Designing tomorrow’s transport systems: The importance of understanding what consumers want

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Build, but what if they don’t come?
Average demand elasticities for pay-as-you-go and unlimited bundled MaaS schemes, as a function of access to different transport modes.
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Average taxi license transfer prices in Sydney
Newcastle Transport to trial new Lake Macquarie "on-demand" timetabling service in off-peak hours

ON DEMAND: Kelvin's Downer buses will trial a new service in Lake Macquarie in 2018.

Driverless shuttle and 'smart bus stop' trial launches in SA

Adelaide fast becoming Australia's autonomous vehicle city
Existing fixed route fixed schedule bus services

25% – 30%  Current cost recovery factors

50% – 60%  Labour costs as a proportion of total costs

50% – 75%  Potential cost recovery from autonomous bus services
If the vehicle can drive itself, the operator can stop minimizing operating costs and start maximizing level-of-service.
Join a road train
A safe and energy-efficient way to travel

The road train system makes it possible for the driver to work on his or her laptop, read a book or watch a film.

The lead vehicle, for instance a bus, is driven by a professional driver. In this system, the lead vehicle takes over all the following vehicles via wireless radio communication.

The system is built into the cars and does not require any extended infrastructure along the existing road network.

As they approach their destination, drivers take over control of their own vehicles, leave the road train by pulling out to the side and then continue on their own to their destination.

The other vehicles in the queue close the gap and continue together on their journey to the location where the road train separates once again into its individual vehicles.

Drivers who want to join a road train state their destination and are guided by their on-board navigation system to the nearest road train. The car joins the rear of the queue and the system takes over control of the car.

From Project SARTRE (Safe Road Trains for the Environment), funded by the European Commission
Throughput of different transport modes and services

<table>
<thead>
<tr>
<th>Mode</th>
<th>Throughput per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorways with human-driven vehicles</td>
<td>1800</td>
</tr>
<tr>
<td>Motorways with connected and autonomous vehicles*</td>
<td>3250</td>
</tr>
<tr>
<td>Sydney’s light rail system</td>
<td>6750</td>
</tr>
</tbody>
</table>

Should cities be building light rail systems that have obvious benefits in the short-term, but will likely be obsolete much before their planned expiration periods?
Example screenshot of hypothetical stated preference (SP) scenario to elicit consumer preferences for different ODT services
<table>
<thead>
<tr>
<th>ODT service</th>
<th>Predicted usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.30 per km (comparable to shared electric autonomous cars); no sharing; real time booking; and door-to-door service</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>11%</td>
</tr>
</tbody>
</table>

Predicted usage rates for shared electric autonomous cars
“The optimists see a world where parking spaces are beaten into plowshares, the carnage from car crashes is eliminated, where greenhouse gas emissions fall sharply and where the young, the old and the infirm, those who can’t drive have easy access to door-to-door transit. The pessimists visualize a kind of exurban dystopia with mass unemployment for those who now make their living driving vehicles, and where cheap and comfortable autonomous vehicles facilitate a new wave of population decentralization and sprawl.”

Joe Cortright, from “The price of autonomous cars: why it matters”
Flow of naturalistic experiment to measure consumer behaviour in the presence of fully autonomous cars, from “Projecting travelers into a world of self-driving vehicles: estimating travel behavior implications via a naturalistic experiment”, by Mustapha Harb, Yu Xiao, Giovanni Circella, Patricia L. Mokhtarian, and Joan L. Walker.
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Household vehicle kilometres travelled (VKT) increased by 83% across the sample!
Technology alone cannot be the solution
From “Reduce growth rate of light-duty vehicle travel to meet 2050 global climate goals” by Jalel Sager, Joshua S Apte, Derek M Lemoine and Daniel M Kammen
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And sometimes technology is the problem
Remember how shared mobility services were supposed to offer a sustainable solution to private car ownership?

After people start using rideshare services like Uber and Lyft, they are 6 percent less likely to ride the bus and 3 percent less likely to ride light rail.

Between 49 percent to 61 percent of ride-hailing trips would have been made by public transport, biking, or walking, or would not have been made at all, if the services were not available.

We spend millions on technology, but hardly anything on understanding what consumers want, or how they are likely to respond.

“The stakes are too high to believe the promises of new mobility technologies without extensive research that goes beyond the technical, regulatory and commercial. Researchers and policy-makers need to treat any significant technological change as a ‘socio-technical’ change that alters daily practices and functioning... Our transport systems, as well as our cities, must be planned for people — not for a particular mode of transport or by a handful of companies with vast lobbying power.”

From “Six research routes to steer transport policy”, by Eric Bruun and Moshe Givoni
What about big data and machine learning?
Big data and machine learning can be very powerful for short-term predictions, where the prediction context is expected to be very similar to the observed context.
Per capita car use in Australia over time
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Per capita car use in Australia over time
Predicted per capita car traffic volume in North America, from “The future mobility of the world population” by Andreas Schafer and David G. Victor, published in April 2000
There are too many sources of uncertainty - cannot trust that past behaviours will be good predictors of future behaviours
Concluding remarks

1. Cannot understate the importance of understanding what consumers want, and how they are likely to respond to new transport technologies and services

2. Technology alone cannot be the solution; sometimes technology is the problem

3. Big data and machine learning can be powerful for short-term operational planning, but any form of long-term strategic planning will necessarily require human input