

‘Gamifying the commute’: Nudge
interventions and their applicability in
managing public transport demand to reduce
greenhouse gas emissions.

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INTRODUCTION

In recent years, policy interventions designed to increase public transport usage in Aotearoa New Zealand have proliferated in transport planning and environmental policy. While road travel constitutes a fifth of New Zealand's greenhouse gas emissions, only 4% of total travel time in New Zealand is undertaken by public transport (Ministry of Transport, 2018; New Zealand's Greenhouse Gas Inventory, 2020) – a problematic finding considering the importance in reducing road travel to curtail the production of greenhouse gases (see Maizlish et al., 2017; Stanley et al., 2011). Accordingly, there is a pressing need to investigate new policy models that encourage public transport usage to reduce the impact of road-travel-related greenhouse gas emissions. While supply-side policy interventions have proliferated as solutions to improve public transportation and increase patronage (e.g. creating new bus lines, increase the frequency of services), *demand-side* policy interventions have been underexamined within policymaking. In an era of significant budgetary restrictions, new ways of thinking through public transport policymaking must be examined, and demand-side policy interventions offer cost-effective and potentially impactful solutions to reduce road travel through increasing public transport usage.

Historically, policy interventions in transportation planning have been designed under the assumption that people are *rational actors*, capable of making decisions that maximise their happiness, health, time, and financial goals (see Vigar, 2017; Reignar & Brenac, 2019). In recent decades, this idea has been challenged by many in the psychological sciences and behavioural economics, arguing that humans are often highly *irrational actors* and make decisions that do not necessarily produce the most beneficial outcomes (e.g. Etzioni, 2011; Maréchal, 2010).

Using this idea, a burgeoning field within behavioural science has begun to examine and recommend ways to encourage rational decision-making using specific policy interventions. Policymakers have begun to use these insights to influence the actions of individuals, groups, and broader populations using *nudges* – a term popularised by Thaler and Sunstein (2008). According to Thaler & Sunstein (2008), nudges are typically non-intrusive strategies for modifying behaviour, without restricting choices, by accounting for behavioural biases. Using insights from psychology and behavioural science, nudges have proliferated as potential policy solutions to reduce greenhouse gas emissions, with interventions ranging from reducing meat demand (Rose, 2018) to choosing renewable energy sources (Momsen &

Stoerk, 2014). Nudge interventions have also been widely employed in transport planning, most notably aiming to increase public transport usage and other sustainable forms of transportation (e.g. Anagnostopoulou et al., 2020; Avineri, 2012; Garcia-Sierra, 2015). While nudge interventions offer a potential solution to reducing New Zealand's greenhouse gas emissions but have not been widely used within transport planning thus far. However, this neglect offers a prime opportunity for policymakers in transport planning to engage more stringently with the behavioural sciences to encourage more sustainable modes of transportation, improve the well-being of patrons, and reduce traffic congestion while also reducing greenhouse gas emissions.

This essay proposes the use of nudge interventions to reduce greenhouse gas emissions in the transportation sector, specifically examining the use of nudges to promote public transport usage. Following the use of a policy intervention first used in Singapore and expanded on in a report by Alta Planning and the UK's Behavioural Insights Team (BIT) for Translink Canada, the essay explores the gamification of public transport use to 'nudge' passengers and reward them for making desirable travel choices. The essay begins by examining the three stages of developing policy interventions for demand-side management in transport planning outlined by Alta Planning's report. The essay then builds on the report's stages by examining how the proposed intervention would be developed and implemented, before outlining the potential outcomes sought, and the incentives placed on various parties. Next, the essay discusses what successful implementation would look like, before outlining potential challenges that may arise during the development process, and potential future steps for using psychological insights to increasing public transport patronage.

STEPS TO DESIGNING NUDGE INTERVENTIONS

In a report by Alta Planning and the UK's Behavioural Insight Team (BIT) for Translink Canada (Alta, n.d), thereafter called the *Translink Report*, three key stages are necessary for outlining and developing nudge interventions for encouraging public transport use. The following section outlines these stages, and examines how these stages may be applied to the specific New Zealand context.

1. Mapping out behavioural touch points

The Translink Report begins by outlining a 'behavioural map' which lays out a range of behaviours that contribute to public transport use (Alta, n.d). By breaking public transport use into different 'micro-behaviours', the Translink report argues that nudge interventions can target specific behavioural areas and increase demand without having to adjust often costly and time-consuming supply-side methods. Figure 1 indicates Translink's Behavioural Map, and the different potential psychological intervention points identified to increase public transport use.

Figure 1



Behavioural map of potential demand and supply-side nudge interventions for Translink Canada (Alta, n.d)

In a New Zealand context, much of the demand-side interventions proposed by Translink are applicable to New Zealand and could be implemented in areas with established public

transport networks. The following five outlines outlines how Translink's potential behavioural interventions could be applied in a New Zealand context.

- 1) Separate public transport cards (e.g. HOP in Auckland, Snapper in Wellington) could be combined to create a universal nationwide transport card, or be simplified with a universal registration website for the entire country. This would potentially reduce the often complicated registritive nature of public transport use and encourage interurban patronage.
- 2) Auto-refills could be expanded to all public transport networks in the country, if there are public transport networks without this feature already.
- 3) Text messages could be sent to patrons who have recently moved to new cities, providing them with information on new public transport networks and a link to register for a new card.
- 4) Marketing could be reframed to evoke personal values and identity. With marketing messages like COVID-19's "Team of 5 million", advertising campaigns could draw on New Zealand's collective identity to encourage New Zealanders to "do their part for reducing greenhouse gas emissions"
- 5) Local governments could be encouraged to gamify their public transport system to incentive off-peak public transport use.

The specific policy proposal outlined in this report will draw on Translink's 5th potential intervention, which encourages the gamification of the public transport system to incentivise off-peak public transport use to reduce greenhouse gas emissions.

2. Designing an intervention

Based on academic literature, the UK's Behavioural Insights Team (BIT) developed the EAST framework to help policymakers design and implement nudge interventions (Behavioural Insights Team, 2014). In order to encourage a behaviour, the EAST framework argues that four particular characteristics have to be met. Firstly, behaviours have to be easy, where individuals are not driven away by complexity or hassle. Secondly, behaviours have to be attractive, where individuals are 'captured' by specific environmental stimuli that encourages that behaviour. Thirdly, behaviours have to be social, where social norms, pressure, and notions of conformity are leveraged to produce the behaviour. Lastly, behaviours have to be timely, where prompts are specifically timed to produce the optimum chance of producing the behaviours.

While the EAST framework is set of overarching principles used to frame nudge interventions, it is also useful to do a stringent analysis of specific transport networks and identify particular barriers to shaping behaviour. As reasons for not using public transport vary widely due to the specific needs and psychological barriers of different individuals, groups, or target populations, there is a need to specifically clarify what behaviours are being asked and what groups of people are asked to make the change. Nevertheless, identifying potential policy interventions using the EAST framework provides a valuable frame for which to understand behavioural intervention and develop policy interventions that successfully can alter particular target behaviours. The policy intervention developed in this essay draws upon the BIT's EAST framework to shape what a potential intervention design could look like.

3. Testing what works

A core aspect of the methodology outlined by BIT are Randomised Control Trials (RCT). In an RCT, a target population is split into two treatment groups, with an intervention group receiving the targeted intervention and a control group receiving no intervention (Akobeng, 2005). The outcomes of the treatment are measured after a set amount of time and compared with the control group to see if the targeted intervention produces its desired outcome. Policymakers have commonly employed RCTs to test the design of nudge interventions (e.g. Ball & Head, 2020; Voyer, 2015), and the Translink Report recommends the use of them where possible (Alta, n.d). Accordingly, the policy intervention developed in this essay aims to use a RCT to test whether the intervention works, and if so, how to further improve on its design.

POLICY PROPOSAL

The following section explores one particular demand-side nudge intervention to promote public transport usage outlined in the Translink Report – the redistribution of public transport demand using gamification. Using the stages outlined in the previous section, this section outlines the rationale behind the use of this intervention and what a potential design might look like in New Zealand.

One of the major barriers to public transport usage, and one of the main concerns of frequent transport users, is overcrowding. Public transport is commonly cited as uncomfortable during peak hours (see Beirão & Cabral, 2007; Cantwell et al., 2009) and sees extensive pressure placed on services. One of the challenges facing transport planners is, thus, ‘nudging’ public transport users to shift their usage to off-peak times or underutilised routes to reduce pressure during rush hour. This would, accordingly, reduce the uncomfortableness produced by overcrowding, and attract greater usage of public transport over time by removing one of the major barriers to potential patrons. *Gamification* (lottery style incentives) is one possible intervention that can be used to help nudge public transport users to shift their use.

Gamification has already been successfully employed in Singapore to reduce demand during peak hour travel (see Lopez & Wong, 2017). Singapore’s Travel Smart programme sees public transport users earn *reward points* every time they take public transport, with particular times and routes being worth a greater number of points. Public transport users can redeem their reward points for money or a lottery for random prizes, and the Singaporean government have partnered with companies to offer their employees extra rewards. Figure 2 indicates the reward points gained by specific time periods, and by different ‘status levels’ of how often a user takes public transport (incentivising more frequent use).

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Figure 2

MONDAY - FRIDAY	BRONZE	SILVER	GOLD	PLATINUM
Before 6:15am <i>off-peak</i>	1x	1x	1x	1x
6:15 - 7:15am <i>decongesting</i>	3x	4x	5x	6x
7:15 - 8:45am <i>peak</i>	1x	1x	1x	1x
8:45 - 9:45am <i>decongesting</i>	3x	4x	5x	6x
After 9:45am <i>off-peak</i>	1x	1x	1x	1x

Reward points available for specific time periods on Singapore's Travel Smart Program (LTA, n.d).

The proposed nudge intervention for New Zealand would operate on the same principles as used by Singapore. Reward points would be automatically calculated using the rider's travel cards, with off-peak and underutilised routes being worth more points. Reward points would be equal to an entry into a lottery for particular prizes, with more points being worth more entries into the lottery. This lottery would be held once a month, with reward points being 'wiped' after each month to avoid the 'snowballing' of points. Unlike the Singapore model, money would not be able to be redeemed to keep the programme simple and easy to understand. Potential prizes of the lottery could include a month of free rides, or food vouchers, for example.

According to BIT's EAST Framework, successful nudge intervention have to be (1) easy and free of hassle, (2) attractive and incentivised to users, (3) rely on social norms and pressure, and (4) must be implemented at particular times. The following policy intervention meets, and aims to meet, these characteristics in the following ways:

- a) The policy intervention should aim to be hassle free as possible. As such, reward points would be automatically calculated upon 'tagging on and off' travel cards, and patrons should be provided easy access to viewing their points via a centralised and well advertised website. Patrons should be reminded of the lottery date (and if they have won or lost) via text message to encourage further use.
- b) The system and the potential rewards to be gained from using public transport should be well advertised to potential users through a wide-ranging marketing

campaign, text messages, and emails. Public transport patrons could be targeted on public transport using a specialised campaign encouraging users to shift their use to off-peak times. Crucially, the rewards users are able to gain should be obvious and clear to the user at all times to incentivise users.

c) The policy intervention should aim to be attractive to new users through the social norms of others. Advertising campaigns stressing the prizes people are able to win, accompanied with stories of how these rewards helped particular users, would benefit with attracting new users.

d) The policy intervention should aim to be implemented at the time of highest usage (e.g. March), specifically targeted at users at peak and over-utilised routes, and be led by a high profile and extensive marketing campaign.

In implementing this policy intervention, policymakers should first run a randomised control trial (RCT) to test its effectiveness. A fixed number of public transport users could be targeted via text messages and emails to be recruited in the trial, and incentivised with the chance of earning a lottery reward. This population-of-interest would then be divided into a control group and a intervention group, which would have access to an alpha-version of the gamified reward system. After a set amount of time, the results of these groups would be compared to test whether demand was able to shift to a sufficient manner. Following this RCT, policymakers could improve upon the design of the policy intervention based on its effectiveness or decide not to go ahead with employing it further.

OUTCOMES SOUGHT

The proposed nudge intervention seeks to shift public transport demand to off-peak times and underutilised routes in order to reduce pressure on particular public transport services. This aims to reduce the uncomfortableness of public transport use, which is commonly cited as one of the major barriers to patrons. This intervention, therefore, aims to remove one barrier to public transport use, thereby increasing ridership and reducing greenhouse gas emissions through ‘getting commuters out of cars’ and by having less vehicles on the road.

INCENTIVES ON PARTIES

The proposed nudge intervention employs a well-known psychological process, the *optimism bias*, to encourage greater public transport usage (Alta, n.d). The optimism bias states that people tend to overestimate the possibility of a rare positive event happening to them (Sharon, 2011), and is widely used in gambling (Rogers, 2011). The targeted population of potential public transport users would be incentivised by the chance of winning a prize (e.g. a month of free rides) through public transport use. In addition to encouraging new users, the scheme would also incentivise public transport users to take more trips to increase their chance at winning. Accordingly, this nudge intervention would aim to increase public transport use by incentivising users with the chance of winning a lottery-based prize.

SUCCESSFUL IMPLEMENTATION

Successful implementation would see the scheme in all urban public transportation networks, with possible expansion to nationwide inter-urban transport networks. Ideally, this would produce observable results in shifting demand to off-peak times and underutilised routes (available to local government data collection teams), and see an increase in public transport use.

CHALLENGES FACING PROPOSAL

The first challenge facing the implementation of this nudge intervention is providing incentives for different local governments to (1) become partners in this project, and (2) implement the technical aspects of gamification onto their systems. One possible solution to this challenge would be providing conditional advertising funding that would promote public transport use in local government areas who sign up for the scheme.

A second potential challenge facing this policy intervention is the different travel cards and technical systems in each independent transport network. This would implementation of policy in each independent network, which may be time consuming and costly. Recent announcements for a nationwide travel card in 2026 (George, 2018) would avoid this challenge and allow the implementation of the scheme on a national scale. Potentially, waiting until his card is fully implemented may be the most timely method to implementing this policy.

The third major challenge facing implementation would be perhaps the most difficult to solve; funding. In a time of limited budgets, prizes would have to be relatively small and cost little, which may reduce the incentives for users. There are two possible routes for incentivising users – (1) many small prizes (e.g. one month of free travel), or (2) a small number of large prizes (e.g. a weekend holiday), to reduce costs. Prizes that have a future cost attached to it (e.g. loss of money from free travel as a prize) would be perhaps the most efficient and cost-effective form of incentive.

NEXT STEPS

If the proposed intervention is successful in promoting public transport use, other nudge interventions in demand-side public transport policy could be potential next steps for using psychological insights for reducing greenhouse gas emissions. Possible nudge interventions (as outlined by the *Translink Report*) include:

1. Referral programs, such as offering free rides in exchange for getting others to use public transport for a week.
2. Incentivising people to send free ride vouchers to others to let them know about public transport and encouraging them to use it

3. Reminding commuters of the time cost of driving in comparison to public transport use.

CONCLUSION

This essay has examined the potential use of nudge interventions to reduce greenhouse gas emissions, specifically focusing on the impact of nudge interventions to promote public transport use. Using a gamification model previously employed by Singapore's Land Transport Authority, the essay has outline how gamification could be used to shift demand to off-peak times and underutilised routes in order to reduce stress and uncomfortableness at peak times to encourage public transport use. Using approaches to demand-side policy interventions employed by the Translink Report, the essay argues that gamification could be an opportunity to increase public transport usage but is not without challenges. Support from both central and local government will be needed, and new models of funding may need to be developed. Nevertheless, psychological insights provide a powerful opportunity for reducing greenhouse gas emissions, and should be investigated further to develop new cost-effective forms of policy.

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