The enhanced system—e-TrafficScan—was successfully launched in April 2006. The key changes and improvements to the system are discussed in the following sections.

Replacing Mobitex system with General Packet Radio Services

With the higher bandwidth that comes with the migration of the wireless communication system to GPRS, more taxi data can be collected. Instead of collecting data only when taxi drivers bid for taxi booking jobs, data can now be collected from taxis at regular intervals throughout

the day, as long as the taxis are running on the roads. The interval for polling taxis for data is also reduced from 5 minutes to less than 3 minutes. As a result, the amount of data collected in a day has increased by 15 times. The hardware in both the taxi operator's system and e-TrafficScan has been substantially upgraded to allow more taxi data to be processed.

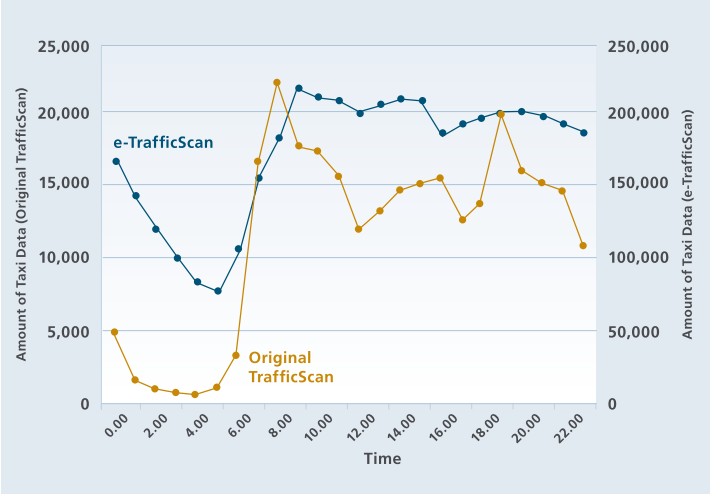
Figure 3 shows the amount of taxi data collected each hour. With e-TrafficScan, there is less variation in the amount of data collected during the day, unlike the original TrafficScan which showed peaks corresponding to peak hours for taxi booking i.e. around 8am and 7pm. Note that the scale for e-TrafficScan is 10 times that for the original TrafficScan.

Enhancement of algorithm

The TrafficScan algorithm was enhanced to track the travel path of each taxi. This allows e-TrafficScan to compute the travel speed of each taxi based on the distance travelled and time taken between two successive locations, instead of using spot speed as in the original TrafficScan. Although the spot speed of the taxi is still collected, it is only used when the travel speed cannot be computed.

The travel speed is more representative of the actual traffic speed experienced by motorists as it is related to the time taken to travel a particular path. In addition, it is subject to less variation than spot speeds. By tracking the taxi movement from one point to another, all road segments along the path travelled by the taxi will have a speed corresponding to the travel speed of the taxi. This improves the speed coverage of e-TrafficScan. See box story "Algorithm of e-TrafficScan" for a more detailed discussion of the enhanced algorithm.

Figure 3: Amount of taxi data collected every hour



Better representation of road segments

The number of road segments used for computing traffic speeds was increased from approximately 32,000 to 53,000. The average length of each segment was reduced from 170m to 102m. With shorter and more road segments, the average traffic speed from e-TrafficScan is more representative of the actual speed for each road segment.

The above enhancements to TrafficScan have improved the accuracy and coverage of traffic speed on the roads. Motorists are now able to access more accurate traffic

Figure 4: Coverage of speeds in central area in original TrafficScan

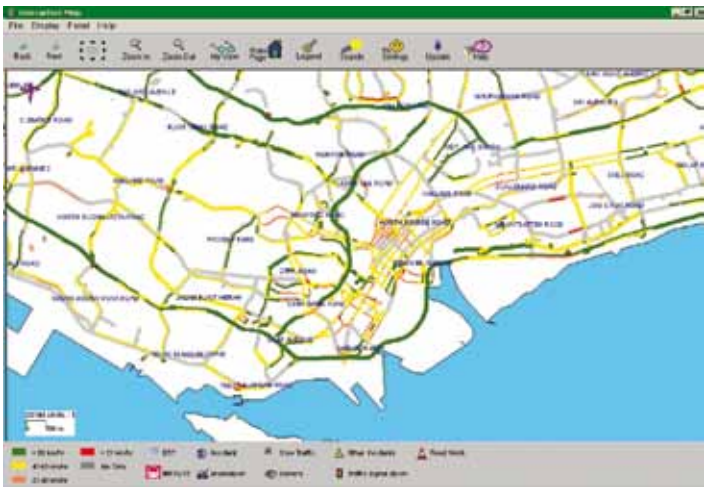


Figure 5: Coverage of speeds in central area in e-TrafficScan

speed information for more road segments. A comparison of *Figures 4* and *5* shows the significant improvement in the coverage of traffic speed information under e-TrafficScan (as shown by a reduction in the number of grey road segments where no data is available).

Manual travel time surveys which involved drivers going around the road network were conducted to assess the accuracy of speeds reported by e-TrafficScan. The results showed that the speed variance on expressways was 7% while that on arterial roads was 17%. This compared favourably with the original TrafficScan, which had a variance of 18% on expressways and 45% on arterial roads.

LTA's annual operating cost for the system was also reduced by 65%, which was significant given the improvements made. This was primarily the result of the advancement in wireless communication technology which allowed higher bandwidth and more computational intelligence at a lower cost.

Conclusion

As early as 1999, the TrafficScan system enabled LTA to collect round-the-clock traffic speeds over a wide area. LTA's innovative approach—using taxis on the road to achieve a large number of widely distributed probe vehicles, and transmitting data through the taxi dispatch system to cut down on data transmission cost—allowed it to overcome the two key difficulties associated with the adoption of the FCD method. However, the accuracy and coverage of the original TrafficScan were limited by the technologies available then.

With the subsequent enhancement to TrafficScan in 2005, it is now more efficient and cost effective to collect traffic speeds over a wide area, round-the-clock on a sustained basis.

LTA continues to work on improvements to TrafficScan. Today, e-TrafficScan uses taxis as probe vehicles. In future, the group of probe vehicles could be expanded to include other public and commercial transportation such as buses and commercial vehicles. Other potential areas of improvement include the employment of fuzzy logic to the TrafficScan algorithm in the areas of mapping, path finding and speed reconstitution, and making TrafficScan information available through other dissemination channels such as dynamic navigational devices.

Algorithm of e-TrafficScan

Overview

The algorithms in the e-TrafficScan system are divided into two major stages. The first stage handles the processing of the incoming taxi data while the second computes the average travelling speeds on the roads using data collected within the 5-minute intervals .

The processing of incoming taxi data includes coordinate conversion, location-to-road mapping, travel path finding and travel speed calculation. This gives a set of speed samplings for each road segment which is used as input for the second stage.

In the second stage, the system computes the travelling speed for each road segment by averaging the speed samplings within each 5-minute interval. The confidence levels for the speed samplings are also calculated using Student t-distribution. If the confidence level is not satisfactory, the system gathers the samplings from neighbouring road segments to re-compute the travelling speeds.

For road segments without speed samplings, and hence not able to produce the average travelling speed, their travelling speeds will be reconstituted from historical speeds or from current speeds of neighbouring road segments.

Coordinate Conversion

The GPS unit in the taxi produces only taxi locations in WGS84 coordinates, which is based on the World Geodetic System for determining GPS positions on Earth. We need to convert them into SVY21 coordinates (which is based on a local reference system for determining positions on the Singapore map) before mapping the location to the road segments. The requirement for e-TrafficScan

system is to use SVY21 coordinates for all geographical information.

Taxi Location-to-road Mapping

The location of the taxi is not very useful unless we associate it to the road segment that the taxi is travelling on. This provides speed information for that road segment as well as the ability to establish the path between the current and the previous location. We can generate more traffic information using the travel path of the taxis.

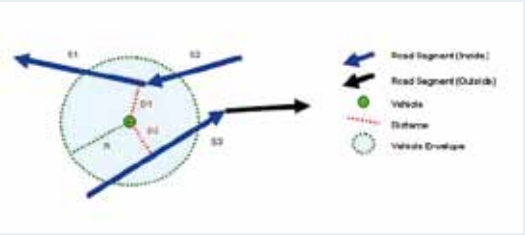
Hence, the algorithm that searches for a matching road segment for each taxi location received is very important. It has to be accurate and more importantly, it has to be very fast. Due to the huge number of road segments and taxis, the system has only a split second to narrow down to a few potential road segments.

The system stores the road segments in a spatial data structure to facilitate the process of matching location to the road. The regions covered by each geographical object are pre-computed and used as the index for fast retrieval.

Each time a taxi location is received, the system computes an envelope around the location where possible road segments may reside. It then pulls out the set of road segments that intercept with the envelope using their geographical properties. These road segments have to go through a selection process before the best matching road segment is chosen.

The figure below shows the basic taxi location-to-road matching selection. The road segment with similar direction and the shortest distance from the location is selected as the road segment the taxi is located.

Taxi location-to-road matching calculation



Travel Path Finding

To calculate travelling speed, the path of the taxi between time t and t-1 must be known. Given the GPS locations of the vehicle at the start and end of the journey, the shortest path connecting the two points is computed using the A-star path finding algorithm.

The A-star path finding algorithm (heuristic graph search algorithm) is implemented in the e-TrafficScan system. The speed and efficiency of the algorithm enables the system to process up to 54,000 taxi data in 5 minutes.

Speed Reconstitution

The purpose of reconstitution is to produce speed information for road segments where there is no data. This ensures that motorists get reliable speed information round the clock.

Speed reconstitution is achieved either by using historical data (time-based reconstitution) or by using data from the neighbouring roads (space-based reconstitution).

In time-based reconstitution, the current traffic speed is assumed equal to the historical traffic speed from the last 5 to 15 minutes. In space-based reconstitution, speed samplings from neighbouring road segments are used to compute the current traffic speed.

Note

1. i-transport platform is an interactive and integrated platform for the management of traffic control and advisory infrastructure for the entire road network.

Acknowledgement

We wish to acknowledge the contribution of Evin Toh Seng Quee, Project Manager, Steria Asia Pte Ltd, in the development of the e-TrafficScan system, and for contributing the box story of "Algorithm of e-TrafficScan" to this paper.

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Lee Chin Wai is the Manager, Intelligent Transport Systems Development in the Land Transport Authority of Singapore. He leads the implementation of Intelligent Transport Systems, including Junction Electronic Eye, which provide real-time traffic monitoring at major traffic junctions using a network of surveillance cameras; and the Parking Guidance System, which informs motorists of availability of parking spaces in buildings within the city. He is also a member of the Technical Committee for the 2nd World Roads Conference in Singapore. Mr Lee graduated from National University of Singapore with a Degree in Civil Engineering.

Managing Congestion in Singapore—A Behavioural Economics Perspective

LEW Yii Der and LEONG Wai Yan

Abstract

Behavioural economics—an emerging field of research that combines insights from psychology and economics—has significant potential in shaping many urban transport solutions today. Using case studies from Singapore's experience in managing road demand, this paper looks at how perspectives from behavioural economics can be used to complement traditional economic theory in explaining the impact of policy innovations in Singapore.

What is Behavioural Economics?

Economic analysis is an integral part of the decision making process in many government agencies. Standard economics however hinges on strong and narrowly defined assumptions about the rationality of individuals and organisations. In recent years, some of these assumptions have been called into question by an emerging field of study known as behavioural economics. Using insights that are drawn from cognitive and social psychology, behavioural economists have shown that, in many instances, human beings predictably behave in ways that can be very different from what is commonly assumed in standard economics.

Empirical findings from behavioural economics often turn up surprising and counter-intuitive results, and may suggest some novel ways for policy design today. This paper will look at some key findings from behavioural economics, and how these provide valuable alternative perspectives into some of Singapore's traffic demand management measures, such as the Area Licensing Scheme, Vehicle Quota System and Electronic Road Pricing system. A richer understanding of people's actual preferences and their responses to these measures can yield deeper insights into the outcome of these policies and provide fresh guidance on future policy designs.

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Area Licensing Scheme

Raising road charges from zero

The Area Licensing Scheme (ALS) was introduced in 1975 to manage congestion in the Central Business District (CBD). Under the ALS, motorists had to purchase a paper licence if they wished to enter a cordoned

area known as the Restricted Zone (RZ) during the morning peak hours. When it was first implemented, the ALS licence cost $3 for a day or $60 for a month.

Together with the introduction of ALS, the parking charges in the CBD and vehicle taxes were raised. The bus network was also enhanced to give commuters more travel options. Taken together, these measures resulted in an immediate 76% cut in the number of cars entering the RZ during licensing hours (Behbehani et al. 1984). Concurrently, the proportion of bus trips increased from 33% to 46% of inbound RZ trips. Transport researchers generally agree that the ALS was a success.

The standard consumer theory in economics undoubtedly provides one explanation for the drop in RZ-bound trips. By raising the price of a car trip while improving the substitutability of public transport to the car, demand for car travel into the RZ can be reduced. However, recent findings by behavioural economists suggest that more may be going on than just conventional economics alone.

A recent study by Shampaneir et al. (2007) on the power of "free" may be instrumental in advancing our understanding of how the ALS became so successful. Shampaneir et al. found that people strongly preferred free items, even when a better deal was available at a nominal cost. They demonstrated this effect through a series of experiments. In one experiment, people were given a choice between expensive Lindt chocolate truffles for 15 cents and ordinary Hershey kisses for 1 cent. Seeing a good deal, 73 percent went for the truffles. With another group, they dropped the price of both the truffles and the kisses by 1 cent apiece: 14 cents for the truffles and free for the kisses. Under these conditions, the authors found a significant switch in taste: 69 percent chose the free Hershey kisses instead (Table 1).

Table 1: Significant demand shift to a free item

% Choice	15c	1c	14 c	Free
Lindt Truffles	73%	-	31%	-
Hershey Kisses	-	27%	-	69%

This strong emotional attachment to zero cost is an inherent psychological trait with no forthright explanation from conventional economic theory. Based on standard cost-benefit analysis, there would be no change to the net benefits of both products and hence no change to the proportion choosing the truffles when the kisses were priced at zero. However, the results of the experiment showed that people saw zero as more than just another price.

The power of "free" also suggests that once a free item is priced above zero, demand for that item could plummet significantly.

The power of "free" also suggests that once a free item is priced above zero, demand for that item could plummet significantly, more than what conventional economics would predict. Could this have happened in the case of the ALS? While it is difficult to attribute the 76% fall in car trips into the RZ to either

standard or behavioural economic forces in the absence of a suitable control, what we now know about the zero-price effect gives us some hints that standard economics is not fully accounting for the strength of motorists' aversion to the ALS.

Car pools provide another interesting perspective on the power of "free." As cars with a minimum of 4 persons were initially exempted from ALS charges, there was a 17 percentage point increase in the car pool market share, out of the total number of cars entering the RZ (Behbehani et al. 1984). Subsequently, the free car pool policy resulted in car pooling evolving in a rather unusual way. Drivers would pick up complete strangers at special car pool pick-up points in order to enter the city without paying ALS. Likewise, car poolers were willing to share car space with other strangers to get a free ride into the city. In the local context where Singaporeans loathe sharing vehicles with strangers, the power of free car pools appeared strong enough to convince a good number of people to overcome their reservations about car sharing[1].

The popularity of free car pools grew and became so attractive that they started to take away bus patronage. The Government eventually decided to abolish the ALS exemption for car pools in 1989 and by doing so, the era of car pools—Singapore-style—came to an end.

The policy conclusion for transport authorities is that the elimination of free roads has a definitive impact on drivers' behaviour. People are so attached to "free" that when roads are priced to manage congestion, travel patterns undergo significant shifts to mitigate the feeling of loss. Unfortunately, the corollary to the power of "free" is the difficult task of convincing car users to give up "free" use of the roads in the first place. The numerous abortive attempts around the world to introduce congestion charging underscore this point.

Vehicle Quota System

Fairness in auctions

In 1990, Singapore introduced a Vehicle Quota System (VQS) to rein in the rapid growth in the vehicle population. Under the VQS, a person who wishes to buy a new car must first obtain a Certificate of Entitlement (COE). The number of COEs available each year is determined by the allowable annual vehicle growth rate. This was fixed at 3% from 1990 and reduced to 1.5% from May 2009.

With a limited supply of COEs, standard economics would prescribe an auction mechanism to allocate the COEs efficiently. But it appears that the general population is not just concerned about economic efficiency alone. Indeed, people dislike the idea of auctions as Kahneman et al. (1986) discovered when they polled 191 adult residents of Vancouver for their response to the following situation:

Due to the popularity of a football team, there is now a shortage of tickets to the next match. The organizers can elect to sell tickets in the

following ways. (1) By auction: The tickets are sold to the highest bidders. (2) By lottery: The tickets are sold to the people whose names are drawn. (3) By queue: The tickets are sold on a first-come-first-served basis.

When asked to rank the three allocation methods in terms of fairness, a large majority of the respondents thought that the queue was the most fair and the auction was the least fair, as shown in Table 2. This preference is opposite to a ranking by an economic efficiency criterion, which would put the auction above the lottery above the queue.

Table 2: Ranking of allocation methods

Allocation Method	Most Fair (%)	Least Fair (%)
Auction	4	75
Lottery	28	18
Queue	68	7

Kahneman et al. concluded that the findings seem to be driven by some general rules of fairness that are held in common by a community. One of these rules states that it is unfair for someone to exploit an increase in market power at the direct expense of someone else.

This rule of fairness is not simply seen in a Western context. During the early stages of the COE debate when the feasibility of using an auction to allocate the COEs was discussed, the Singapore public likewise raised concerns that those who could afford bigger luxury cars would use their superior "market power" to outbid small car buyers.

What was the policy response to these concerns? Firstly, conventional economics still prevailed. A competitive bidding system was adopted, with all successful bidders paying the lowest successful bid price[2]. Nevertheless, to address the social equity concerns, a decision was taken to classify vehicles into different categories, as follows:

- Category 1: Small cars (engine capacity of 1,000 cc and below)
- Category 2: Medium-sized cars (engine capacity of 1,001cc to 1,600 cc)
- Category 3: Big cars (engine capacity of 1,601 cc to 2,000 cc)
- Category 4: Luxury cars (engine capacity of 2,001 cc and above)
- Category 5: Goods vehicles and buses
- Category 6: Motorcycles
- Category 7: "Open" (for any kind of vehicles)

Each category had its own COE quota and COEs obtained under one category could only be used to buy vehicles from that category[3].

The VQS example illustrates a more general principle about policy making in Singapore. While the conventional economic prescription may guide the overall policy direction, behavioural economics often has a useful role in tailoring the solution to better suit the needs and aspirations of the population. Hence, although having a single COE category is economically more efficient, separate categories were introduced to improve public acceptance of the scheme and to address concerns of social equity[4].

Electronic Road Pricing System
From sunk costs to variable charges

The transition in 1998 from the ALS to the Electronic Road Pricing (ERP) system signalled a fundamental shift in Singapore's road pricing strategy. The manual ALS system charged motorists a fixed fee for the day or the month, regardless of actual usage. The ERP, on the other hand, provides greater flexibility for the congestion charges to be fixed based on different locations and times of the day, depending on the prevailing traffic condition. It is also based on a pay-as-you-use principle, where the congestion charge is instantaneously deducted from a stored-value card in an In-vehicle Unit (IU) every time the vehicle uses a priced road (Chin and Menon 2004).

From what we know of people's behaviour, charging a fixed fee—as in the case of the ALS—may lead to more, rather than less, consumption. This is termed the "sunk cost effect"—the tendency to continue in an activity once an investment of time, money or energy has been made. Standard economics states that sunk costs are irrelevant to current decisions and should therefore not be taken into account. However, it appears that people routinely do the opposite, as Arkes and Blumer (1985) discovered.

…charging a fixed fee…may lead to more, rather than less, consumption. This is termed the "sunk cost effect"…

In one experiment, people buying season tickets to a theatre group's performance were randomly given one of three different classes of tickets: full-priced tickets at $15, tickets with a small $2 discount and tickets with a sizeable $7 discount. If these people were to behave like homo economicus (rational man) and weigh the marginal costs and benefits of attending each play, then the average number of plays attended should not differ across the three groups as the discounts were randomly assigned. However, what Arkes and Blumer found was that those who paid full price, i.e. a higher sunk cost, attended significantly more plays than the other groups, at least in the first half of the season.

Table 3: People who paid higher sunk costs attended more plays

Types of tickets	Average number of plays attended
Full price ($15)	4.11
$2 discount	3.32
$7 discount	3.29

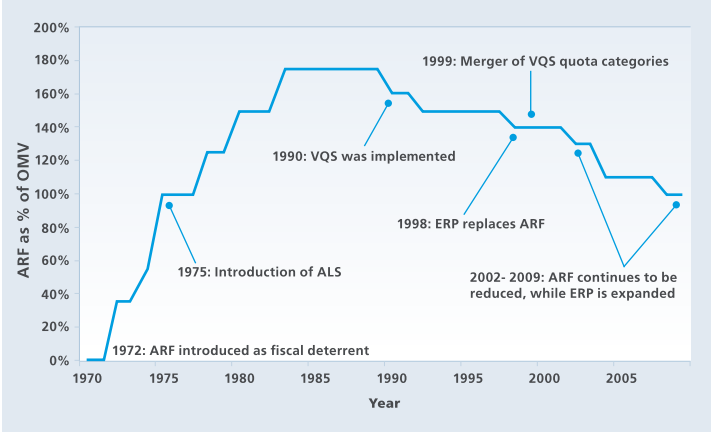
Viewed from this perspective, designing the ERP on a pay-per-use principle is thus a better option, compared to fixed fee charging like the ALS. As seen in the Arkes and Blumer experiment, the latter option might encourage even more consumption of limited road space. Likewise, because sunk costs matter, the high fixed cost of car ownership can be inimical to our objective of restraining car usage. Thus, instead of simply relying on high car ownership cost to manage congestion on the road, the Government has been reducing vehicle taxes and shifting more towards usage charges (through the ERP) to manage the demand for road space. *Figure 1* traces

changes to the Additional Registration Fee[5] for cars. It illustrates the Government's move to rely less on fixed ownership cost to manage congestion with the introduction of VQS and subsequently, ERP.

Indeed, from 1998 to 2007, the average ownership cost of a medium-sized car dropped by about 40%, while average usage cost increased by only about 20%. This means that motorists are paying less today to own and use a car, compared to 10 years ago. Yet, traffic on the road continues to be relatively smooth flowing, showing that demand can in fact be effectively managed with lower fixed costs and higher usage charges.

Nevertheless, owning a car is still a substantial investment even without the taxes. There is thus an inherent tendency for the car owner to maximise its usage once the car is bought. Hence, the Government thinks it is important to strike a balance between using ownership control and implementing usage charges to manage overall road congestion.

Figure 1: Changes to Additional Registration Fee for cars from 1972 to 2009



.....the experience of 'having the meter running' is generally unpleasant ... as it is both salient and directly linked to the consumption activity.

Refining the ERP System

Making charges more salient

Behavioural economists have observed that people use cognitive processes known as "mental accounting" to record their financial transactions and assign activities to specific accounts (Thaler 1999). In particular, if payment is decoupled from consumption, i.e. put in separate mental accounts, the perceived cost of consumption is reduced and this encourages more consumption, as in the case of the credit card. Conversely, the experience of "having the meter running" is generally unpleasant to most people as it is both salient and directly linked to the consumption activity. For example, Thaler (1999) notes that many car owners would be financially better off selling their cars and taking taxis to the supermarket. But this is rarely done because paying $10 for each taxi trip seems to raise the cost of groceries in ways that paying off a monthly car loan does not.

With this insight, one way to enhance the effectiveness of ERP is to make ERP charges more salient i.e. make people take greater account of the charges. To this end, the

LTA has installed real-time electronic display of ERP charges at all gantries since 2008 (*Figure 2*). This is expected to raise motorists' awareness of the actual cost of a trip and help them make a considered decision, for example, whether to shift some trips to a less congested time period where the ERP charges are lower or zero.

The next generation In-Vehicle Units (IUs) will also help to make ERP charges more salient to the motorist. Unlike the current IUs which only display the balance in the stored-value card, the new IUs will display the actual charge incurred every time the vehicle passes under an ERP gantry.

Figure 2: ERP grantry with real-time display of ERP charges

Conclusion

Behavioural economists have made much progress in recent years in understanding the psychological basis for our human preferences and tendencies. Unlike standard economic theories which have an established history of influencing policy debates, behavioural findings are only just beginning to make inroads into the public policy domain. As these become more widely understood and accepted, behavioural economics surely represents a rich body of insights for the design of effective, bold and innovative policies for the future.

Notes

1. As an example of how strangers are generally reluctant to share space in the same car, a scheme to encourage taxi sharing among taxi users heading in the same direction did not enjoy a high take-up rate and was eventually discontinued.

2. When the COE open bidding system was introduced in 2002, some changes were made to the auction process and successful bidders pay the highest unsuccessful bid price + $1.

3. The exception is the "Open" category whose COE can be used to purchase any type of vehicle. This is meant to give the VQS greater flexibility to respond to changing demand for different types of vehicles.

4. A government committee recommended in 1999 to consolidate the four car categories into two, quoting examples of economic inefficiencies associated with too many quota categories. See "Report of the Vehicle Quota System Review Committee" (March 1999) at http://www.lta.gov.sg/corp_info/doc/VQS%20Review%201999.pdf.

5. The Additional Registration Fee (ARF) was introduced in 1972 as a fiscal deterrent to curb the growth in car population. It is pegged to a certain percentage of the car's assessed value i.e. its Open Market Value.

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The Role of Smart Bike-sharing Systems in Urban Mobility

Peter MIDGLEY

Abstract

Following the success of the smart bike-sharing system in Paris, these systems are rapidly being introduced in European cities for daily mobility. The basic premise of the smart bike-sharing concept is sustainable transportation. Such systems often operate as part of the city's public transport system. They provide fast and easy access, have diverse business models and make use of applied technology (smart cards and/or mobile phones). Bike-sharing systems are currently operating in 78 cities in 16 countries using around 70,000 bikes. This paper reviews the state of the art of bike-sharing systems, drawing on experiences in selected European cities.

Introduction

The basic premise of the bike-sharing concept is sustainable transportation. They differ from traditional, mostly leisure-oriented bicycle rental services, in the following ways:

- They can be "rented" at one location and either returned there or at another location;
- They provide fast and easy access;
- They have diverse business models;
- They make use of applied technology (smart cards and/or mobile phones); and
- They are often designed as part of the public transport system.

Rental charges are time-based pay-per-ride fees, and in most systems, the first half hour is free of charge. Bike "pick up" and "return" stations operate 24 hours per day, 7 days a week. They are strategically placed at regular intervals throughout the city, making them easily accessible from public transport stations as well as office and shopping areas. The latest systems operate with smart technologies and provide users with real-time bike availability information on the internet. These "smart" bike-sharing systems provide the missing link between existing points of public transportation and desired destinations, offering a new form of mobility that complements the existing public transport systems.

... "smart" bike-sharing systems provide the missing link between existing points of public transportation and desired destinations...

Bike-sharing systems are currently operating in 78 cities in 16 countries using around 70,000 bikes. With the exception of systems

in Australia, Canada, China and the recently introduced system in Washington D.C. (USA), all systems are in Europe and most are in France (*Table 1*).

Table 1: Distribution of bike-sharing schemes by country

Country	Systems	Bike Fleet	Bike Stations
Australia	1	n/a	n/a
Austria	1	1,540	58
Belgium	1	250	23
Canada	1	2,400	300
China	2	200	2
Denmark	2	2,400	167
France	26	39,798	2643
Germany	6	5,800	n/a
Italy	19	2,563	246
Luxembourg	1	250	25
Norway	3	1,575	153
Portugal	1	350	33
Spain	6	9,689	720
Sweden	2	2,125	191
UK	5	198	59
USA	1	100	10
Total	**78**	**69,238**	**4,630**

The Vélib system in Paris is by far the largest with 20,600 bikes available in 2008. The systems in Caen, Copenhagen, Dijon, Lyon and Paris have the highest densities, with an average of one bike per 200 persons.

Objectives

In general, bike-sharing systems are introduced to increase mobility choices, improve air quality and reduce congestion. *Table 2* lists the objectives as articulated by some cities for their respective systems (Curran 2008).

Examples of Smart Bike-sharing Schemes

The largest and most famous smart bike-sharing system is in Paris, France. Called "Vélib", which stands for "vélo libre" ("free bicycle") or "vélo liberté" ("bicycle freedom"), it was launched on 15 July 2007 with 10,000

Table 2: Objectives of selected bike-sharing schemes

System	Objectives
Barcelona, Spain	• Improve interchange between different modes of transport, and promote sustainable travel. • Create a new individual public transport system for citizens' habitual travel needs. • Implement a sustainable, health inducing service fully integrated with the city's public transport system. • Promote the bike as a common means of transport. • Improve quality of life, reduce air and noise pollution.
Göteborg, Sweden	• Raise the status of cycling. • Promote using bicycles for short distance trips.
Lyon, France	• Help create a more sustainable transportation system in the region by launching a public bicycle system that provides a new mobility option for short trips. • Help achieve transport and land use planning objectives including pollution emission reductions, reduced traffic congestion, road and parking cost savings, consumer cost savings, energy conservation, reduced crash risks, improved public health, and support for smart growth land use development.
Montreal, Canada	• Encourage the use of public bicycles instead of cars for short, inner-city trips.
Paris, France	• Act on air quality and public health. • Improve mobility for all. • Render the city a more beautiful and agreeable place to live in. • Encourage economic vitality. • Reinforce regional solidarity.
Washington, D.C.	• Provide as many transportation options as possible and reduce the level of congestion, especially downtown.

bicycles and 750 automated rental stations, each with 15 or more bike spaces. In less than 2 years, Vélib has become a high performance service with 20,600 bikes and 1,451 stations (*Figure 1*), available 24/7. Mayor Betrand Delanoë's re-election six months after the launch of Vélib was even credited in part to the success of the system.

Figure 1: Vélib bike station in Paris

Source: Luc Nadal, ITDP

Paris, France

(City population 2.15 million)

The Vélib system is highly accessible with bike stations every 300 metres and more than 230 miles of cycling lanes. The first half hour of usage is free of charge (as a result, in the first two months of operation, 92 percent of trips lasted less than 30 minutes). After the first half-hour, time is charged by 30-minute increments[1]. The aim is to encourage the turnover of bikes, but the rates are also designed to avoid competing with private bike rental companies. Users need to take out a subscription[2], which allows for an unlimited number of rentals during the subscription period.

Two-thirds of users say their Vélib trips are usually part of a longer journey. Among the 212,000 long-term subscribers (Faye 2008), a majority of them use Vélib daily to go to work or school, and about 20 percent reported driving less. After one year in operation, Vélib has clocked 27.5 million trips, representing an average of 8 to 10 users per bicycle per day (Nadal 2008). Since it was launched, the system has averaged 75,000 trips per day and each Vélib bicycle has covered a total of 10,000 km.

The entire network is operated by JCDecaux at its own expense. JCDecaux paid start-up costs of about $115 million. It employs the equivalent of about 285 people full time to operate the system and repair the bikes. The city receives all the subscription and usage fees from the scheme (estimated to be about □20 million) and a fee of about □4.3 million a year from JCDecaux. In return, JCDecaux receives exclusive rights to advertise on 1,628 city-owned billboards for 10 years, while the city retains the right to use about half of that billboard space at no charge for public-interest advertising (Anderson 2007).

Figure 2: Bicing bike station in Barcelona

Source: Clear Channel Outdoor

Barcelona, Spain

(City population 1.5 million)

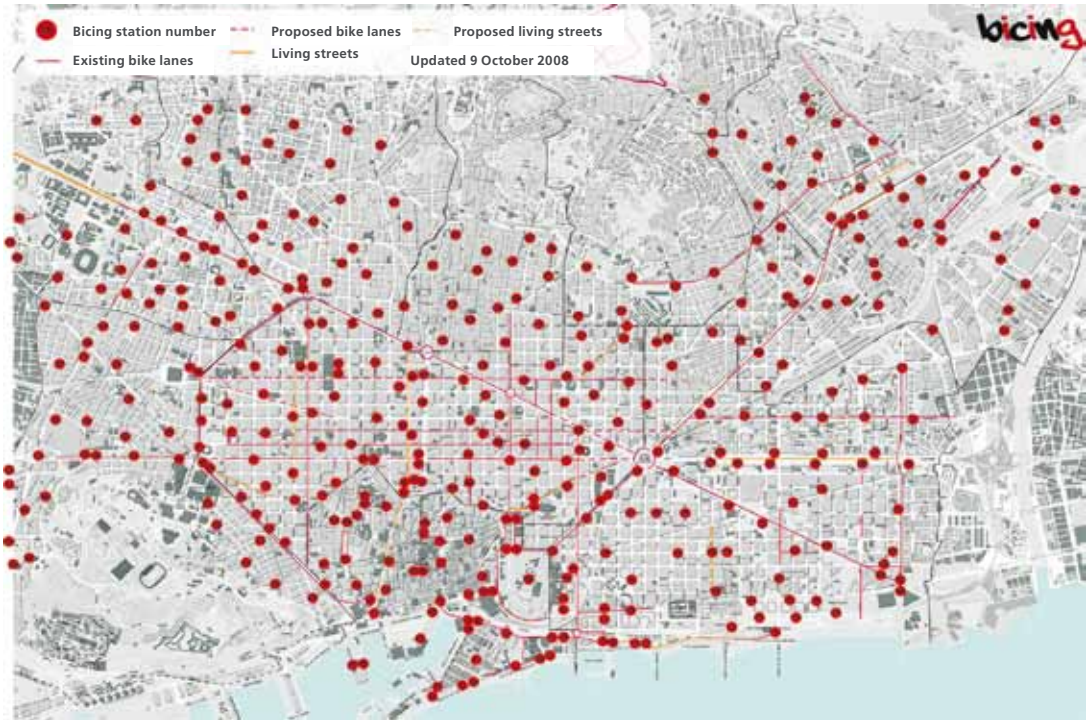
Called "Bicing", the system was launched in May 2007 with 750 bikes and 50 stations (*Figure 2*) located near Metro stations and major parking areas. By the end of 2008,

it had expanded to 6,000 bikes and 400 stations. The system is highly accessible with bike stations every 300 m. Some 22 km of new bike lanes have been implemented to link the bike stations with the city's strategic 128 km cycling network. *Figure 3* shows the distribution of Bicing stations and bike lanes in Barcelona.

The system has over 170,000 subscribers and an annual subscription cost of □24 (only residents can use the system). The first half hour of usage is free and each additional half hour costs □0.30, up to a maximum of 2 hours. Users that exceed this time limit are penalised. More than 15 million trips have been made (of which 57 percent are work trips) totalling 43.4 million km. The average trip is 3 km and 10 percent of users reported that their bike trips have replaced car trips. Among the users, there is an equal split between men and women; 51 percent are between 25 and 35 years and all are local residents; 30 percent say they use the system because it is faster than other means of transport; 37 percent value the exercise and 22 percent say they use it because it is environmentally friendly.

Like many of the latest smart bike-sharing programs, Bicing provides real-time information on bike availability on the internet. The system is managed by B:SM (Barcelona de Serveis Municipals), a municipal service company. Clear Channel Outdoor has a contract to operate the system for 10 years. Unlike other systems, Bicing is funded with revenues from on-street parking.

Figure 3: Distribution of Bicing stations and bike lanes



Source: Barcelona de Serveis Municipals

Figure 4: Bike station in La Rochelle

Source: Communauté d'Agglomération de La Rochelle

La Rochelle, France

(City population 80,000)

La Rochelle initiated the first successful bike-sharing system in France in 1974 with the introduction of the famous "Vélos Jaunes" (Yellow Bikes). By 2003, there were over 300 bikes in use and the city had built 130 km of exclusive bike lanes. In 2005, La Rochelle launched a second generation bike-sharing system with 120 bikes at 12 stations (*Figure 4*). It was converted to a smart bike system in 2008 and the number of stations increased to 25 while the bike lane network expanded to 150 km. 50 stations with 300 bikes will be available by the end of 2009.

The scheme uses a smart card system which can also be used for electric car sharing, parking and buses. The use of a single smart card enhances the integration of the scheme with the public transport system. Smart card holders can use the system free for the first three hours (compared to two hours for other users).

Major Smart Bike-sharing Systems

Many smart bike-sharing systems are provided and operated by city administrations or public transport operators. But increasingly, city administrations are contracting private operators to provide these systems. There are currently 3 major operators, each with their own smart bike-sharing system: Bicincittà by Comunicare (Italy), Cyclocity by JCDecaux, (France), and SmartBike by Clear Channel Outdoor (USA).

Bicincittà

First introduced in 2004, the Bicincittà system has been installed in 21 cities, mostly in Italy, but also in Spain (San Sebastian and Pamplona). There are nearly 11,000 registered users and more than 1,700 individual stands (*Figure 5*) in 21 locations. The charging structure varies—in some cities, the service is free; in others, there is an hourly fee; and most cities require pre-registration and an annual subscription. An Italian company, Comunicare s.r.l., provides Bicincittà systems in partnership with City councils (Bicincittà 2008).

Figure 5: Typical Bicincittà bike station

Source: Bicincittà

Cyclocity

JCDecaux, the second largest global outdoor advertising company, is the world leader in

street furniture advertising. In 1999, JCDecaux invented a self-service bike system called "Cyclocity". The first generation was launched in June 2003 in Vienna (Austria), Gijon and Cordoba (Spain). In 2004, a new generation bike (*Figure 6*) was developed and on 19 May 2005, 1,000 bikes were introduced in Lyon and Villeurbanne. By 2007, the Lyon fleet had increased to 3,000 (currently 4,000 with bikes used 20,000 to 30,000 times a day). The Cyclocity system has attracted a large number of cities, the largest of which is Paris (20,000 bikes). The system is also used in Aix-en-Provence, Besançon, Brussels, Marseilles, Mulhouse and Seville (Cyclocity 2009).

Figure 6: Typical Cyclocity bike

Source: JCDecaux

SmartBike

SmartBike is operated by Clear Channel Outdoor, the world's largest outdoor advertising company. 10 years ago, Clear Channel Outdoor deployed the first smart bike-sharing program in Rennes, France. Nearly 8 million trips totalling over 25 million miles have been made on SmartBike systems by a combination of 260,000 users in 6 countries and 13 cities: France (Caen, Dijon, Perpignan, Rennes), Italy (Milan), Norway (Drammen, Oslo, Trondheim), Spain (Barcelona, Zaragoza), Sweden (Gothenburg, Stockholm), and the USA (Washington, D.C.) (Smartbike 2009). *Figure 7* shows a typical bicycle used for the scheme.

Figure 7: Typical SmartBike

Source: Clear Channel Outdoor

Issues

The major issues with the earlier generation of bike-sharing schemes were people keeping bikes longer than the allowed period, theft and vandalism. The use of smart technology and credit cards has reduced these risks.

Topography and climate may not be appropriate in some cities for bike-sharing schemes.

For example, Clear Channel Outdoor bikes have a unique identifier and use a GPS tracking system to reduce theft. The OYBike in London has an anti-theft system that uses an algorithm to generate unique codes to open and lock the bikes (Curran 2008). In most systems, users must provide credit card information so that if they do not return a bike, they will be charged its replacement cost. In addition, smart bikes are designed to require the use of special tools for disassembly, thereby discouraging

unauthorised removal, and most of the components are of uncommon dimensions that would not be usable on other bikes. The bikes also have a unique design so as to stand out from other bikes (DeMaio 2004).

Nevertheless, theft and vandalism have run higher than expected in Paris, where the operator has replaced thousands of bicycles at a cost of 3 to 6 million Euros a year. In some cities, people will borrow a bike for a week or longer and others will not return the bike to a rack. To encourage people to return bikes to underused stations, Paris recently announced a 15-minute credit for returning bicycles to specific stations, particularly those on hills.

Topography and climate may not be appropriate in some cities for bike-sharing schemes. Stuttgart (Germany) is hilly and the city is launching an electric bike scheme called "Pedelec". Although many bike-sharing programs aim to reduce traffic congestion, in some cities, bikes are used instead of walking or public transportation.

Implementing Bike-sharing Schemes

For cities which are considering the introduction of bike-sharing schemes, some key conditions for implementation are:

- A strong commitment to sustainable urban mobility and the promotion of cycling;
- A minimum standard of bicycle infrastructure (bike lanes and bike paths) for safe and convenient cycling;
- Sufficient resources to achieve a real impact; and
- Sufficient space for racks/parking to guarantee access to bicycles.

Most bike-sharing schemes need to be financially backed by a large transport operator or by public resources.

The NICHES (New and Innovative Concepts for Helping European Transport Sustainability) project (Bührmann 2007) 2008 has developed the following checklist to help policy-makers design and plan for a successful bike-sharing scheme.

City size

- Most suitable for medium to large cities (> 200,000 inhabitants).

Implementation time

- Short term (<2 years).

Stakeholders' involvement

- For service implementation and operation: Rail or public transport operators, street furniture companies, advertising companies or local authorities;
- For political and financial support: local authorities, user associations.

Challenges

- Mutual respect between cyclists, pedestrians and car drivers needs to be strengthened (especially in cities with little bicycle use).

Costs

- Principal cost factors include staff needed for operation, service and maintenance; bicycles (costs can range from □250 to more than □1,200 depending on smart bike technology); and racks and service terminals.

- In most cases, financial backing is needed as most of the schemes are not financially self-supporting.

Most bike-sharing schemes need to be financially backed by a large transport operator or by public resources, either through direct funding or indirectly through Public Private Partnerships (PPPs). In most cases, a PPP between a billboard company and a local authority is established. The billboard company receives the right to use specific public spaces for advertisements and in return implements and operates a bike-sharing scheme (e.g. Clear Channel Outdoor and JCDecaux). The Barcelona system operated by Clear Channel Outdoor is financed by revenues from on-street parking.

Conclusion

Bike-sharing programs have expanded rapidly throughout Europe in recent years as cities search for ways to increase bike usage, meet increasing mobility demands and reduce adverse environmental impacts. The introduction of smart technology has resolved many of the vandalism and theft problems of earlier bike-sharing programs and has made bike sharing popular and trendy, especially among younger users. The city of La Rochelle has shown that bike sharing can be fully integrated with other transport modes by adopting a single smart card ticketing system. In Paris, tens of thousands of Vélib users on the street have boosted a renewal in cycling with resultant sales of bicycles jumping 35 percent. A key ingredient for success in any city is the availability of an extensive and continuous bike lane/path or car free network. Equally important is the combination of a bike friendly topography and climate.

Notes

1. Current rates are □1 for the first additional half hour, □2 for the second additional half hour, and after the third additional half hour, the rate increases steeply to □4 for each additional half hour.

2. Current subscriptions are □1 per day, □5 per week or □29 per year.

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Earning a Public Space Dividend in the Streets

Paul BARTER

Abstract

Experiments with shared space or "naked streets" have captured imaginations and considerable media coverage in recent years. Most of the excitement stems from surprise that streets without kerbs, road markings or signage can work well and achieve "safety through uncertainty". This paper looks at another equally important insight from shared space. It focuses on a series of innovations that, like shared space, re-arrange the roles of streets in new ways to yield a "dividend" of expanded urban public realm, with little or no loss of transport utility. Such a space dividend should be especially welcome in dense cities that are both congested and short of public space.

Introduction

What are streets and roadways for? An obvious answer is traffic movement. But that is clearly not the whole story. A second role is to allow the reaching of final destinations—the role we call "access". Thirdly, streets can be valuable public places in their own right. In addition, moving high-speed motor vehicles differ enormously from movement by low-speed, vulnerable modes such as bicycles. Unfortunately, speedy motor traffic movement and the other roles of streets are in serious conflict. For almost a century, the tension between these roles has been at the heart of debate over street design (Hass-Klau 1990; Jacobs et al. 2002). This article reviews emerging resolutions to this tension.

The Battle for Street Space

The essence of a street is that it serves all these roles simultaneously—providing for traffic movement and access, and as public space for urban activities. However, mainstream roadway management has spent many decades seeking, like Le Corbusier, the "death of the street". It tends to turn everything between kerbs into "traffic space" where motor vehicle movement is the design priority (Patton 2007).

…a street … serves all these roles simultaneously—providing for traffic movement and access, and as public space for urban activities.

Motorised traffic, slow modes and pedestrians are strictly segregated in both space and time. The role of streets as "public realm" has been largely restricted to the pavements (sidewalks) and to pedestrian zones. Most cities are desperately short of attractive public space and space for the networks needed by the

gentle but vulnerable modes such as walking and cycling.

Since the 1930s, traffic engineers have routinely classified every roadway in a hierarchy according to the degree to which it serves either traffic movement or access. Major arterials and expressways which are at the top of the hierarchy are managed primarily for maximum vehicle mobility. Any access functions are carefully limited to contain "friction" with the mainstream traffic. Only streets at the lowest level of the hierarchy are used mainly for access. Furthermore, the planning process often seeks to remove as much activity as possible (and hence, the "public space" role) from roadways and their vicinity. The influential UK report of 1963, *Traffic in Towns* by Colin Buchanan, reinforced the idea that segregation was essential (Hamilton-Baillie 2008).

The roadway hierarchy has no place for streets that serve both traffic and multiple other purposes (Svensson 2004). Yet, traditional urban streets and main streets remain ubiquitous. They provide (inadequately) for both access and mobility and are sites of perennial conflict. Such conflict is especially obvious in the heavily used streets of many dense Asian cities. The conventional traffic engineering approach offers little guidance for such multi-role streets (Svensson 2004).

Expanding Public Realm without Evicting Motor Vehicles

Recently, a series of promising street management innovations has emerged that re-assert in new ways the multi-purpose nature of the street. (See Box Story "Innovations that Expand Public Realm in the Streets".) They offer ways to increase the public realm without removing the motor vehicles or seriously undermining the utility of the motorised traffic system. Does that sound too good to be true?

These innovations exploit common insights and principles. First, they involve making a strong distinction between "traffic areas" or "highway" and public space or the "public realm" (Shared Space project 2005). Traffic areas are the realm of conventional traffic engineering where high-speed motor vehicle movement is primary, with its flow carefully segregated from slower users like pedestrians and cyclists.

Second, some of this redefined "public realm" can be shared. It includes new spaces designed for the peaceful co-existence of public place activities, slow movement by vulnerable modes as well as motor vehicles, especially those seeking access to the vicinity. The key to such co-existence lies in keeping speeds low, ideally to no more than about 30 km/h (Shared Space project, 2005). Low speeds mean that motor vehicles need not be excluded but those present will mainly be making access movements or on the "last mile" (or the first) of their trips.

The key to such co-existence lies in keeping speeds low.

Third, these innovations shift the boundary between public realm and traffic space, so that a surprising amount of what we now

think of as traffic space becomes part of the low-speed public realm. In shared spaces and in other slow zones, such as Tempo 30 zones and bicycle boulevards, whole streets and intersections are converted to public space. In multi-way boulevards, public realm includes everything from the building line to the outer edge of the central, high-speed traffic lanes. This newly expanded public realm serves local motor vehicle access, slow-mode movement, public space roles and sometimes some through-traffic (with low priority and at low speed). Only the high-speed traffic movement is excluded and kept within traffic space.

Fourth, a key design goal is that both the public realm and traffic space should work better by being kept distinct (Shared Space project 2005). Cities still need high-speed traffic space of course, just as some pure pedestrian space must also remain. But a surprising amount of shared public realm could be reclaimed without diminishing total traffic capacity. The key is that most of the expansion of the public realm envisaged here would take over traffic space that does not work very efficiently anyway. For example, the capacity of many of today's motorised traffic lanes is reduced by turning movements, kerbside drop-offs, parking, loading and other street activities. After transforming such spaces into public realm, the remaining traffic space can be re-designed more thoroughly for its traffic function. Moreover, the new public realm retains some traffic function, albeit at low speed, as a safety valve at times of extreme congestion.

Expanding the low-speed public realm would also allow us to be much more tolerant of a diverse range of small, vulnerable vehicles.

A high percentage of traffic volume in most cities is carried by roads at the top of the roadway hierarchy. Much of the remaining traffic is in fact short-distance traffic, or is on the first or last "mile" of a longer trip, or is circling for a parking spot. Such traffic does not need high speeds. In fact, a slower environment is more appropriate for access movement. Furthermore, although public realm requires very low peak speeds, the approaches discussed here also usually reduce the need for stopping and starting, so that average speeds and travel times are often little changed. Therefore, reclaiming such space as public realm has less impact on traffic performance than one would think based purely on the percentage of traffic space "lost".

Expanding the low-speed public realm would also allow us to be much more tolerant of a diverse range of small, vulnerable vehicles that currently do not fit easily into our transport systems. These include bicycles, in-line skates, skateboards, kick scooters, wheelchairs and many other "Personal Mobility Devices".

Barriers to Change

As with most innovations, change will take more than a simple policy decision. In most countries, roadway management practices

are deeply embedded in institutions, their missions, objectives, performance-measures and boundaries of responsibility between agencies; in professional guidelines, codes and design standards; and in traffic rules and road user education.

Fortunately, little change is needed in conventional roadway management when it is applied to its appropriate domain i.e. the high-speed arterials and highways. It is only within an expanded public realm and at its boundaries that drastic change is called for. Standard practice must no longer apply to such spaces. Level of service (LOS) has no place here. Nor do conventional approaches to road safety, such as removal of "fixed hazardous objects". Roadways that form part of the shared public realm should not resemble highways despite the presence of motor vehicles. Design principles for such streets, including signage and road markings, must be different from those for traffic space.

The public realm of streets needs a whole new set of procedures, guidelines and metrics of success. More research is needed to develop them. This is beginning to happen through experimentation in many countries (Shared Space project 2008; Hamilton-Baillie 2008; Jacobs et al. 2002). The Netherlands, Sweden and the United Kingdom have revised their guidance manuals on street design (e.g. DfT 2007). Traffic engineers will need to adapt their problem solving to the special challenges of designing shared public realm. They will need to collaborate more with urban design professionals and urban planners, who will also need to take more interest in the streets that they have long neglected.

The public realm of streets needs a whole new set of procedures, guidelines and metrics of success.

Conclusion

This article has provided a quick review of promising new ways to reconcile movement, access and place-making within our precious urban rights of way. New public space is gained through including low-speed access movement by motor vehicles within the public realm. It is this "public space dividend" that has been my focus. It may be too soon to tell if these ideas can deliver on their promise. We may only find out by trying them out.

Innovations that Expand Public Realm in the Streets

Traffic Calming—The First Wave

For several decades there have been efforts to use roadway modifications, such as humps and chicanes, to control motor vehicle speeds on streets whose primary roles are non-traffic ones (Hass-Klau 1990). Such traffic calming began in north-west Europe and by now is familiar almost everywhere.

Early traffic calming tended to focus on streets at the lowest levels of the roadway hierarchy to reinforce the primacy of access and pedestrian activity at that level. More recently, adaptations of traffic calming techniques have been applied to some streets at higher levels of the hierarchy, such as short stretches of shopping streets and the main streets of towns. An early Dutch traffic calming innovation, the *Woonerf* or "home zone", involved a complete re-design of urban residential streets to make it clear to motorists that they were guests in a home environment. This was a precursor to the more ambitious shared space experiments.

Tempo 30 Zones

(Or "Twenty's Plenty")

A variation on traffic calming is to simply signpost very low speed limits, notably 30 km/h (or 20 miles/h). Many European cities now have extensive *Tempo 30* zones (*Figure 1*). Graz in Austria has been a pioneer, with a blanket 30 km/h speed limit over much of the city. Only major roads allow higher speeds of 50 km/h or more. Sweden's "Vision Zero", which aims to eliminate road deaths and minimise the effects of the "foreseeable crashes" between pedestrians and motor vehicles, has prompted more Tempo 30 zones in that country.

Figure 1: Tempo 30 Zone in Vienna

Shared Space

(Or "Naked Streets")

The shared space approach to streets emerged in the 1990s, pioneered by the late Hans Monderman in towns across the northern region of the Netherlands. Sometimes called "naked streets", this approach is also seen as a second generation of traffic calming that has been spreading rapidly with trials underway in many countries.

Shared space completely overturns the idea that urban road safety depends on predictability and on clearly defining who

has the right of way (Hamilton-Baillie 2008). Shared space designs often remove most traffic lights, signs and kerbs. No particular user or movement has automatic right of way. This forces road users (car or truck drivers, bicycle users and pedestrians alike) to proceed cautiously and to negotiate their way forward, mostly through eye contact. Australian innovator, David Engwicht (2006), calls this "safety through intrigue and uncertainty". If this is difficult to imagine, then the videos at http://www.youtube.com/user/Sharedspace will help.

Low speeds are both a consequence of and a necessity for this social mode of negotiated motion. In high-speed traffic the human mind is not capable of negotiating with other road users through eye contact. We can only do this at or below about 30km/h. Both crash incidence and the probability of death or injury, even for pedestrians, are very low at these speeds (Shared Space project 2005). Trials have included main streets and intersections in town centres. Surprisingly, travel times hardly suffer because, although top speeds between junctions are much lower, there is much less stopping at intersections.

Even though shared space includes motor vehicles, they become very much part of the public realm at low speeds. Monderman made clear that shared space design is only for the parts of the network that can be designated as public realm. His vision of an expanded public realm includes many surprisingly busy streets. However, it does not include those major arterial roads on which high speeds remain important. These remain traffic space.

Accidental Shared Space

The informal emergence of shared space street dynamics can be seen when pedestrians and/or slow vehicles dominate a street space, leaving motorists little choice but to proceed on a negotiated and cautious basis. This is common in inner urban streets of many developing countries (*Figure 2*). It can be seen also on the narrow streets of Singapore's Little India area. Such "chaos" is of course widely lamented, with pedestrians and other road users blamed for indiscipline. Moreover, at times of low pedestrian activity, traffic speeds do rise and crash risk and severity can become very high. However, the imposition of traffic-focused design in such places would often be a mistake. A better option for these streets might be shared space by design rather than by accident.

Figure 2: An example of "accidental" shared space in Nanjing, China

Bicycle Boulevards/Slow Streets Network

Traffic-calmed "bicycle streets" on which bicycles have clear priority over motor vehicles are common in German cities, among others

(Pucher and Buehler 2008). A number of North American cities, notably Berkeley, California, have successfully used bicycle boulevards to enhance their network of safe, low-stress routes for bicycle users. Bicycles enjoy relatively uninterrupted journeys along these streets, whereas motor vehicles often face detours.

Multi-way Boulevards

Surprisingly, it is also possible to create public realm and local access functions on very busy roadways that move a large volume of fast-moving traffic. Multi-way boulevards are one way to do this. *The Boulevard Book* by Jacobs et al. (2002) highlights their potential and provides guidance on design. The trick this time is to create slow spaces at the edges.

Figure 3: Multi-way boulevard in Nanjing, China. The street space on the right (behind the bus shelter) allows pedestrians, cyclists and slow-moving vehicles making access to co-exist.

Figure 4: Multi-way boulevard in Vienna

Some of the most elegant and successful streets in the world, such as many of the avenues in Paris, are multi-way boulevards. They are typically grand streets that have a central zone that is primarily traffic space. Then there is a tree-lined landscaped zone with walkways. This wide median separates the main traffic lanes from a smaller roadway next to another footway and the building line (*Figures 3* and *4*). In the best boulevards, this side-access street forms the low-speed public realm where traffic, bicycles and pedestrians can share the space safely. The authors argue that well-designed multi-way boulevards, such as Avenue Montaigne in Paris or the Passeig de Gracia in Barcelona, have good safety records, and the traffic lanes work better than equivalent space on conventional roadways. Many countries in Asia, including India, China, Vietnam and Indonesia, also have a tradition of multi-way boulevards. Some, such as CG Road in Ahmedabad, already work well while others could benefit from an effort to ensure low traffic speeds in the service lanes in order to include these lanes and their adjacent medians as part of the public realm.

"Road Diets"

"Road diets" is another innovation that allows public realm to be created with minimal impact on the utility of traffic space. As you may guess from the name, arterial roads have their traffic lanes reduced (and sometimes narrowed). However, a centre turning lane or turning bays are added, often with medians and an expansion of pedestrian and cycling space as well. In many situations, all this can be done without a loss of vehicle capacity.

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Young People—The Future of Public Transport

Alessandra GORINI

Abstract

Public transport is one of the first tools a youngster uses to discover the world and to gain independence. Their first steps on public transport facilities often make them feel self-empowered. The role of public transport in young people's life is large, as is the presence and trust of youth in public transport organizations. Through its Youth Project, the UITP is committing itself in different ways to promote youth participation as a key to successful programming. The UITP Youth Project involves young people in relevant aspects of programming through the Youth Project Awards, and encourages dialogue between governments and youth groups through the Youth Parliaments. It also supports youth initiatives to build their organizational, advocacy and programming capacities, and provide opportunities for young people to voice their demands through collaboration with international organizations.

The UITP Youth Project

The youths have been one of the top priorities of the UITP General Secretariat since 2005. The UITP Youth Project recognizes the strong mutual links between public transport organizations and young people. It aims to bring public transport organizations to consider young people as essential for public transport, and to prepare young people to think of public transport as a critical component of their lives.

To promote active youth participation and leadership, we must first change the way adults perceive and deal with young people, as their capacities are often unrecognized or undervalued. At the same time, we must take into consideration their age and maturity levels as well as relevant cultural, gender and economic factors. This is exactly what the UITP has been doing through its Youth Project, committing itself in different ways to promote youth participation as a key to successful programming. The key elements of the Youth Project involve:

- Promoting projects for the youths, through the **Youth Project Awards**;
- Encouraging dialogue between governments and youth groups, through the **Youth Parliament**; and
- Supporting youth initiatives, building their organizational, advocacy and programming capacities, and providing opportunities for young people to voice their demands for education and other services through **Collaborations with International Organizations.**

Since the launch of the UITP Youth Project with the Youth Project Awards in 2005, and the UITP's 57th World Congress 2007 in Helsinki, the emphasis on youth participation has gained ground and acceptance with our members. Our members have been very supportive of all our initiatives through participation, organization of events, concrete proposals and communication. One important result is that more and more of our public transport operators are getting closer to their young customers, educating them to respect and take responsibility in the usage of public transport facilities, offering them cultural and artistic events, and involving them in promoting safety and security, and fighting vandalism.

Youth Project Awards

The first stage of the UITP Youth Project was marked by the creation of the Youth Project Awards.

The first edition of the Awards focused on public transport initiatives in favour of young people, preferably realized in collaboration with young citizens. The projects should contribute, directly or indirectly, to better mobility (including easy and affordable mobility for teenagers) and social integration for all.

Figure 1: Maquette of the Youth Project Award (2nd Edition)

Hence, the projects should combine public transport with values that are important for the young people, such as social interaction, conviviality, freedom, speed, adventure, pleasure and innovations; and with a direct link to core areas in the young people's lifestyles such as culture, education, leisure and first jobs. At the same time, the projects may also help fight road fatalities among young drivers, tomorrow's congestion, social exclusion, generation barriers and unemployment.

UITP received 40 projects covering wide-ranging issues, including educational and vocational training, cultural issues, environmental sustainability, safety and security, and social inclusion matters. The projects were detailed, concrete, modern and innovative. Each project demonstrated very visible results in terms of employment, safety and changing the behaviours of youths and the image of public transport. Projects such as Cuta International Youth Summit on Sustainable Urban Transportation, the Internship Project from Metro Sao Paulo and RATP's marketing campaign on Imagin'R card are just some examples of the incredible variety received. The Singapore Land Transport Authority won the first International UITP Youth Project Award in the category 'Improving Mobility of Young People' with an educational game developed in an immersive 3D environment.

The second edition of the Awards will focus on promoting public transport best practices in favour of youths. The winners will be presented with the Awards at the 58th UITP World Congress in Vienna in June 2009. *Figure 1* is a maquette of the Award.

Through the Youth Project Awards, participants and winners from all over the world have come to recognize UITP as a major actor in promoting changes in their professional lives, as well as the public transport operators, regulators and industry players for their value, efforts and activities in these directions.

Youth Parliament

Young people are heavily dependent on public transport. It is often their only way to reach school, working places, sports facilities and any other locations where they live and build their future. And through their views, we can predict how public transport will evolve.

Young people are heavily dependent on public transport … through their views, we can predict how public transport will evolve.

The UITP Youth Parliament initiative recognizes the distinctiveness of youth cultures and ideologies and advocates a participatory decision-making process for youth policies. The initiative aims to provide opportunities for young people's full participation in society and plans to set in place long-term strategic instruments that improve their social opportunities.

The idea of a Youth Parliament was first mooted at UITP's 57th World Congress in Helsinki. A small delegation from Helsinki University went on stage to comment on the Youth Project Award winners. From there, we decided to recreate similar sessions where young people were invited to participate in important UITP events all over the world and present their views on the subjects discussed during the events. After the events, they generally continued to be committed to public transport issues through the respective local UITP members.

Through the Youth Parliament, UITP reaches out to both organized and informal youth groups at private and public schools and universities, and young interns dealing with urban, environmental and public transport issues. It helps to create and improve spaces where ideas and experiences are shared, to tap on young people's creative potential and recognize its uniqueness. Youth participation is also essential to the development of successful programming.

With energy, ambition and belief in their own capabilities, young people can be powerful agents of positive changes. Including young people in issues that directly affect them contributes to their self-confidence while collaboration with adults who share some of their views reinforces their ideas and values. The experience of contributing to a cause, a decision or a group can play a crucial part in developing a sense of responsibility, purpose and self-worth in the young people. This can help prepare young people to exercise the rights and responsibilities of adulthood

With energy, ambition and belief in their own capabilities, young people can be powerful agents of positive changes.

and citizenship, and develop their sense of identity too.

Young people, aged 15 to 24, have been invited to join Youth Parliaments in the following cities from the UITP Regions: Helsinki, Karlsruhe, Guadalajara, Johannesburg, Vancouver, Milan, Istanbul, Taipei and Vienna. Each Parliament produced a report at the end of their sessions. These reports have been presented at the closing sessions of UITP events in these cities. *Figure 2* shows such a presentation by the Youth Parliament at the UITP Sustainable Development Conference in Milan.

Figure 2: Presentation by the Youth Parliament in Milan

At the World Congress, a global Youth Advisory Parliament comprising representatives from the nine Parliaments will give feedback on their UITP experience, and advise on the needs and wants of the youths for public transport. For the first time, they will share their ideas and communicate their common vision for the future. The Youth Advisory Parliament will also deliver the Final Worldwide Report, a comprehensive set of recommendations on public transport planning, policy-making and programming to decision makers at the Congress to secure the commitment of politicians on youth and public transport policies.

Collaboration with International Organizations

Today, half of the world's population is under the age of 25. This includes the largest ever generation of adolescents who are approaching adulthood in a rapidly changing world. And the number and proportion of urban young people is increasing dramatically. That is why one of the focus areas of the UITP Youth Project is to work in collaboration with international organizations and Non-Government Organizations (NGOs) worldwide, such as UNESCO and Youth Forums in Latin America and Canada.

The UITP Youth Project aims to valorize public spaces which shape youth cultures and identities.

Young people are the main creative force shaping our culture and the UITP Youth Project aims to valorize public spaces which shape youth cultures and identities. Public spaces have an intrinsic role in the development of our societies. They allow young people to exchange ideas and trigger their creative potential. They make it possible for youth cultures to express themselves outside the framework of the dominant culture. Public areas foster the generation of symbols, rituals and practices that form the foundation of our culture. Improving existing public areas and creating new ones allow young people to build their identity as they reconcile their personal ideas with those shared by their peers.

We must therefore recognize the need for youths to access democratic arenas. Substituting public spaces with private and commercial areas will reduce places where people can meet without any commercial purpose.

The UITP, in partnership with UNESCO, will launch a project in 2009 to respond to the needs of young people in relation to the availability and quality of public spaces, and to understand the role of public transport in providing and improving public spaces for the young people. Together with UITP members, the project has planned a series of activities to highlight places like underground stations and bus stop areas as places where young people can feel free to gather spontaneously, to exchange ideas and socialize openly in a safe and secure environment, not places where people aggregate for anti-social behaviour. Through these activities, we aim to keep public spaces alive for our young people.

Online Public Transport and Youth Guide

There are thousands and thousands of publications available today on the topic of youths, but not many of them are really useful for public transport operators, industry players and authorities. Moreover, the number of these publications is so huge that it would be difficult to choose the right one. Hence UITP will be publishing an online Public Transport and Youth Guide which will consolidate its past initiatives and future plans. This online guide will serve as a key resource for all the public transport actors who want to know more on the subject.

The online Public Transport and Youth Guide will be launched at UITP's 58th World Congress in June 2009 and will be available on the UITP website thereafter. It will contain all the reports from the Regional Youth Parliaments, and all winning projects from the two editions of the Youth Project Awards. In addition, ongoing activities with UNESCO and other NGOs and all the principal youth forums and organizations in the world will also be included.

Through this guide, UITP aims to let the public transport industry have a better view of youth issues, suggest ways to penetrate youth spaces to interact more with them and tap on their energy to provoke changes.

Conclusion

The UITP Youth Project is fundamental to building interventions and spreading the message to promote public transport, to broaden and raise awareness, stimulate interest and encourage the growth of new initiatives. More than that, it has an active role in youth's development. The young people are not only the future, they are already the present. We have to act decisively to influence their educational paths as only by doing this will we change their attitude towards public transport.

Alessandra Gorini was born in Rome where she took a PhD in Biology and became a scientific journalist for the Italian Broadcasting Channel (RAI). She has been responsible for the communication sector in scientific organizations such as World Wildlife Fund (WWF) and Greenpeace. Ms Gorini entered the world of public transport in 1997, and was seconded from the Public Transport Company of Rome, ATAC, to the European UITP department as expert of events and communication. After a few years there, she joined UITP as International Relations and President Programme Manager. She is managing and coordinating the UITP Youth Project and dealing with Advocacy at UITP.

Turning Heads—To Land Transport

Rosina HOWE and Tammie LOKE

Abstract

Today's young users of land transport will "own" both the public transport system and the road network tomorrow. For this group to invest their hearts and minds in shaping our future transport system, they need to understand the significance and trade-offs of their transport options. Yet catching young people's attention amid the many distractions and media outlets is a challenge. This paper looks at how the Land Transport Authority (LTA) of Singapore used a variety of innovative platforms to capture the attention and involvement of the younger generation on land transport issues.

Introduction

Cities around the world are examining how to meet exploding transport needs and one thing is clear—getting people to understand the need to rely more on public transport and less on private cars will be critical. Smart planners, policymakers and communicators know that a pivotal audience is young travellers.

Put simply, today's young are forming opinions about their lifestyles. Owning a car is a common aspiration among young people, yet convincing them that public transport can meet most of their needs will be essential for the well-being of most cities. Those who do choose to drive need to understand the broader environmental implications and responsibilities of car ownership.

LTA has been actively engaging the younger generation through various channels to ensure that the transport system will cater to their needs and aspirations, now and into the future.

Competing Creativity

In 2004, a group of young LTA officers was tasked to create a programme that would engage youth. The organizers asked the students to envision Singapore's future and then share their ideas and insights on how land transport could evolve to fit Singapore's needs. The students were invited to put their visions and ideas in the form of an essay, in what would become the annual "LTA Book Prize."

Smart planners, policymakers and communicators know that a pivotal audience is young travellers.

LTA's objective was to view land transport through young people's eyes, and in doing so, consider the possible impact of LTA's services

"It is a very good experience for our students to be given an opportunity to participate in this competition and to have come so far." - Richard Seow *(Lecturer, Temasek Polytechnic, 2008 Winner)*

"[I became more] familiar with transport issues and LTA, juggling with different variables to arrive at a best solution…" Galven Lee *(Hwa Chong Institution, 2007 winner)*

"I did not know LTA had staff who are super cool! It was an eye opener to explore places in Singapore…" Faris Basharahil *(Temesek Polytechnic, 2007 Winner)*

"I learnt about what LTA does for its community and a lot of my misconceptions were erased…" Andrea Taryn Baker *(Catholic Junior College , 2004 winner)*

and operations upon the broader community. At the same time, LTA hoped that the students would not only gain a better understanding of the complexity of building a land transport system to meet the needs of a diverse population, but also ignite their interest in land transport planning, development and management.

Over the years, the LTA Book Prize increased its outreach from junior colleges to polytechnics and international schools. Students rose to the challenge—short-listed candidates serenaded judges with original songs, skits and poems to get their ideas across. All winners were awarded cash prizes and invited to a 10-week apprenticeship with LTA.

In 2007, the competition included an "Amazing Race" component. The finalists teamed up with LTA staff and travelled around the island to investigate and analyse real-life land transport challenges, such as traffic noise and road safety concerns for the visually impaired, and proposed solutions to LTA's senior management.

In 2008, LTA revamped the essay competition to take advantage of growing interest in online networking. Students were asked to work in teams to design a social networking website to encourage idea-sharing on land transport based on LTA's newly-launched Land Transport Masterplan: A People-Centred Land Transport System (the full report may be viewed online at *http://www.lta.gov.sg/ltmp/*). The top winners of the competition produced creative networking ideas.

The Alien has Landed…

Possibly the most colourful spin-off to date from the LTA Book Prize is an e-game for primary school students, conceived by winners of the 2004 prize. Recognising that young students may find studying government policies and traffic regulations rather dry, LTA embraced the proposal to develop an e-game to inject education into entertainment and equip the young students with a relevant working knowledge of land transport. The result: edutainment.

In recognition of LTA's 10th anniversary, the new game was called VR-10 ("we are 10"). VR-10 is embodied in a small green space alien who lands in Singapore on his spaceship (*Figure 1*). Bits of his spaceship fly off during landing. To return home, VR-10 must use public transport to find the missing bits. In the process, VR-10 picks up interesting and little-known facts about Singapore's land transport system, as well as safety tips when using the road and rail networks.

Figure 1: VR-10 with an ez-link card in hand to travel on public transport

VR-10 enjoyed overwhelming interest from the public, particularly students, parents and education officers. The e-game received the Minister's Innovation Merit Award 2006 from Singapore's Ministry of Transport, and was showcased at various events, including the World Cyber Games 2006 Asian Championship. In 2007, VR-10 clinched the coveted International Association of Public Transport (UITP) Youth Project Award Grand Public Prize in the category "Improving Mobility of Young People" at the 57th UITP World Congress in Helsinki, Finland.

LTA launched the sequel "VR-10 Returns" in 2008 with more characters and greater interactivity. This new edition e-game goes beyond learning about land transport to promoting greater civic consciousness and good commuter behaviour. Besides the CD-ROM edition distributed to schools and libraries, the game can also be downloaded from *www.vr-10.com*.

More on the Web…

If I were the Transport Minister

The overwhelming interest in VR-10 spurred LTA to further leverage on new media as an effective and interesting channel to engage younger audiences. In 2007, when the Ministry of Transport and the LTA undertook a year-long land transport review that culminated in the launch of the Land Transport Masterplan, LTA developed an online game, "The Great Transport Challenge 2020—If I Were the Transport Minister." The game was designed not only to help the younger generation become aware of the land transport review, but also to help them understand that land transport policy planning is about making choices and understanding the trade-offs at work.

In the game, participants learn about using different strategies to achieve desired outcomes e.g. do you use more traffic management techniques on existing roads, or build more roads (probably underground and more costly) and consider tolls to pay for them? The game is not a win or lose proposition. It produces a scenario that might result from the series of choices that the

"Minister for the Day" makes: ranging from a congested and unlivable city, to a clean and mobile metropolis.

Public transport security website for students

Enlisting young commuters in public transport security may seem obvious given the amount of time that they spend on the network, but getting them to think about it in the first place is a bigger challenge. LTA, in collaboration with other government agencies and the public transport operators, will be launching a website to address this need for greater awareness and vigilance.

The website will encourage students to learn about public transport security, such as counter-terrorism measures taken to secure public transport infrastructure and make journeys safe and, what to do when suspicious-looking persons or articles are spotted on public transport or when there is an emergency. LTA held focus group discussions with school teachers and students to learn more about students' interests so that the website would be captivating to the young audience and allow them to relate easily to the information. The outcome is a website where public transport security awareness is reinforced through animation, interactive multi-media games and regular contests related to public transport security.

A Gallery that Exhibits….

LTA opened its Land Transport Gallery in January 2008 with multi-media and interactive exhibits tracing Singapore's land transport progression from 1945 through the present day and into the future.

The Gallery has since become a key learning platform for students of all ages who visit LTA. It is a popular stop under the Ministry of Education's "Learning Journeys" programme, which sees students visit key national institutions and heritage sites in Singapore to learn about subject matter beyond their textbooks. LTA has a dedicated team of officers to host such visits and devises programmes and projects to engage younger citizens. For older students, a visit to the Gallery is followed by a discussion on land transport matters and how they affect everyone.

…the Art that Left the Gallery

When LTA built the North East Line (NEL)[1], it made a visible commitment to making sure the journey was pleasant—in each of the line's 16 stations, the commuter will find "integrated art" or, as LTA calls it, "Art in Transit." Artwork of different media and genres decorates each station uniquely, bringing to life the history and culture of the neighbourhood it serves. Nothing quite so vividly expresses the idea that the journey is more than just getting from one point to the next. Art in Transit is now an integral part in the design of all rail stations.

Nothing quite so vividly expresses the idea that the journey is more than just getting from one point to the next.

LTA has further teamed up with Art Outreach[2] to offer the Art in Transit Walking Tour. The two-hour tour brings students, young professionals,

and anyone keen to get a unique view of the rail line to the artwork in the NEL stations. Through the tour, visitors get a glimpse into Singapore's rich, diverse cultural fabric and the artists' take on the neighbourhoods and their inhabitants, plus stories of how various considerations (*e.g.* area flooding and emergency shelter needs) influenced the design of the station. *Figure 2* shows participants at the Art in Transit Walking Tour learning about the artwork.

Figure 2: Art in Transit Walking Tour

Art Outreach also includes in its classroom portfolios an entire segment on the NEL integrated art. The school children love the idea that they can commute and appreciate art all at the same time. And they like that someone had the idea to make their train ride pretty.

Coming to a School Near You

To reach out to more students, LTA heads out to meet its young audience on their main turf: at school. It brings a roving exhibition to secondary schools to showcase the Land Transport Masterplan and the thinking behind it. The exhibition's appealing illustrations and interactive games usually pique students' interest enough to whet their appetites for more. This often leads to subsequent visits to LTA's Land Transport Gallery as an extension of the learning journey.

KPE Underground

Reaching out to communities around major land transport infrastructure projects has been a core element of LTA's public communications planning. Recent efforts to further ramp up the engagement, especially to get the attention of the younger audience, included walks/runs, promotions and outdoor events helmed by popular radio DJs.

The recent opening of Singapore's longest underground expressway, the Kallang-Paya Lebar Expressway (KPE), demonstrated the creative use of both new and traditional media to "stir up" the appeal and reach of an otherwise mundane road safety programme. The primary task of the KPE public education programme was to ensure that motorists know how to use the 12-km long KPE safely.

LTA decided that radio would be the best channel to reach the motoring public. Moreover, radio had the capacity to pull in younger listeners too with music. Music and radio make fine partners and became the cornerstone of the public education programme.

KPE Underground Radio—a 30-minute radio show over a one-week period—was launched to talk to the public, especially motorists, about the KPE and how to drive safely on it. To drive home safety messages, LTA cut an album titled "Sounds of the Underground" that featured prominent local artistes with songs such as "Turn on the Radio", "Don't Overtake" and "Look at the Signs". The songs were played during morning drive-time on the KPE Underground Radio.

Figure 3: Advertising the KPE Underground Radio

Urban graphic art and edgy stylized photography could be seen on LTA's construction hoardings and public places, such as underground linkways, serving as teasers to "advertise" the KPE Underground Radio (*Figure 3*). These elements came together to create the "KPE Underground" public education programme, clever word play alluding to the unknown programme to come and the literal location of the KPE.

For the younger and web-savvy motorists with a preference for new media, LTA also launched a KPE web portal (*http://www.lta.gov.sg/kpe/*). The portal took on a refreshing design distinct from usual government websites. It was designed to be thorough, informative, easy to update and appealing. This portal would be pivotal in drawing hits over time and at full launch in September 2008 received more than 3 million hits in the first month.

Figure 4: Tunnel Discovery programme for school children

New and old media aside, bringing people into the tunnel before it opened had an obvious and long-lasting impact. Prior to the first phase opening of the KPE in October 2007, LTA developed a "Tunnel Discovery" programme for school children (*Figure 4*). The children visited the tunnel, met the people involved in the project and learnt about the unusual challenges faced by the team, such as dealing with soil the consistency of

"toothpaste", snaking the tunnel between tall apartment buildings, safely moving canals and going under a river.

To give youths an opportunity to leave their mark on a significant land transport infrastructure, LTA held a Mural Design Competition for neighbourhood schools along the KPE. The designs of 18 finalists now decorate the tunnel's escape staircase housings that dot the streets in those neighbourhoods.

Conclusion

Tapping on the outlook and formative ideas of the younger generation is an essential component of a public education programme on land transport. To succeed in getting this energetic audience's attention, events and programming need to be geared to their schedules, interests and motivations using the channels of communication they use. Doing this successfully will go a long way in keeping our major cities on the move.

Notes

1. The North East Line is a 16-station rail line that starts at the northeast perimeter of Singapore and heads straight to the central business district. It is 20km long and is Singapore's first fully underground, driverless rail system.

2. Art Outreach is a not-for-profit organization that teaches art appreciation in local schools, using art as a platform to discuss everything from history to current events.

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Tammie Loke is the Group Director of the Corporate Communications Group in the Land Transport Authority of Singapore. Under her leadership, LTA has invigorated its public education and community outreach efforts through media relations, marketing and various consultation programmes. She leads the organization's ongoing public communication of LTA's policies and projects outlined in the Land Transport Masterplan. Ms Loke firmly believes that building working partnerships with LTA's many stakeholders helps the LTA to address commuters' rising expectations, increasing construction challenges and complex policy decisions. Reaching out to today's young, who are tomorrow's owners of the land transport network, is especially critical to creating greater understanding of the many issues confronting transport development in Singapore.

LTA ACADEMY
SINGAPORE

The LTA Academy was launched in September 2006 by the Singapore Land Transport Authority. The Academy aims to be a global knowledge hub in urban transport. It serves as a one-stop focal point for government officials and professionals around the world to tap on Singapore's know-how and exchange international best practices in urban transport management and development.

JOURNEYS is a biannual publication of the Academy. It provides a platform for the Academy to showcase and share urban transport trends, policies, technologies and challenges in different cities. It is also one of the key resources to complement and enhance the learning experience of participants at the Academy's programmes.

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