Thinking Outside the Box

2024 Thought Pieces

The Institute of Transport and Logistics Studies (ITLS) at the University of Sydney Business School in 2015 started a commentary series, adding it to its portfolio of engagement with the broader community of interests in the space of Infrastructure, Transport, Logistics and Supply Chain Management.

While academic publications and reports are a very important outlet for high quality research including debates on themes with a rich policy and strategic value beyond theory, methods and evidence, there is room for a series of short pungent commentaries on themes that are of broad community interest. These are short pieces so they can be digested through the many social media platforms and focus on topics of currency that are also likely to be challenging and controversial – hence the titling of the series 'Thinking Outside the Box'. It has all the elements of critical thinking and the 'challenge of change'.

Each piece is published monthly since April 2015, but we thought it would be useful to bring all of the 2024 contributions together into a monograph that is freely available. We hope it will be useful to researchers, consultants, government and industry agencies and associations as well as in the classroom for debate and discussion.

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Founding Director, ITLS

Thinking outside the Box Series

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Our Projects

Our research projects contribute to the design, improvement and optimisation of infrastructure, transport, logistics and supply chain initiatives around the world. Our experts are investigating a range of pertinent issues including the implications of Working from Home, Sustainable Transport Futures and MaaS. We are also regularly being called upon for media comments. You can view all this work and more on our **research projects page**.

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1. Autonomous Vehicles: Friend or Foe (or both)?

8 January 2024

Abdullah Zareh Andaryana, Michael Bell, and Mohsen Ramezani provide an overview and critique of autonomous vehicles.

The advancement of mobile information technologies, coupled with connected sensors, actuators, and the Internet of Things (IoT), holds promise for the development of smart infrastructure and services in future cities. These advancements are leading to the emergence of autonomous vehicles (AVs) or self-driving cars, sparking speculation about how these technologies could benefit future transportation by creating safer and less congested roads. Within this future transport landscape, autonomous lockers could navigate footpaths alongside or among pedestrians, fulfilling their role as efficient parcel delivery systems [1]. Meanwhile, autonomous shopping trolleys could independently move around shopping centers, returning to their designated locations after shoppers have finished with them [2]. This harmonious interaction between humans and mobile robots offers an enticing vision for future cities [3].

Read more: **We must plan the driverless city to avoid being hostage to the technology revolution** [4].

However, alongside the excitement and promise, the vision of a smart city with AVs in the future (perhaps not so distant) raises questions regarding how transportation systems consisting of a mixture of humans, human-driven vehicles, and mobile robots will be managed, particularly in spaces where their paths cross.

Read more: **Self-driving cars are coming – but are we ready?** [5]

The interactions between AVs and vulnerable road users, such as pedestrians and cyclists, in "shared spaces" are of particular concern. These enjoyed a period of popularity in many cities as a way of both making better use of scarce street space and taming drivers by forcing them to slow to a little more than walking speed [6]. While significant progress has been made in autonomous vehicle technology, there is still substantial development required before these vehicles can merge seamlessly into regular traffic.

As self-driving vehicles will coexist with vulnerable users on many roads, and not just in shared spaces, there is a need for a social consensus as to which vehicles should have priority when paths cross and under what circumstances. This becomes more challenging, especially in the central areas of cities with prevalent shared spaces because of the density of vehicles, pedestrians, and cyclists. AVs are carefully designed to operate flawlessly, both by avoiding mistakes themselves and compensating for the occasional errors and misjudgements made by fallible humans. But what happens when humans realize they can exploit this programmed reliability by deliberately stepping in front of self-driving cars, causing traffic to grind to a halt? In a densely populated urban landscape, this realization could lead to safety-aware AVs getting trapped in gridlock while humans enjoy unfettered movement [7].

Read more: **Nothing to fear? How humans (and other intelligent animals) might ruin the autonomous vehicle utopia** [8]

Alternatively, AVs may learn by experience that they can intimidate and dominate vulnerable road users and take priority where their paths cross. There has been much concern in the media [9] of late about the threat of AI and AVs learning to behave aggressively in the presence of vulnerable road users could be a manifestation of this. Any form of aggression raises profound ethical and moral issues, which can only be resolved by a clear understanding of what constitutes

"acceptable behaviour." Eventually "acceptable behaviour" will need to be codified into new rules of the road. Perhaps one way to ensure good behaviour from autonomous vehicles is to subject them to a driving test, just as we do with human drivers, as being investigated in the current European Horizon Research Project "i4driving" [9].

Read more: **Driverless cars might follow the rules of the road, but what about the language of driving?** [10]

Addressing these multifaceted behavioural factors presents a significant challenge to the successful integration of autonomous vehicles into our transportation systems. Understanding the complex dynamics between humans and self-driving technology will be instrumental to establishing a harmonious coexistence on roads. Neglecting these crucial aspects puts autonomous vehicles at risk of eventual exclusion from areas where they would come into contact with vulnerable road users, preventing society from benefiting from their full potential.

In current research funded by the Australian Research Council at Sydney University, the issue of how to tame the behaviour of AVs through the concept of "micro pricing" is being investigated. The idea is that AVs should be programmed to take into account the costs imposed on others when deciding whether or not to yield if paths cross, without of course compromising safety. For this to work in practice, however, there will be a need for a social consensus as to what should take priority, and this social consensus will need to be incorporated into the rules of the road. Ultimately, priority is a political decision, but one basis for assigning priority, setting the emergency services aside, might be the head count. For example, an AV carrying (non-urgent) freight might be expected to yield to a pedestrian whereas a pedestrian might be expected to yield to a driverless bus carrying many passengers. In the realm of autonomous vehicles, the challenge of taming traffic invites us to consider a fundamental question: How do we design AI systems that not only navigate roads but also integrate seamlessly into the interconnected transportation ecosystem and societal norms?

References

1. South China Morning Post. **Jd.com rolls out fleet of autonomous delivery vans as online shopping giants embrace unmanned operations**. 22 Oct, 2022. Accessed: 4 Jul 2023.
2. i24NEWS English. **Israeli cust2mate launches smart shopping cart**,2022. Accessed: 4 Jul, 2023.
3. Mateja Kovacic. **Robot cities: three urban prototypes for future living.** 10 Apr, 2017. Accessed: 4 Jul 2023.
4. Crystal Legacy John Stone, Carey Curtis and Jan Scheurer. **We must plan the driverless city to avoid being hostage to the technology revolution.** 28 Apr, 2017. Accessed: 4 Jul 2023.
5. Johanna Zmud and Paul Carlson. **Self-driving cars are coming – but are we ready?** 27 Jul, 2017. Accessed: 4 Jul 2023.
6. **Transport for NSW. Speed zones.** 2023. Accessed: 4 Jul 2023.
7. Emily Sunman and Nial O'Brien. **If avs are safer, why aren't we accelerating?** 30 Aug 2022. Accessed: 4 Jul 2023.
8. NBC News. **Ai risks leading humanity to 'extinction,' experts warn.** 31 May 2023. Accessed: 4 Jul 2023.
9. Panteia company. **Integrated 4d driver modelling under uncertainty.** 1 Oct, 2022. Accessed: 4 Jul 2023.
10. Abdesalam Soudi. **Driverless cars might follow the rules of the road, but what about the language of driving.** 8 Jan, 2018. Accessed: 4 Jul 2023.

2. How value adding is AI for strategic transport planning? Is AI Intelligent or simply a descriptive information dump?

5 February 2024

Professor David Hensher reflects on the use of artificial intelligence (AI), particularly generative-AI (G-AI), in strategic transport planning, discussing its adaptability to diverse and unpredictable future scenarios, highlighting concerns about the limitations of G-AI in predicting situations with high divergence and emphasizing the need for utilizing hidden data not captured by AI.

Twenty-five years ago, I wrote a paper (Hensher and Ton (2000)) to compare machine learning algorithms associated with neural networks with the behaviourally more appealing (less black boxy) discrete choice models. At the time, the curiosity was with how much better or worse machine learning with its training algorithms could improve on the predictive performance of a simple multinomial logit choice model. At that time, we were unaware of the pending explosion of interest in machine learning as megabytes of data became available, and what is now known as artificial intelligence (AI) and generative-AI (G-AI). G-AI models use neural networks to identify the patterns and structures within existing data to generate new and original content, something we did for many years under the name of classification and regression trees (CARTS; Breiman et al. 1984)[2], albeit with smaller data sets. One of the innovations with G-AI models is the ability to leverage different learning approaches, including unsupervised or semi-supervised learning for training. In discussing the explosion of interest in AI and G-AI, I want to be clear that I am not on a warpath but rather a search for the 'available opportunity'.

I thought I would revisit the meaning of 'artificial' and of 'intelligence' and see if we are describing this new tool appropriately. According to the Cambridge dictionary[3], the word artificial refers to something that is 'made by **people**, often as a **copy** of something **natural**.' The word intelligence refers to the ability to think, to learn from experience, to solve problems, and to adapt to new situations; although in recent times it has been interpreted as involving mental abilities such as logic, reasoning, problem-solving, and planning.

While AI can claim to be aligned quite well with these meanings, there is one thematic that remains concerning, namely 'to adapt to new situations.' One wonders whether this is only possible where the new situation is a small variation around current or past behaviour, given that G-AI models learn the patterns and structure of their input training data and then generate new data that has *similar characteristics* (my emphasis) and possibly repetitive in nature. Take a future where, for example, we have 100% electric cars, and active travel and micro-mobility are a dominant transport mode, which is a non-marginal variation on the past and today. How well can AI or G-AI predict this circumstance (in contrast to a human-devised scenario unless this is already in the available data, and which might also be questionable) based on trolling the existing data bases and rules on offer? If expectations of the future are widely divergent, however, one might consider 'tuning' AI (over a mass of data) to discern the most probable future at an earlier stage than might be achieved by any other methodology. One appealing ingredient (found in the trolling exercise if in the public domain) could be the many studies that have undertaken a form of stated preference study to explore behavioural intentions under future scenarios that test for 100% electric cars, and active travel and micro-mobility. One doubts, however, whether this is enough to give us confidence in the future circumstance?[4] Indeed, a great deal of potentially very useful data (e.g., unit records on individuals' travel behaviour) is never released into the public domain[5]. Such 'hidden from AI captured' data is indeed what transport planners should be using in informing now, the near future, and possibly the distant future. Sadly, in a situation where there is high divergence across the likely future scenarios,

while G-AI is likely to be of little use, that limitation applies to most other forecasting methods as well.

An important question is: 'can we'/'how can we' derive benefit from this new, AI tool? Being optimistic, if you applied AI to a mass of behavioural observation data, you might be able to detect patterns of decision making that would rival, or even surpass other analytical analysis. Once discerned, those patterns of decision making can be fed back into policy sphere and so nudge the process a little bit to the left or right hopefully towards a better societal outcome.

We have, I believe, a real dilemma, described brilliantly by Anable and Goodwin (2021) in the context of de-carbonising transport where they see it like shot silk. The warp (blue) relates to still being able to use our cars, because they will be electric; we will still be able to fly away on holiday, using non-carbon fuel, and technology will give us a timely transition. The weft (green) is the potential for significant traffic reduction including a substantial mode shift to walking, cycling and public transport, increasing car occupancy overall, and embedding transport de-carbonisation principles in spatial planning to ensure that new development promotes sustainable travel choices. The challenge, however, is that only one colour is typically seen, depending on where the viewer is standing. This behavioural positioning seems to me to be a problem for G-AI since the data in place and training tools may be challenged beyond the ability to take on board this situation and do anything materially useful with it.

So, the real question becomes – 'how much can we depend on the outputs of AI and G-AI to guide us in making decisions on our future' and replace traditional sources of data such as household surveys? There has been a lot of scope creep, particularly with AI attempting to get into more behavioural areas of research, when it works best more in the automation and perhaps non-behavioural aspects of performance[6].

It appears to me that this is equivalent to the view of experienced transport modellers that 'models are a useful guide to contribute to the debate that ultimately will be dependent on many other soft as well as political factors.' Time will tell, but I suspect we (or at least many) are at the 'love affair' phase with AI, and in time, it will be placed in context as a useful but not so dominant part of the puzzle on life. Could G-AI then become nothing more than a source of information ambiguity and/or an intelligent agnostic for strategic transport planning and policy decision making?

References

Anable, J and Goodwin, P (2021) ***Two Futures: Transport Policy, Planning and Appraisal for the New Climate Reality***. (Forthcoming).

Breiman, L., Friedman, J.H., Olshen, R.H. and Stone, C.H. (1984) *Classification and Regression Trees*, Chapman and Hall/CRC, imprint of Taylor and Francis Group, Baton and Roca.

Hensher, D.A. and Ton, T. (2000) A predictive assessment of neural networks and discrete choice methods. (Presented at 8th WCTR, Antwerp, July 1998) *Transportation Research Part E*, 36 (3), September, 155-172.

Footnotes

1. The focus of this opinions piece is on strategic travel model systems. If you have a connected autonomous vehicle (CAV), then AI inputs make better sense. Discussions and comments by Ian Christenson, CEO iMOVE, are appreciated.
2. Use of trees in regression dates back to the AID (Automatic Interaction Detection) program developed at the Institute for Social Research, University of Michigan, by Morgan and Sonquist in the early 1960s. The ancestor classification program is THAID, developed at the institute in the early 1970s by Morgan and Messenger.
3. https://dictionary.cambridge.org/dictionary/english/artificial
4. We have had several episodes recently when the future initially appears to comprise binary options, but subsequent reality displays a much more nuanced and combinatorial approach. Examples include AV's will take over the world, office work is dead, net zero by '20anything', and domination or demise of private passenger vehicles. I thank Ian Christensen for this insight.
5. Unlike traffic data, which is rich with data, and typically repetitive in nature.
6. I thank John Rose for this insight.

3. Making cost-benefit analysis more relevant when reducing social exclusion matters

4 March 2024

Professor John Stanley explores the recent shift in land use transport (LUT) policy priorities towards reducing social exclusion, highlighting the challenge in cost-benefit analysis (CBA) of monetising societal benefits.

A higher priority for reducing exclusion

The last decade has seen a striking change in the land use transport (LUT) policy priorities being pursued by many jurisdictions. From a situation where economic outcomes long reigned supreme, much greater emphasis is now being placed on

- cutting greenhouse gas emissions to levels more in line with keeping global temperature rise below 2°C and
- ensuring that all residents have more equitable access to the benefits of living in their city/region.

The language of 'reducing social exclusion', or 'increasing social inclusion', is often used to describe the second direction.

London, Malmö, Manchester, Melbourne, Singapore and Vancouver, for example, prioritise *reducing social exclusion*, as does Scotland, and *increasing social inclusion* is a focus of United Nations Sustainable Development Goals 8, 10, 11 and 16 (UNDESA, 2023) and is central to the European Social Model (Eurofound, 2023).

Burchardt et al. (2002, p. 30) developed a widely used definition of social exclusion: 'An individual is socially excluded if he or she does not participate in key activities of the society in which he or she lives". This essentially sees social exclusion as '… the end result of a set of processes that prevent people from participating in different forms of economic, social and political activity' (Saunders, 2011, p.12).

The social goal evaluation gap

A major challenge for those seeking ways that LUT policy and planning can reduce social exclusion, informed by cost benefit analysis (CBA) of alternative options, is the lack of a means of monetising the societal benefits from reduced social exclusion. Thus, while transport CBAs have long valued travel time savings for car drivers in dollar terms, they do not have comparable values for the societal benefits from reducing social exclusion. This evaluation gap can only serve to entrench exclusion.

Closing the gap

ITLS researchers, and colleagues from The University of Melbourne, have been working for some time on closing the CBA evaluation gap confronting initiatives intended to reduce social exclusion (Stanley et al., 2011, 2021, 2022a, b). Drawing inspiration from studies that used trade-off settings to value travel time savings, the team has identified *trade-off settings* from which monetised values of several LUT policy-relevant factors thought likely to influence social exclusion can be inferred.

Those policy-relevant variables are trips (as a measure of mobility), bridging and bonding social capital, sense of community, three conceptions of wellbeing and area socio-economic disadvantage. A range of personal characteristics were also identified as likely to influence someone's risk of exclusion, such as age, household income, abilities, household circumstances (e.g., presence of children), personality, etc.

The research shows that an additional trip is worth around A$22.75 (2019 prices), based on the contribution of this trip to reducing social exclusion. Similar trip values were found in separate modelling for both Melbourne and regional Victoria. Monetary values have also been developed for changes in bridging and bonding social capital, sense of community, three conceptions of wellbeing and area socio-economic disadvantage.

The trip value of A$22.75 is several times higher than the value that results from applying the economists' traditional 'rule-of-a-half' to estimate these benefits from additional trips. The higher value is because the ITLS estimated trip value includes an inferred value for BOTH

- the 'rule-of-a-half' benefits to the trip-maker PLUS
- an inferred estimate of the value of the reductions in the wider societal costs of exclusion, that follow from increased trip making by at-risk people (e.g., lower costs of crime, lower health system costs, improved productivity).

Ignoring these wider societal benefits, as current LUT CBA does, imposes a serious bias against initiatives that increase trip making as a way of reducing exclusion.

Former ITLS student, Dr Leong Wai Yan, Chief Transport Economist at Singapore Land Transport Authority, and his team have seen the potential value in the ITLS work and replicated the analysis of trip values for Singapore. They found similarly 'high' values. This is significant independent corroboration of the ITLS/University of Melbourne research. The LTA is using its trip values to evaluate its future plans for Singapore's land transport system, including its *Friendly Streets* initiative.

ITLS case studies have shown that using these trip values can substantially improve the absolute and relative business/investment case for major improvements to public transport services in areas of higher exclusion risk. For example, for improvements in Sydney's relatively disadvantaged west, Parramatta Light Rail benefits more than doubled and benefits from doubling local bus services increased by half when inclusion benefits were added, dramatically improving the case for these initiatives to proceed (Stanley et al. 2022b).

Further support for the credibility of the ITLS monetisation research comes from benchmarking its values for changes in subjective wellbeing against UK values. The UK value for a one-unit increase in someone's subjective wellbeing score for one-year averages two values, one based on association between income and life satisfaction (HMT & SITF, 2021). The relevant UK value represented 45% of 2019 UK mean household income. The midpoint of the ITLS/University of Melbourne subjective wellbeing values was 49% of sample mean household income, strikingly close to the UK percentage and a little below what Biddle et al. (2020) found in a recent Australian income/life satisfaction analysis.

These comparisons support use of the ITLS monetised values in Australian LUT evaluations, particularly evaluations of initiatives intended to reduce social exclusion. To assist such application, the values should be embedded in Australian transport planning/evaluation guidelines. Those at risk of social exclusion deserve this respect.

References

Biddle, N., Edwards, B., Gray, M. & Sollis, K. (2020). *Hardship, Distress, and Resilience: The Initial Impacts of COVID-19 in Australia*. ANU Centre for Social Research and Methods. **The initial impacts of COVID-19 in Australia**

Burchardt, T., LeGrand, J. & Piachaud, D. (2002). Degrees of exclusion: developing a dynamic, multidimensional measure. In: Hills, J., Le Grand, J., Piachaud, D. (Eds.), *Understanding Social Exclusion* (pp. 30-43). Oxford University Press.

Eurofound (European Foundation for the Improvement of Living and Working Conditions) (2023). *Social inclusion*. Retrieved 19 December, 2023, from **Social inclusion | European Foundation for the Improvement of Living and Working Conditions (europa.eu)**

HMT & SITF (HM Treasury & Social Impacts Task Force (SITF) (2021). ***Wellbeing Guidance for Appraisal: Supplementary Green Book Guidance***.

Stanley, J., Hensher D., Stanley, J. &Vella-Brodrick, D. (2011). Mobility, social exclusion and well-being: Exploring the links. *Transportation Research,* 45,8, 789-801.

Stanley, J., Hensher, D., Stanley, J. & Vella-Brodrick, D. (2021). Valuing changes in wellbeing and its relevance for transport policy. *Transport Policy*, 110, 16-27.

Stanley, J., Hensher, D. & Stanley, J. (2022a). Place-based disadvantage, social exclusion and the value of mobility. *Transportation Research Part A,* 160, 101-113.

Stanley, J., Hensher, D., Wei, E. & Liu, W. (2022b). **Major urban transport expenditure initiatives: Where are the returns likely to be strongest and how significant is social exclusion in making the case.** *Research in Transportation & Business Management,* 43, 10071.

Saunders, P. (2011). *Down and out: Poverty and exclusion in Australia*. The Policy Press.

UNDESA (United Nations Department of Economic and Social Affairs) (2023). *Sustainable Development: The 17 Goals*. Retrieved November, 24, 2023, from **https://sdgs.un.org/goals**

4. E-Scooters: Coming Soon to a Street Near You or Not?

2 April 2024

Stephen Greaves (ITLS, University of Sydney) and Geoff Rose (ITS, Monash University) discuss how the proliferation of e-scooters in Australia has brought about legislative challenges, with confusing rules and safety concerns, revealing a disconnect between existing regulations and public expectations. The evolving landscape calls for a thorough examination of infrastructure, licensing, registration, and insurance to ensure the responsible and sustainable integration of e-scooters into the urban transportation system.

In common with much of the world, e-scooters have emerged onto the urban landscape in Australia promising a practical, greener and 'fun' form of personal mobility. However, this promise has opened up a 'Pandora's box' of legislative challenges with confusing rules and catch-up regulations around the e-scooters themselves, where they are allowed, and who can use them. The risk is these regulations may not align with public expectations, compromising the extent to which e-scooters could meet community needs and contribute to broader sustainability goals.

First a potted history of e-scooters. Their origin can be traced back to the wooden 'kick scooters' of the early 1800s, with the motorised *Autoped* patented during World War 1 marking the birth of the modern e-scooter. Marketed as a low-cost personal mobility device for quick, short-distance travel for the masses, the promise of the *Autoped* was constrained by technology and infrastructure, which increasingly favoured other forms of motorised travel including the car. Fast-forward to the 1990s, when a Swiss inventor developed a foldable metal scooter with inline skates designed to cover distances deemed too far to walk but too close to drive, the 'first/last mile problem'. This concept was taken on-board in walkable cities, such as Tokyo, but ultimately found commercial success as the Razor scooter, the 'must-have' kid's toy of the early 2000s. The game-changer to a viable form of personal mobility, was developments in lithium-ion battery technology in the 2010s, putting the 'e' into scootering. Coupled with growing sustainability concerns, this facilitated commercial interest and the launch of several shared e-scooter schemes overseas. E-scooters eventually reached Australian shores with the first shared scheme opening in Brisbane in 2018. Subsequently, all states/territories have run shared trials with private e-scooters allowed in Queensland, Tasmania, WA, ACT and most recently Victoria. As of 2022, there were an estimated 250,000 private e-scooters in Australia, growing at roughly 20%/annum, with 10,225 shared e-scooters[1].

The rising popularity and power of e-scooters has exacerbated safety concerns for the rider and other road users. While national guidelines exist, regulating them is ultimately the responsibility of each state/territory. E-scooters are typically regulated by maximum power output (200-250 W) and maximum speed (20-25 kph), with further restrictions around where they are allowed (particularly footpaths and higher speed roads) and minimum rider age (16-18)[2]. While riders must wear helmets, there are currently no requirements for compulsory insurance, or the e-scooter to be registered. These regulations have been enforceable for shared e-scooter schemes as part of the operating contracts. However, private e-scooters present a bigger challenge, as there are few barriers to their import and sale and controlling where and how they are used requires additional policing enforcement. In addition to being relatively affordable, lightweight, often foldable, easy to recharge and providing a range of 40-60km, modern private e-scooters are capable of going anywhere at speeds significantly faster than 25 kph – recent evidence from Queensland suggests around 60% of private e-scooters are capable of exceeding 25 kph[3].

Little is known about what people think about e-scooters and whether current policies are meeting public expectations. In late 2023, 1,500 Greater Sydney residents (where e-scooters are effectively outlawed) aged 18+ provided views on e-scooters as part of an annual survey

conducted by transport researchers at the ITLS, University of Sydney. Half of Sydneysiders support legalising e-scooters, with one-quarter opposed and one-quarter unsure. Support was marginally stronger for legalising private e-scooters, possibly reflecting the negative experiences with shared e-bikes in Sydney. Levels of disagreement around where they should be allowed were highest for main roads and footpaths, mirroring well-publicised concerns. Levels of agreement were strongest for bike paths and to a lesser extent shared paths and low-speed roads, although both attracted significant opposition, reflecting the 'contested' nature of such spaces. Strong support for helmets, insurance, licencing and registration points toward treating them more as motorcycles/mopeds than bicycles. Support was marginal for allowing them on public transport, arguably key to unlocking their first/last-mile potential.

Where does this leave e-scooters? Evidently, the growth in e-scooters in Australia coupled with public sentiment, suggests a conversation is needed around how this might happen in a considered and safe manner. Infrastructure is key, as with all micro-mobility options, and footpaths and other shared spaces are at the forefront of this conversation. Licencing, registration and insurance appear to be one area where proponents and detractors of e-scooters concur, although impacts on pre-licenced teens must be considered. Adding further 'fuel to the fire' for regulators is the fire-risk associated with recharging highly flammable lithium batteries indoors. A final thought is the role e-scooters could play for the millions of Australians with minor mobility limitations that restrict walking but have not yet confined them to car dependence. E-scooters can play an important role in sustainable mobility options, but there is a need to ensure that public expectations are not neglected when regulatory changes are made.

References

1. **https://micromobilityreport.com.au/infrastructure/bike-scooter-share/2022-a-year-of-change**.
2. ACT allows 12 year-olds to ride e-scooters under adult supervision
3. Leung AC-K, **Burke M** (2022) '**Understanding private ownership and use of personal mobility devices (PMDs) in South East Queensland**', *26th International Conference of Hong Kong Society for Transportation Studies*.

5. Should supply chain leaders invest in generative AI solutions?

6 May 2024

Dr Jyotirmoyee Bhattacharjya provides three basic questions for supply chain leaders to ask to determine if they should invest in generative AI solutions.

This is a question I am asked quite often during our collaborative projects and other industry engagements. My answer is always a qualified yes based on a supply chain leader's answer to three basic questions. Let me explain.

1. **Does your organization have an established AI policy that will guide your project?**

Generative AI (GenAI) platforms have made AI widely accessible to employees across organizations. This has made it increasingly important for businesses to establish clear policy guidelines that balance perceived benefits with potential reputational risks. Companies I have spoken with in the last 12 months are at various stages of establishing AI-related policies that align with their existing data governance frameworks. In organisations with established policies around the use of AI, there are often limitations placed on the use of sensitive information on GenAI platforms. In businesses without an established policy, supply chain teams are often exploring different GenAI tools without a coherent objective. Without an established policy, there is no clear project approval process that can result in a deployable outcome that would meet business needs. Companies looking for resources on AI policy development would find it useful to explore publicly available policy content created by government agencies (e.g., **Generative AI: basic guidance | Digital.NSW**) and frameworks shared by solution vendors to communicate the trustworthiness of their offerings (e.g., **IBM Artificial Intelligence Pillars - IBM Policy**). Given the data-driven nature of operational decision making, supply chain leaders can make a significant contribution to the development of such policies within their organisations. GenAI can also be part of the solution in this context. For example, solution vendor, Dataiku, provides a GenAI-based policy and regulations explorer that can help a company develop its approach to AI governance (**AI Policy & Regulation Explorer | Dataiku**).

2. **Does your problem need a GenAI-based solution?**

If the organization has a policy with clear guidance on the application of GenAI, then a supply chain leader needs to consider whether the problem does indeed need a GenAI-based solution. My concern here is the overuse of GenAI because of the easy accessibility of a ChatGPT prompt. My team and I are currently using both GenAI and predictive AI models in our supply chain projects with industry partners. A simple but useful comparison of the two types of AI models is available here: **Generative AI vs. predictive AI: Understanding the differences | TechTarget**. Predictive AI involves the use of machine learning to identify patterns in historical data (demand, price, sales, etc.) to make predictions about the future. In our predictive AI projects, comparing the performance of different machine learning models has become standard practice. This is due to the complexity of models at the deep learning end of the spectrum and the fact that the highest performing models are also often the least explainable. The increasing drive for making AI applications more explainable to decision makers has led to the emergence of the field of explainable artificial intelligence (XAI) but there is still considerable progress to be made in this area (**DARPA's explainable AI (XAI) program: A retrospective - Gunning - 2021 - Applied AI Letters - Wiley Online Library**).

GenAI differs from predictive AI in the sense that is designed to create new content based on user prompts. GenAI models (e.g., large language models – LLMs) are pretrained on large volumes of unstructured data and can be trained further on organization-specific datasets. While it is challenging to 'look under the hood' of many predictive AI models because of complexity, it is impossible to do so for proprietary GenAI models such as **GPT-4 (openai.com)**, the most recent LLM from OpenAI. Use of GPT-4 to generate code for forecasting does not further the goal of

producing explainable AI solutions for decision makers. It is also not productive to prompt OpenAI's chatbot, ChatGPT, to generate a forecast knowing that hallucination is a significant problem for LLMs. There are also several open-source LLMs currently available in the market and several lists compiled by various sites (e.g., **8 Top Open-Source LLMs for 2024 and Their Uses | DataCamp**). Most supply chain teams would not have adequate bandwidth or LLM domain knowledge to explore the range of models available to identify a suitable solution.

We do not use GPT-4 for our predictive analytics projects but we do use it in projects involving the extraction of information from large volumes of internal company documents relevant to supply chain management (e.g., contracts, policies, and procedures). Some problems can also be quite easily addressed with traditional natural language processing (NLP) solutions and not require the use of LLMs.

Identifying the most appropriate solution for an operational problem, whether it is based on GenAI or predictive AI models might be an area where expert advice is beneficial to supply chain teams if such expertise does not exist in-house.

3. Are the right skills and tools available to your supply chain analysts?

By 'the right skills', I do not mean programming capabilities. I would never advise supply chain leaders to turn their analysts into data scientists. To be effective in their roles, supply chain analysts need supply chain domain knowledge much more than they need programming skills. Skills and tools are closely connected since smarter tools require fewer skills. With the growing availability of no-code/low-code AI platforms, supply chain analysts can now generate machine learning-based predictions using a sequence of simple visual drag-and-drop steps. The global no-code AI platform market is worth billions of dollars, so it is important for supply chain leaders to consider their strategic needs carefully and ask enough questions before selecting a platform. Once adopted, such a platform would be a far better option for predictive analytics than allowing analysts to prompt ChatGPT to generate forecasts as an alternative to acquiring programming skills. No-code AI platforms can also facilitate no-code access to OpenAI's GPT models for projects where these are most suitable. Having a single platform for both predictive analytics and GenAI projects can also make it easier to train your analytics team and create a shared knowledgebase that will benefit future projects. Supply chain leaders also need to foster a continuous learning culture within their teams, so the organization benefits from the rapidly evolving AI landscape.

To supply chain leaders who reply in the affirmative to all three of the above questions, my answer is yes, you should absolutely invest in GenAI. The world is only at the beginning of our journey with GenAI. The possibilities are endless. As long as business leaders are making thoughtful strategic decisions that are mindful of emerging regulations and the company's data governance framework, there are benefits to be gained from adopting generative AI models for the right projects.

6. Funnelling congestion: How Sydney exacerbated congestion after spending tens of billions on transport infrastructure

3 June 2024

Dr Christopher Day and Dick Day point to a need for more integrated, thoughtful planning, guided by independent research and a more accountable and transparent evaluation process.

The opening of Sydney's much awaited $3.9 billion Rozelle Interchange in November 2023 was met with gridlock. Changes made to existing surface roads to make space for four dedicated tolled lanes connected to the new WestConnex motorway disrupted existing traffic flows onto the Anzac Bridge (Wiggins, 2023). Whilst the motorway was meant to improve traffic flow on the already busy Victoria Road, the substantial reduction in lanes associated with the new interchange has significantly slowed traffic. Emergency works undertaken to add an additional lane where the City West Link joins the new Crescent Overpass will shift rather than address the bottleneck (Stonehouse, 2023). The government has limited options for unravelling the mess as any changes which disrupt the flow of traffic onto WestConnex would require negotiation with the Transurban consortium.

How do such missteps with transport infrastructure occur? Why would a government fund expensive urban motorway infrastructure that will channel even more traffic into a congested central area? The answer rests with poor governance and an inability to assess projects at a city-wide network level. Despite its cost and purported importance, Rozelle Interchange was not reviewed by Infrastructure Australia during the project's later stages nor were detailed designs shown to local councils and communities. Regrettably, this is not an isolated case. The desire to rush through projects with poor cost-benefit was observed with the decision to build the $9 billion Western Sydney Airport Metro line, which Infrastructure Australia advised against (Rabe and O'Sullivan, 2021). Then there was the signing of multi-billion-dollar tunnel boring contracts for Metro West shortly before the March 2023 NSW state election (Sydney Metro, 2022).

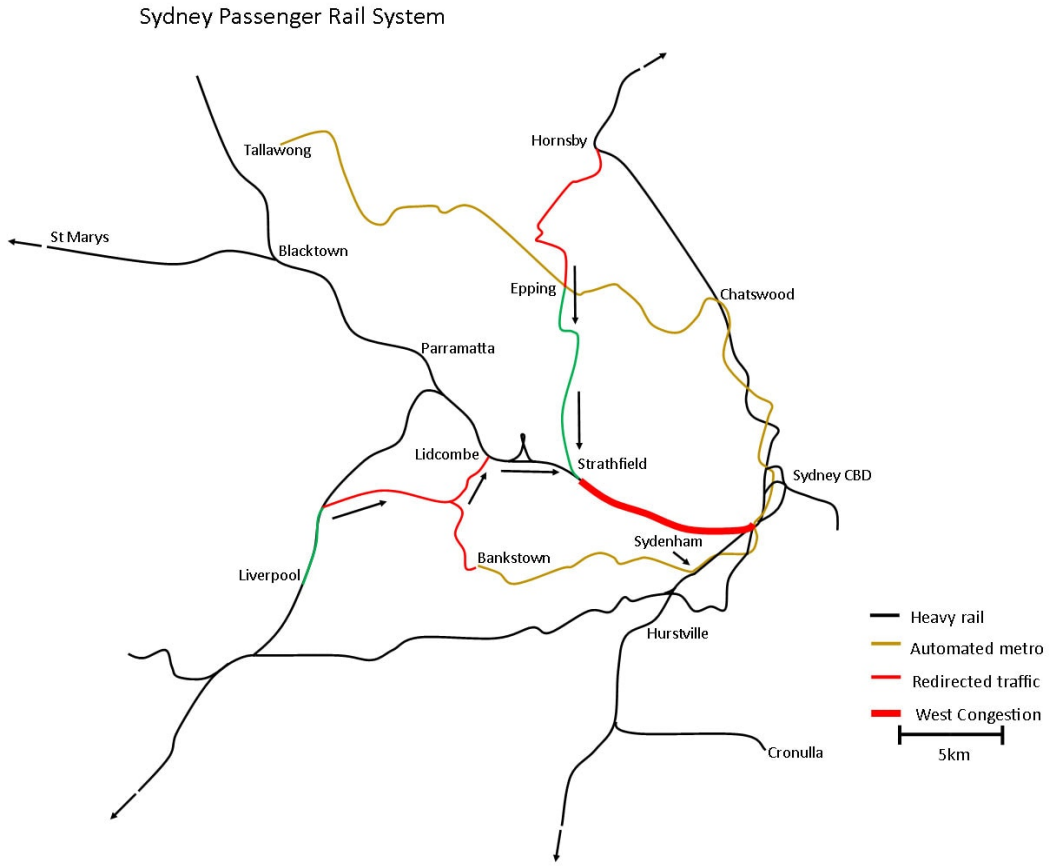
An even bigger mess for rail

Over $50 billion has been committed to automated metro railways in Sydney yet both initial schemes have managed to increase congestion on Sydney's busiest Western rail line in their endeavour to increase capacity elsewhere.

Sydney's first metro connected the Northwest sector to the existing heavy rail network at Chatswood. Whilst the line west of Epping was new, the metro cannibalised the relatively new heavy rail Epping-Chatswood link which opened in 2009. Aside from the disruption caused by closing the line for over a year, whilst metro conversion works were undertaken, the metro unwound congestion relief provided by the Epping-Chatswood rail link. It did this by forcing Hornby services, previously diverted by the Epping to Chatswood link to the North Shore Line, back onto the route via Strathfield and the congested Western Line into the CBD (See Figure 1).

To make matters worse, Phase 2 of the metro, from Chatswood through the Sydney CBD and onto Bankstown, required an expensive conversion of the existing heavy rail line from Sydenham to Bankstown. Leaving the prohibitive cost of this exercise aside (Day and Merkert, 2022), closure of the Bankstown Line to heavy rail requires traffic from Liverpool and stations west of Bankstown to be redirected onto the already congested Western Line at Lidcombe. This will result in significantly slower and less reliable train services from these already poorly served parts of the City (Day and Day, 2023).

In contrast, Sydney's second major metro project, Metro West, which connects the CBD to Parramatta, appears superficially to add much needed capacity to the congested western rail corridor. Connecting Sydney's two CBDs seems a no brainer. Regrettably, Metro West will fail to alleviate Western Line congestion. The overwhelming majority of passengers travelling on the line originate from destinations west of Parramatta. These passengers will not change onto the metro at either Westmead or Parramatta as the existing railway offers both higher frequencies (every 3 minutes instead of 4) and a choice of three CBD station destinations as opposed to just the one on the new metro line. The existing Western Line also offers compatible journey times, better interchange opportunities and through services to destinations on the North Shore. This realisation, coupled with the need to get some utilisation from this $26 billion metro, is behind the recently introduced imperative to rezone land for very high densities along the new metro route and pivot away from the narrative that Metro West provides congestion relief to the existing rail system (Hyland, Roe and Lewis, 2023).



How can Sydney get it so wrong?

In a nutshell, successive NSW governments have steadfastly refused to develop and implement a meaningful long-term strategic transport and land-use strategy. This is not simply an oversight. Students of Lynn and Jay's weighty tome "*Yes Minister*" will recall the horror with which Minister Hacker's Permanent Secretary (in those far off days when permanent departmental heads were actually permanent!) heard the news that his Minister had been lured into accepting the role of transport supremo. As Sir Humphrey observed," *we need a transport policy like an aperture in the cranial cavity*." He went on to describe the job as a bed of nails, a crown of thorns, and a booby trap (Lynn and Jay, 1989, p429).

The reasoning behind Sir Humphrey's concerns, unfortunately, remains apposite in a parliamentary democracy. A meaningful transport and land use strategy will attract opposition from all quarters. It would raise questions about why we would want a very high density multi story Asian style city that needs metro railways with a standing capacity up to about 50,000 passengers per hour in each direction. Why would we not put such high densities along the Northern Beaches where the amenity would be much higher than the Bankstown corridor? In

addition to contemplating the redevelopment of Rosehill racecourse, why don't we convert Centennial Park and the Randwick racecourse to high density apartments in order to give the Metro West fiasco at least some patronage from the east into the multibillion-dollar Wynyard Station redevelopment? After all, the future projected route to Kogarah with a leg to La Perouse will hardly generate sufficient demand to justify a metro without the massive redevelopment we dare not talk about!

In a titular sense the NSW Department of Transport has bought all transport undertakings into a single entity, in the process emasculating the professional knowledge previously held by the separate entities. However, the Department has studiously avoided any attempt at joining up the dots. Instead, billions of dollars have been spent on a variety of new builds that have paid insufficient attention to network and land use dynamics. Conversely, they have enriched the consultancy industry, major construction and transport operating companies and the innumerable bankers and lawyers entrusted with managing the sea of required and opaque contractual obligations. Inevitably, it has been a case of locking in the building commitment first and revealing the societal implications and real costs later.

It did not have to be so. There was no demand driven imperative for such haste in selecting a plethora of new and incompatible technologies. There is no thoughtful explanation on why the link between Parramatta and Westmead, already served by numerous direct bus services and a minimum of six train services per hour in the off-peak period, also requires a highly circuitous and expensive light rail connection and an additional metro railway!

The unfortunate result of this plethora of suspect decision making is missed opportunities and ineffectual investment which has assisted in overheating the construction industry. At the macro level, central area employment has taken a significant hit globally in the aftermath of the covid pandemic which served to exacerbate what was already an increased tendency to work from home. Additional automation and AI technologies will continue to challenge the traditional office centric role of the CBD. In light of this, the much-vaunted new Chatswood to Sydenham metro will be more than enough to take care of any possible increase in CBD peak hour commuter demand for the foreseeable future. Yet not only has the NSW government committed to what amounts to open-ended expenditure on an additional metro from Parramatta to the City Centre, but also completed a major tollway upgrade designed to encourage more cars to try and enter Sydney's highly congested area. In contrast the poorly serviced Victoria Road/Ryde corridor has been adversely impacted as has travel to the Sydney City Centre from the Liverpool area.

Where to next?

No politician has an appetite for courageous policy decisions regarding the future size and configuration of the Sydney metropolitan area. Yet even they are becoming forcibly aware that the excesses of the last few years are creating a nest of problems that cannot readily be rectified and are going to cause increasing acrimony amongst many constituencies. Discerning politicians have long appreciated the role of a suitable scapegoat responsible for pointing out electorally unpleasant truths. Traditionally, Government Treasuries have often fulfilled the important role of investment appraisal by questioning expenditure on everything. Unfortunately, this function has lapsed. Given the extent of public debt and the ever-increasing calls on the public purse a renewed vigour from this quarter might be acceptable.

It is probably too much to hope that Universities can devote greater resources to pressing real world policy issues. However, given the suppression of independent thought within government departments, is there any hope for better funding of independent research institutes? Referral of an issue for further investigation has the immediate political advantage of deferring commitment whilst giving at least the appearance of positive action. Such an apparently open-minded approach might even permit the adoption of a subsequent recommendation based on thoughtful and integrated analysis rather than on an immediate need to pacify a lobby group or particular ideological prejudice. Might a meaningful approach to land use and transport planning emerge from an independently funded research institution?

References

Day, C.J. & Day, R.A. (2023). **Taken for a ride: How the poor cost-effectiveness of Sydney's automated Metro Railways provides a salutary lesson for infrastructure planning**. *ITLS Working Paper,* 22-23.

Day, C.J. & Merkert, R. (2022). **Costs of Sydney's driverless train conversion outweigh the benefits**. *The Conversation,* 16 August.

Hyland, J., Roe, I. & Lewis, A. (2023). **NSW Government plans to see Rosehill Racecourse replaced by more than 25,000 homes as Metro West confirmed**. *ABC News*, 6 December.

Lynn, J. & Jay, A. (1989). *The Complete Yes Minister*. BBC Books, London.

Rabe, T. & O'Sullivan, M. (2021). **Cost far outweighs benefit: Sydney's $11b airport rail link slammed**. *The Sydney Morning Herald*. 12 March.

Stonehouse, G. (2023). **Construction on Sydney's West Link and Anzac Bridge to prevent bottlenecks around Rozelle Interchange**. *ABC News*, 4 December.

Sydney Metro. (2022). **Final major tunnelling contract awarded for Sydney Metro West**.

Wiggins, J. (2023). **Rozelle road designs kept from public view**. *The Australian Financial Review*, 15 December.

7. Navigating the Seas of Carbon Taxing: Balancing the Scales in Global Shipping

1 July 2024

Veronica Schulz and Michael Bell discuss how the expansion of the EU Emissions Trading Scheme to include shipping reflects progress in tackling carbon emissions, but challenges like carbon leakage persist, requiring coordinated global efforts. Australia could enhance its emission reduction by making its ACCU scheme mandatory for ships and establishing green shipping corridors, aligning with international initiatives.

The recent expansion of the European Union Emissions Trading Scheme (EU ETS) to include the shipping sector[1] highlights both the potential for progress and the intricate challenges involved in reducing carbon emissions. Originally designed to reduce emissions in the aviation and industrial domains, the EU ETS has recently broadened its scope to include shipping operations. This expansion acknowledges the substantial contribution of maritime transport to global carbon emissions and emphasises the importance of integrating it into broader emissions reduction strategies. Under this scheme, shipping companies operating within European waters are obligated to purchase emissions allowances corresponding to their vessels' carbon output (100% of emissions on voyages and port calls within the EU and 50% of emissions on voyages into or out of the EU).[2]

However, the concern of carbon leakage arises, whereby regulatory interventions intended to alleviate emissions inadvertently incentivise the relocation of polluting activities to regions with less stringent environmental regulations. Indeed, preliminary observations suggest a pattern wherein shipping lines opt to deploy their least emitting vessels in European waters while directing more carbon-intensive operations to regions lacking or with lax carbon pricing mechanisms.[3] While the EU's endeavours to internalise the external costs of carbon emissions are commendable, the risk of carbon leakage poses a significant challenge to achieving substantive emissions reductions on a global scale. Indeed, the phenomenon of “flag hopping”, whereby ships register under flags of convenience in countries with lenient regulations, further complicates efforts to enforce emission standards and effectively combat climate change.

This presents further challenges for Australia, due to the voluntary nature of the national Australian Carbon Credit Unit (ACCU) scheme.[4] While these initiatives provide incentives for emissions reductions and carbon sequestration, their voluntary nature constrains their efficacy in mitigating emissions from sectors like shipping. Australia can draw inspiration from the European Union's effective policy framework and consider making the ACCU scheme mandatory for all ships visiting Australia, extending its coverage to include shipping emissions. By aligning with the EU's approach, Australia can enhance the comprehensiveness and enforceability of its emissions reduction efforts.

Additionally, Australia could explore the establishment of more green shipping corridors, akin to the one being established between Australia and Singapore.[5] These corridors could incentivise the adoption of cleaner technologies and practices, facilitating the transition towards sustainable shipping operations while bolstering international cooperation in mitigating maritime emissions. Such initiatives not only align with global decarbonisation objectives but also offer economic and environmental benefits by reducing fuel consumption and enhancing air quality in port cities.

Overall, the current fragmented approach risks perpetuating inefficiencies and inequities while falling short of achieving the requisite emissions reductions to effectively mitigate climate change on a global scale. Instead, a coordinated strategy, underpinned by multilateral agreements and cooperation, is imperative for harmonising carbon pricing mechanisms, enforcing global emission standards, and fostering technological innovation across borders.

One promising avenue for such cooperation lies within the International Maritime Organization (IMO). The IMO's mandate to set global standards for shipping emissions and facilitate dialogue among member states provides a platform for fostering consensus and driving collective action on climate change mitigation.[6] By collaboratively establishing binding emission targets, implementing effective monitoring and reporting mechanisms, and incentivising investment in low-carbon technologies, the international community can ensure that the shipping industry contributes to achieving the objectives of the Paris Agreement.

In conclusion, the inclusion of shipping in the EU ETS marks a significant advancement in addressing carbon emissions in the transport and logistics sector. However, the strategic behaviour of shipping lines and the risk of carbon leakage underscore the imperative for coordinated global action to ensure the effectiveness and equity of emissions reduction endeavours. Australia has an important role to play here.

References

1. **Reducing emissions from the shipping sector** *European Commission*
2. **EU ETS – Emissions Trading System** *DNV*
3. **ETA: EU ETS should regulate cargo diversion and carbon leakage** *SAFETY4SEA*
4. **Australian carbon credit units** *Clean Energy Regulator, Australian Government*
5. **Singapore and Australia Green and Digital Shipping Corridor** *Department of Foreign Affairs and Trade, Australian Government*
6. **2023 IMO Strategy on Reduction of GHG Emissions from Ships** *International Maritime Organization (IMO)*

8. How much do you know about electric vehicle owners' travel habits? Still not much …

5 August 2024

Dr Andrea Pellegrini discusses how collaboration between private charging operators, research institutions, and policymakers is essential to enrich understanding of EV owners' travel behavior and improve the public EV infrastructure network. Initiatives such as the partnership between the Institute of Transport and Logistic Studies (ITLS) and the Australian Vehicle Council to conduct an EV vehicle ownership survey demonstrates a step towards addressing this knowledge gap.

The mass proliferation of electric vehicles (EVs) is widely regarded as one of the most effective solutions to the current climate change crisis. National governments so far have implemented a wide range of policy measures to strongly support the EV rollout, including the deployment of purchase incentives, introduction of registration tax rebates, extension of warranty periods, access to public transport lanes, just to name a few. With the increasing number of greener vehicles, one would expect an increasing abundance of data on EV owners' travel preference behaviour too. Nonetheless, the reality is quite the opposite, in that information on EV users and their travel patterns remains largely limited.

Initially, one of the main obstacles in obtaining real-world data on EVs stemmed from their relatively low rate of adoption compared to conventional fossil-fuel powered vehicles. In Australia, for example, only 49 electric cars were reported to be driven in 2011 (International Energy Agency, 2016). After EVs gaining popularity, more observational data became available to researchers and policymakers for their empirical investigations. However, data were usually in an aggregated form and available from fragmented sources, while also often affected by numerous missing observations. The poor data quality resulted in forecasting exercises undertaken via the use of driving preference behaviour of conventional vehicle owners. Restrictive analytical assumptions were also made necessary to simplify the complexity of predictions. The most common assumption was to treat the population under examination as if it were a statistic object throughout time. However, this implied that any simulated scenario typically disregarded the impact that structural changes to the population itself due to factors, such as, economic crisis, national/international conflicts, immigration measures, exerted on individuals' travel and purchase behaviour.

Over the years, the scarcity of data has led more and more transportation modelers to rely almost exclusively on web-based questionnaires. Nevertheless, their dissemination is usually commissioned to third parties who make use of pre-sets of panellists, mostly made up of prospective clients rather than actual EV owners. Given that survey administration costs have also skyrocketed in the last ten years, researchers often found themselves making a trade-off between the number of questions to ask and the number of respondents to interview. More often than not, analysts prioritize the sample size which can yet affect the variety of topics covered in the questionnaire. Consequently, many studies have abandoned the goal of extrapolating comprehensive information from EV drivers' experience in favour of investigating primarily consumers' purchase intentions. The assessment of consumers' purchase preferences is usually carried out by showing respondents a series of hypothetical purchase scenarios from which they have to choose the electric vehicle that most appeal to them from a list of provided options. The answers collected are next analysed to give an indication of how much consumers are willing to pay for different combinations of vehicle characteristics. Despite being useful, measures of the willingness to pay alone partially enhance our understanding of how the EV market will evolve over time. In fact, respondents should also be asked to indicate how far they would travel with the selected vehicle, whether the selected vehicle would be added to the household vehicle fleet or replace an existing one, or where the chosen vehicle would be likely charged. The collection

of this information would in part compensate for the lack of knowledge of EV owners' driving and charging decisions. Without rich data, policy makers are likely to struggle to develop strategic interventions that can effectively strengthen the demand for EVs.

How can the existing lack of data on EV owners' travel patterns be overcome in Australia?

The answer to this question is that Australia launches its own national longitudinal EV survey. Institutions, policymakers, and political authorities can potentially team up on the development of a comprehensive EV questionnaire that adequately investigates EV charging behaviour, travel decisions and overall experiences with EVs. A national EV survey will not only bridge the existing knowledge gap of EV owners, but also ensure the preservation of the data quality and the representatives of the sample (EV owners should be sampled from all over Australia). Further, the longitudinal nature of the data collection will allow for capturing potential variations in EV owners' driving and charging preferences that might occur overtime. Internationally, the German Mobility Panel (GMP) serves as an example of a national longitudinal study that collects data on mobility/charging decisions of a (still relatively small) sample of battery electric vehicle owners, alongside other transport information. The GMP incorporates questions designed to gather information on respondents' daily car trips over an eight-week period, such as the inter-charging duration (in days) between two consecutive charging activities, the distance travelled (in kms) before charging the vehicle, the location where the charging activity is undertaken, as well as the characteristics of the vehicle and the EV owner (KANTAR, 2022; Vallée et al., 2022). Incorporating some of these questions into the EV national survey would be crucial for accurately forecast the evolution of EVs in Australia. Meanwhile, private charging operators and research institutions should strengthen their collaboration. Currently, for example, public charging companies tend to avoid sharing the information on charging instances recorded at their outlets. When they do share it, they often require the interested party to commit large financial resources for acquiring the data. Ideally, data extracted from web-based surveys should be coupled with public charging data. This combination will enrich our comprehension of EV owners' travel behaviour, while also revealing what needs to be done to further improve the public EV infrastructure network.

The Institute of Transport and Logistic studies (ITLS) has partnered with the Australian Vehicle Council to design a survey on EV vehicle ownership experience. More than 1700 respondents have agreed to spontaneously partake in the EV vehicle ownership survey between February and March 2024. Of these 1700 respondents, approximately 1550 participants are reported to be electric vehicle owners. In the next future, additional data collections will be administrated with ultimate goal of better understanding the factors that are still preventing a large-scale diffusion of EVs in Australia.

References

International Energy Agency, (2016) International energy outlook. KANTAR 2022. **Deutsches Mobilitätspanel MOP – Erhebung der Alltagsmobilität sowie der Pkw-Fahrleistungen und Kraftstoffverbräuche – Endbericht zum Paneljahr 2021/2022**.

Vallée, J., Ecke, L., Chlond, B., Vortisch, P. 2022. **Deutsches Mobilitätspanel MOP – Wissenschaftliche Begleitung und Auswertungen Bericht 2021/2022: Alltagsmobilität und Fahrleistung**.

9. IPART – an example of practical thinking outside the box

2 September 2024

Professor John Stanley explores NSW's Independent Pricing and Regulatory Tribunal (IPART) fare setting policies for public transport and considers how social inclusion benefits also need to be taken into account when proposing or updating fare structures.

External costs/benefits in public transport fare setting

NSW's Independent Pricing and Regulatory Tribunal (IPART) is a world leader in development of efficient public transport (PT) fare structures that recognize benefits and costs to service users and to the wider society, as well as service delivery costs. This leadership has been recognized, for example, in several Thredbo International Conferences on Competition and Regulation in Land Passenger Transport.

However, as noted at the Thredbo 14 Conference, a weakness in the IPART fare setting approach has been the neglect of agglomeration economies and social inclusion benefits flowing from public transport services (Stanley & Levinson, 2016). The new IPART Draft Report, *Maximum Opal Fares until 2028* (IPART, 2024a) begins to rectify this weakness.

Both agglomeration economies and social inclusion benefits are important for improved PT fare structures and improved transport planning and evaluation more generally:

1. *agglomeration economies* because Australian cities would not be nearly as productive without their dense PT networks, particularly those mass transit services converging on the city centres, yet Australian transport planning and evaluation guidelines have been wary of counting these PT benefits, almost denying the reality that is agglomeration; and,
2. *social inclusion benefits* because the social safety net role of public transport services has been long recognised in policy terms, but Australian transport planning and evaluation practice and guidelines have ignored the societal benefits from reducing social exclusion. ITLS research has shown these benefits to be considerable (Stanley et al., 2022).

IPART is now proposing that agglomeration economies be handled in the fare setting process by excluding some costs of PT vehicle ownership from the efficient cost quantum to be recovered through user fares. The IPART Technical Paper says:

We have excluded costs of ownership of public transport vehicles from the marginal cost. Our reason is that we consider the costs of fleet ownership, along with costs of owning dedicated public transport infrastructure (such as railway lines, train stations, bus stops and depots, ferry wharves and light rail track) to be costs that are incurred in order to secure agglomeration benefits. (IPART, 2024b, p. 9)

In the draft proposal, half these ownership costs are excluded. In taking this implied cost approach to reflect agglomeration benefits, IPART argues that agglomeration benefits should (at least) equal this cost quantum at the margin. This seems a useful starting point for discussion, at a time when the relative contributions of physical proximity and virtual proximity to agglomeration economics are in flux, thanks (for example) to COVID and its influence on hybrid working arrangements (Hensher, Weisbrod & Christensen 2023).

For social exclusion, the IPART Technical paper (IPART 2024b) recognises the importance of buses for social inclusion and proposes a cost-based (proxy) approach to benefit recognition. In

addition to fare concessions for selected user groups (as at present), which can support social inclusion, the Technical Paper proposes that a significant proportion of bus service costs be excluded from the cost base to be recovered from user fares, totalling around $470m annually. The relevant costs are part of the bus costs that vary by number of bus kilometres travelled, as an estimate of the marginal costs of additional bus service provision beyond the service level that might be optimal if there were no inclusion benefits. *The reason that actual bus timetables include services that are lightly patronised is that there are social benefits to more frequent services in the urban fringe* areas (IPART 2024b, p. 9).

Rather surprisingly, however, the provision for inclusion benefits in setting optimal fares does not carry through to the IPART fare proposals, for unexplained reasons. There is sufficient information in the various IPART papers, particularly the pricing worksheets[1], to explore the implications of this somewhat tentative in/out approach to inclusion.

Figures 1 and 2 show optimal fares with and without the inclusion discount of $470m. Figure 1, which is important for the IPART fare proposals, shows that short (2 km) bus trips cover their peak and off-peak costs (estimated efficient prices are less than current prices) but longer bus trips do not, particularly very long trips.

Figure 2 shows that recognising social inclusion benefits of ~$470m substantially reduces estimated efficient prices, as compared with Figure 1, and results in estimated prices for peak and off-peak bus trips of both 2 and 5 kms being higher than current prices with the efficient price shortfall much less than in Figure 1 for longer trips. Which set of bus costs should provide the basis for efficient fare setting?

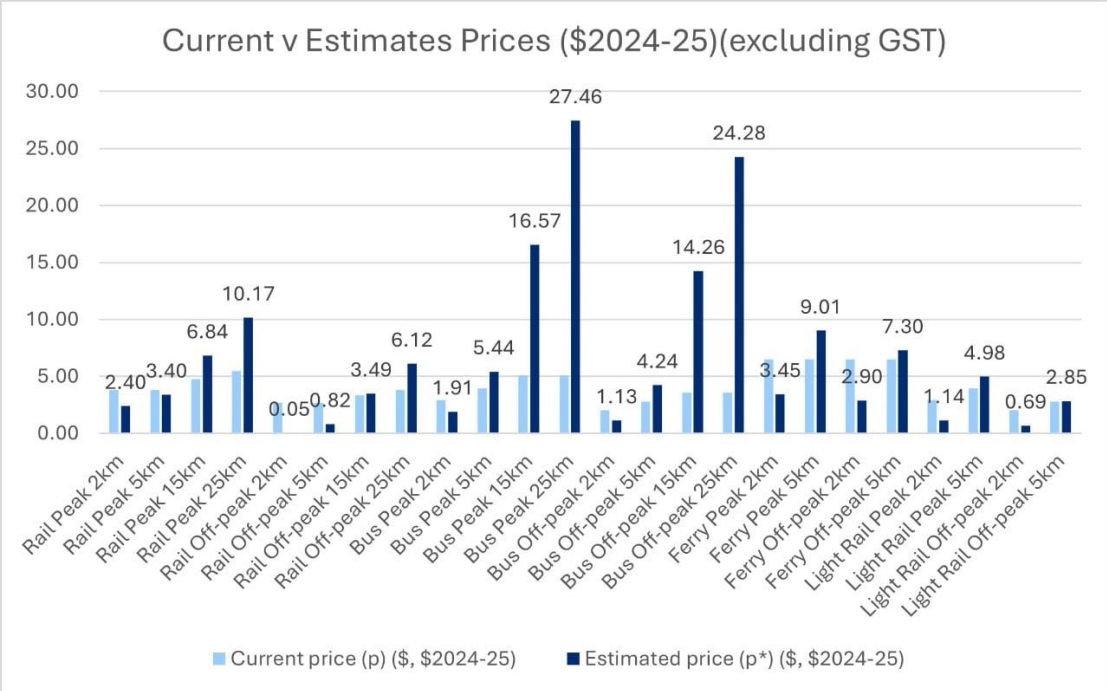


Figure 1: IPART efficient PT costs compared to current prices

Source: https://www.ipart.nsw.gov.au/documents/spreadsheet-model/spreadsheet-model-fare-optimisation-model-review-opal-fares-2028?timeline_id=17398

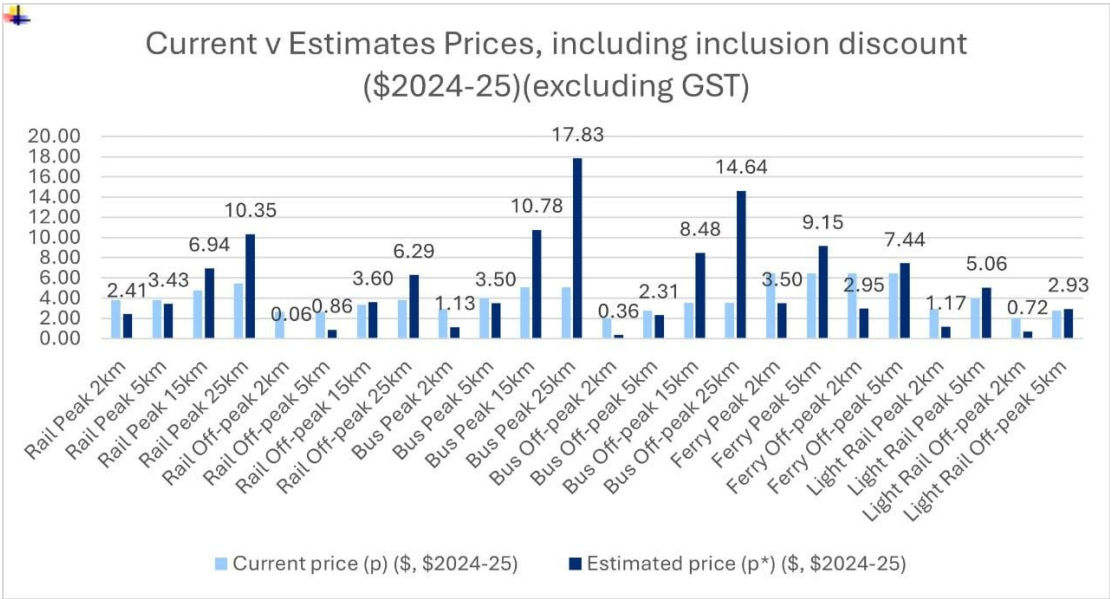


Figure 2: Efficient costs applying $470m social inclusion benefit allowance for bus, compared to current prices

Source: Author, using https://www.ipart.nsw.gov.au/documents/spreadsheet-model/spreadsheet-model-fare-optimisation-model-review-opal-fares-2028?timeline_id=17398

Social inclusion benefits

ITLS researchers and colleagues from The University of Melbourne have shown that an additional trip is worth around A$22.75 (2019 prices), based on the trip's contribution to reducing social exclusion, with this value increasing in inverse proportion to declining household income (Stanley et al., 2022). Similar (currently unpublished) trip values have been found in recent research by economists at the Singapore Land Transport Authority, supporting the ITLS findings.

The mean trip value of A$22.75 includes generated traffic benefits (to new trip maskers) plus an inferred value for the reductions in the wider societal costs of exclusion, which follow from increased trip making by at-risk people (e.g., lower costs of crime, lower health system costs, improved productivity). These inferred societal (external) benefits account for about three quarters of the $22.75/trip benefit.

The IPART Technical Paper's ~$470m provision for inclusion benefits of bus can be tested against these ITLS trip values. Using these values, around 20 million annual bus trips would need to be attributable to the additional bus services that result from the ~$470m bus service support. In the absence of this support, these 20m trips would have to have either not been made, required a lift-giver or required an expensive modal choice (e.g. a taxi). This is about 10% of total bus trips, which seems a conservative estimate of the proportion of bus users who will be at risk of mobility-related exclusion. Stanley & Hensher (2011), for example, estimated that around one-third of Melbourne bus trips are in this exclusion risk category, so a 10% proportion for Sydney looks very conservative. Building a $470 cost discount into the optimal fare setting process seems very conservative on this basis. Ignoring that provision, as IPART has done in its final proposal, seems to deny the reality of mobility-related exclusion.

Conclusion

IPART has a well-deserved reputation for PT fare setting that is best practice in terms of economic efficiency. Its latest proposals reinforce this reputation by some thinking outside the box to recognize agglomeration benefits and social inclusion benefits, taking account of the former in the fare-setting process. Refinement in the way IPART handles inclusion benefits is now needed

too, with fare structures that take account of a discount for social inclusion benefits being a better reflection of the societal benefits and costs of bus services than the proposals recently put forward by IPART, (which excluded these benefits).

Footnote

[1] https://www.ipart.nsw.gov.au/documents/spreadsheet-model/spreadsheet-model-fare-optimisation-model-review-opal-fares-2028?timeline_id=17398

References

Hensher, D., Weisbrod, G. & Christensen, I. (2023). *Value creation through physical and virtual agglomeration.* https://www.sydney.edu.au/business/news-and-events/news/2023/09/04/value-creation-through-physical-and-virtual-agglomeration.html

Independent Pricing and Regulatory Tribunal (2024a). *Maximum Opal fares until July 2028: Draft Report. August 2024.* Draft-Report-Maximum-Opal-fares-until-July-2028-August-2024.PDF (nsw.gov.au)

Independent Pricing and Regulatory Tribunal (2024b). *Maximum Opal fares until July 2028. Modelling socially optimal fares. Technical paper. August 2024.* Technical-Paper-Modelling-socially-optimal-fares-August-2024.PDF (nsw.gov.au)

Stanley, J. & Hensher, D. (2011). Economic Modelling. In Graham Currie (Ed.), New Perspectives and Methods in Transport and Social Exclusion Research, (pp. 201-219). United Kingdom: Emerald Group Publishing.

Stanley, J. & Levinson, D. (2016). Workshop 3 report: Sustainable funding sources and related cost benefit measurements. Research in Transportation Economics, 59, 143-150.

Stanley, J., Hensher, D. & Stanley, J. (2022). Place-based disadvantage, social exclusion and the value of mobility. *Transportation Research Part A*, 160, 101-113.

10. A tale of two continents – the experience of on demand bus transport

2 October 2024

Professor Emerita Corinne Mulley and Professor John Nelson consider the effectiveness of various implementations of on demand transport (ODT) bus-based services both in Australia and overseas.

On demand transport (ODT) is a bus based public transport service where the route and timings are determined by the user unlike conventional bus services which are scheduled and run on fixed routes between their origin and destination. On-demand transport has several names, originating as 'dial a ride', and more recently demand responsive transport or flexible transport services.

There has been extensive academic and grey literature looking at these services covering experimental services, funded by Government bus 'challenge' funds in the UK, small schemes designed to meet niche needs all over Europe and more long-lived schemes that have existed around the world. European (including the UK) services have been subject to evaluations, often with a focus on cost factors, concluding that these services are more expensive than conventional services. However, they fail to recognise the contribution to quality of life, reductions in social exclusion and the potential to increase social capital. Other evidence has focused on why services fail (Currie and Fournier, 2020). A close look at the barriers to implementation identified the way in which 'big' bus operators were not comfortable with small bus and flexible operations and governments who subsidise (usually on the basis of the kilometres run) found the idea of an unknown total liability arising from flexible operation a difficult concept. More importantly, bus legislation typically is designed to cater for conventional fixed route services in a way that makes the design of a flexible service difficult.

In this tale of two continents, we ask the question why the trials introduced in NSW with great aplomb providing 14 new urban ODT and 11 rural and regional ODT from late 2017 are different and whether this experience needs to be promoted to *thinking outside the box* to revise the literature on the elements of success of ODT services.

Promoted by the (then) Transport Minister, Andrew Constance, the NSW trial services were introduced as technology achievements reflective of the advancements in transport information technology. In some of the cases the trial services must be regarded as a success by transferring from a status of 'trial' to permanence (for example Bridj in Sydney's Inner West). Whilst these trial NSW services were announced and implemented with a fanfare, it should be also be recognised that other Australian states had implemented ODT services, some quite long standing such as Telebus in Melbourne (since 1978 but replaced with fixed route complemented by other flexi-ride services in 2021 – which should not be considered a "failure"), Keoride in Mount Barker (who also operate in Sydney's Northern beaches), Victoria, Roam zone in Adelaide and other roam zones in South Australia in towns replacing fixed route services such as Grafton.

What do the successful ODT trials that have translated to permanence have in common? And do they share this with other longstanding schemes? The literature generally claims that ODT schemes are expensive as indeed they are if they are overlaid onto the existing network. The successful NSW schemes have not been overlaid on the network but were designed to be part of the network thus benefiting from the network effect. Whilst contrary to previous practice, this element of success was identified in 2012 for low density services, where a potential redesign of the conventional network into conventional trunk services complemented by access services by ODT could be provided within the existing budget but with an estimated increase in access to public transport from 56% to 92% (Mulley and Daniels, 2012). And on examination, the most long-lasting scheme in the UK, introduced in 2001 in rural Lincolnshire, CallConnect was designed

and branded to be part of the network. Nelson and Wright (2021) reported that since inception the service has resulted in the level of unmet need in the communities served being reduced by 90% with the subsidy required for DRT approximately the same as that required for the former (less effective) fixed route services. Clearly, from a cost of provision point of view, designing as part of the network rather than duplicating the network will offer better value for money. Benefiting from the network effect is not restricted only to successful ODT services and is a well-documented aim of network planning (Mulley and Nelson, 2021)

The successful ODT services in NSW were led by a Champion in the form of the Transport Minister. The presence of a Champion has been a feature of many really successful transport schemes from Enrique Peñalosa's vision and implementation of the Bogata BRT, the intuitive adoption of Busways as a solution for Brisbane by the Chair of the Traffic and Transport Committee, Councillor Maureen Hayes (Tanko and Burke, 2013), to London's congestion charging scheme by Ken Livingstone.

What is 'out of the box' about the ODT successes in NSW? The successes have shown the literature to be lacking in two respects. First, the recognition that successful ODT services must be integral to the network and not just an add on and second, successful transport options which are promoted by a committed Champion are associated with success. But the final aspect of success of the ODT services in NSW is how the key elements of success are now recognised by Transport for NSW. As identified by Executive Director Sue Wiblin, ODT services are an effective transport mode when incorporated into network, provide value for money when designed as part of the network and should be considered another, and separate service type.

References

Currie, G., & Fournier, N. (2020). Why most DRT/Micro-Transits fail–What the survivors tell us about progress. *Research in Transportation Economics*, *83*, 100895.

Mulley, C., Nelson, J., Teal, R., Wright, S., & Daniels, R. (2012). Barriers to implementing flexible transport services: An international comparison of the experiences in Australia, Europe and USA. *Research in Transportation Business & Management*, *3*, 3-11.

Mulley, C., & Nelson, J.D. (2021). Public Transport Network Planning. In: Vickerman, R (Ed) *International Encyclopedia of Transportation*, vol. 6, (pp. 388-394). Elsevier.

Nelson, J.D. & Wright, S. (2021). Flexible Transport Services. In C. Mulley, J.D. & S. Ison (Eds) *Handbook of Public Transport*. (pp. 224-235). Routledge.

11. Climate Change: It is real but are we misreading or over-reacting to the impact on natural evolution of human settlement as the cause of the problem?

4 November 2024

Professor David Hensher debates whether the impact of human activity on the climate been overstated, and whether the changes we observe are correlational in nature rather than causal.

There is no denying that the climate is changing, and indeed we might suggest constantly changing. This has been occurring for thousands if not millions of years, with recurring droughts, floods, tornadoes, earthquakes, heatwaves, and fires. This is nothing new and occurs both incrementally and seismically. For example, about 400,000 years ago, large parts of Greenland were ice-free with scrubby tundra basking in the Sun's rays on the island's northwest highlands. Evidence suggests that a forest of spruce trees, buzzing with insects, covered the southern part of Greenland. Christ et al. (2023) pins the time of Greenland's last melting to some 400,000 years ago. In 2016, a study of a unique bedrock core drilled from under the centre of the Greenland ice sheet suggested that most, or all, of the ice covering Greenland had melted away at least once during the last 1.1 million years. This resulted in elevating sea levels and fertile land. A comparable example closer to home is the loss of the land bridges to Tasmania and New Guinea when sea levels rose ~12,000 years ago. This occurred during the climate warming process that ended the ice age that lasted from 30,000BC to 10,000BC[1].

What is new, at least over the last 200 years, is that these events are today occurring and being recorded in areas which we call human settlements, which in the distant past (and often less distant past) were affected by significant climate change events such as floods, fire and hurricanes, but not impacting humans to the same extent witnessed today because there were no (or very few) humans living in many of the affected areas (be they a floodplain, bushland, desert etc.) in most nations. What we now see is the exponential growth of human beings (i.e., population explosion) who, throughout the world, are ever increasingly settling on land that is often marginal, if not totally unsuitable, for human habitation, as well as agglomerating in cities and megacities. In many countries, the infrastructure is not built to safe standards, and there is significant overcrowding and local poverty. This is a big part of the observed "climate" problem. Whether the land is suitable or not, it is relevant to acknowledge the poor stewardship of resources by humans - over farming, overfishing etc. The consequence is that the land is poorly managed with significant negative impacts when nature decides to erupt for whatever reason.

A question of importance, and much current debate, is what role human beings have played in creating these climate catastrophes? They might be catastrophic for humans as seen as climate warming, frequent severe weather events, and the impact on communities of these events, but possibly not so for the earth on which we live, given they have been occurring for millions of years and the earth is still here in its many revised (positive or negative) forms. The often-claimed suggestion is that humans caused *all of this*. One might question the extent to which this claim is valid (The science is very imprecise and subject to significant error bands). While it is true that humans have modified the sources of environmental degradation through developments designed to serve them well (so they typically believe) and have thus contributed to changes in the environmental context in which they reside and move around, it may well be that their contribution creates a correlational effect rather than a causal effect on the change in climate[2]. In other words, human interaction may indeed deliver many undesirable outcomes such as increased local air pollution and increased carbon emissions, but whether this has been enough in itself to cause (i.e., contribute significantly to) non-marginal changing climate that has been

occurring well before we built our high-density cities and encouraged sprawl, and we populated almost every part of the world, and generated significant global mobility, must remain unanswered or at least questioned without full proof [3]. *A priori*, correlation is not the same as causality, we might all agree, but to date the dominating causal thesis is the greenhouse effect linked to human activity, and it needs more careful consideration.

Time may show that the world will survive no matter what we do to reduce emissions, and that it may be time to stop the alarmist rhetoric which does nothing to support sensible sustainability initiatives. Given an interest in transport emissions, a key contribution, which are impossible to totally eliminate, we should reflect on the importance of transport to humankind's ability to cope with adverse weather events. How else are we going to support the communities that are affected if not by the transport of people and supplies to and from the affected areas?

A question that will remain unanswered for now is that when we eventually get CO_2 emissions, blamed significantly on the transport sector, to a level we believe is what we need to be at, will this make any difference to the preservation of this magnificent earth or not? Some of us might question the commentary of extreme activists and the disproportionate amount of research focussed on this topic.

We reiterate how important it is to distinguish between person-made microclimatic (local) impacts, some of which can be mitigated (with sufficient political will) by better building design, behaviour change programmes etc., and global effects which might be occurring anyway. A key reason why we blame humans for enhanced climate change beyond the catastrophic forces of nature in their absence is that humans are increasingly impacted because they are ever present everywhere, and they make unwise decisions like building on flood plains.

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Christ, A.J. et al. (2023) Deglaciation of northwestern Greenland during Marine Isotope Stage 11, *Science*, 381, Issue 6655 pp. 330-335 **DOI: 10.1126/science.ade4248**.

[1] **https://www.nma.gov.au/defining-moments/resources/separation-of-tasmania#:~:text=About%2030%2C000%20years%20ago%20an,Papua%20New%20Guinea%20and%20Tasmania**.

[2] **https://www.researchgate.net/post/Climate_Change_is_Correlation_Cause_and_Effect**.

https://www.quora.com/Is-human-caused-climate-change-an-example-of-confusing-correlation-and-causation-Why-or-why-not#:~:text=How%20do%20we%20know%20global,surface%20temperature%20would%20be%20255K.

[3] This commentary does not challenge the idea that the current episode of climate warming is due to the greenhouse effect of CO2 and other gasses in the atmosphere; however, it raises the question of what this will mean for the reconstitution of the earth on which we live.

12. Lower residential speed limits: let's stop the "car"nage

2 December 2024

Professor Stephen Greaves and Ray Macalalag explain why they support lowering residential speed limits for reasons of safety, environmental benefits, and the potential for more active and healthier lifestyles by encouraging walking and cycling.

The City of Sydney recently announced it would be lowering the default speed limit from 50 km/h to 40 km/h on all regional and council roads within its council area. Additionally, the city centre and other high activity areas with lots of pedestrians, cyclists and scooters are being considered for reductions to 30 km/h, putting them in line with some school zones and Centennial Park among others. This edict has unsurprisingly been challenged by motoring groups, industry and Premier Minns, who commented, 'You could walk quicker than that' and 'Sydney shouldn't be treated as a country town'. Aside from rankling residents of regional NSW, given average walking speeds are 5-6 km/h, perhaps Premier Minns was still thinking about the Olympic 100m where sprinters average around 35 km/h?

The arguments for and against lowering speed limits in urban areas are well-documented. The primary motivation is safety, not just for pedestrians, cyclists and other vulnerable road users but all road users. Higher speeds increase both the risk of a crash due to limits on our ability to react in time (typically one second to an unexpected event) and severity because kinetic energy imparted increases with the square of the speed[1]. According to the World Health Organisation a pedestrian hit by a car at a speed of 50 km/h has a roughly 20% chance of survival, with odds improving to 75% (40 km/h) and 90% (30 km/h). If they're hit by our growing population of SUVs, delivery vans and electric vehicles (much heavier as well as much quieter), the odds are stacked further against. Research conducted by the University of Sydney using 12 years of accident data for NSW from 2010-22 suggests that pedestrians comprise around 15% of fatalities despite travelling ten times fewer kilometres than the typical car[2]. Roughly half of all pedestrian/vehicle accidents result in a fatality/serious injury with one-third of these accidents occurring on 60 km/h roads and half occurring on 50 km/h roads. Additionally, the data show the relative risk of a fatal/serious accident reduces dramatically with lower speed limits – for instance dropping from 60 km/h to 50 km/h reduces relative risk by 30%, while dropping to 40 km/h reduces relative risk by 45%.

Additional arguments for lowering speed limits point to the potential fuel savings and environmental benefits of lower speeds. The relationships between vehicle speed, fuel consumption and emissions are highly complex and vary by vehicle make, model and vintage, but generally a speed of around 40-50 kph is considered 'optimal' although this overlooks the stop/start nature of urban driving. Noise is evidently reduced with lower speeds.[3] What is more irrefutable, is that slower speeds present a more amenable environment for cycling and walking, promoting active and healthier lifestyles in our continued battle with sedentarism. This has become particularly acute for our younger and older populations; on the one hand trying to reverse trends against driving children to school, on the other maintaining healthy aging for whom walking is the number one form of exercise.

The vocal naysayers point to economic impacts of increased travel and delivery times, along with increased potential for driver frustration, non-compliance and enforcement challenges. It is true, if we lower speeds, travel times will increase adding what amounts to a few minutes for the typical Sydney commute. Considering the average speed in Sydney is 30-40 km/h, dropping to as low as 20 km/h during the peak, this doesn't seem like a game-changer. Motorists will adapt or fill government coffers with fine revenue, many will still recall when default residential speed limits were 60 km/h. Realise also, we are talking very much about *local* streets, once the domain of children playing in the street or riding a bicycle without fear of being hit.

Premier Minns also spoke about Sydney as having "broader obligations than just those people that live and pay rates within its boundaries ... it's a major international city,". The reality is Sydney is sadly lagging well behind many 'major international cities' in adopting lower urban speed limits including London, Edinburgh, Paris, Rome and Stockholm. This is working directly against efforts to improve the liveability of this great city, compromising state and local government Movement and Place initiatives. We are now seeing whole countries take a stance, with Wales adopting a default 20 mph limit in 2023 and Scotland set to follow suit in 2025. Australia, with some of the highest default speed limits in the developed world is a notable non-signatory of the "*Stockholm Declaration*" adopted by 130 countries in 2020, advocating 30km/h limits in urban areas where "*vulnerable road users and vehicles mix in a frequent and planned manner*."

Perhaps it would be naïve to suggest that reducing speed limits alone offer a silver bullet solution. Many of our residential streets are wide with design speeds of 50-60 kph, creating a mismatch with lower speed limits. Generally, we have tried to address this through the installation of bone-jarring speed bumps and other 'traffic calming' fixes, which make travelling by cars, buses and bicycles unpleasant. Given a choice, perhaps we would all sacrifice a few kilometres of speed for a more pleasant ride, while simultaneously creating environments that are more pleasant for walking and cycling.

For the sake of our city and our children, let's stop the 'car'nage and lower residential speed limits.

References

[1] **https://www.itf-oecd.org/sites/default/files/docs/speed-crash-risk.pdf**

[2] **https://www.transport.nsw.gov.au/system/files/media/documents/2023/mbnov2023_01122023.pdf**

[3] **https://www.sciencedirect.com/science/article/pii/S0160412022005785**