HOW PEOPLE RESPOND TO COMPLEXITY IN PUBLIC TRANSPORT FARES

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Infrastructure Victoria

Independent insight.

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EXECUTIVE SUMMARY

Introduction

Infrastructure Victoria (IV) is currently undertaking a program of research on possible improvements to the Victorian public transport fare structure for both the metropolitan and regional transport system. As part of this, IV are seeking to understand how people respond to complexity in public transport fares to ensure that fare structures they are considering operate efficiently in theory and in practice.

IV commissioned SGS Economics and Planning (SGS) and the Behavioural Insights Team (BIT) to examine how people respond to complexity in public transport fares. SGS and BIT have examined fare complexity across four streams of research:

- A comprehensive literature review to find the most relevant research on how people engage with complex pricing structures;
- Expert consultation with five academics and policy makers to uncover additional insights and how these may apply in a specifically Victorian case. This research was used to triangulate the literature review content;
- An online experiment designed to test how a panel of public transport user types from across society responded to different levels of complexity in transport fares. A total of 2011 people participated in the experiment; and
- User consultation (focus groups and phone interviews) engaging with public transport users on their understanding of, and behaviour in response to, pricing complexity. In total, 39 people were interviewed or participated in a focus group.

Complexity in public transport fares

Public transport fares are often comprised of different structural elements and complex fares can contain several elements. Australian states and territories use different combinations of pricing features in their capital cities. Half of the cities use a flat fare, three use a zonal system and one uses a distance-based fare. Some also use mode-based pricing and peak pricing. The figure below shows the fare elements that are the focus of this study.

PUBLIC TRANSPORT FARE ELEMENTS

PEAK/OFF PEAK PRICING	MODE-BASED PRICING	DISTANCE-BASED PRICING	ZONE-BASED PRICING
Fare has an additional cost imposed when the system is at or near capacity. There is a reduction in cost for using the system outside times when the system is at or near capacity	Fare is determined by the mode of transport selected, e.g. tram, bus or train travel have different prices	Fare is determined by distance, e.g. per kilometre	Fare is distance-based and determined by the number of zones a trip covers

There are different rationales for applying both flat and differentiated fare structures. Over recent decades, responsible transport authorities have opted for flat fare structures in favour of simplicity, administrative efficiency, low fare collection costs, and perceived reductions in customer confusion (Huang et al, 2016; Yoh et al, 2012).

Arguments for flexible and differentiated fares date back to the 1980s, these include:

- **Social optimum:** fares that are differentiated by distance help promote the socially optimal use of public transport because they better reflect the marginal cost of service provision.
- **Social equity:** a fare structure that creates higher fares for disadvantaged users can compound income inequality within a city, and one that creates lower fares can effectively reduce inequality.
- **Cost recovery:** a differentiated fare structure is more effective at increasing an operator's revenue than a flat fare.

The literature suggests that people prefer 'simple tariffs' and display a general preference for predictable prices across different commercial markets (Bonsall, 2007). This is likely due to the extra cognitive effort needed to comprehend overly complex fares being perceived as an addition to the transaction cost of the service (Nahata et al., 1999; Szabo, 1999).

When fares become too complex they do not necessarily elicit the intended response from public transport users. Across multiple consumer markets, Grubb (2015) argues that consumers are often unsuccessful when selecting the best prices because they are confused comparing prices, search too little, or show inertia when moving away from past choices and default options.

Lyons (2006), when discussing choice-making behaviour in public transport options, reveals individuals are not necessarily making decisions based on the most cost-effective options. Rather, users choose options that satisfy the minimum requirements. This means that people are not motivated to search for more information or explore alternatives once they find an option which meeting their minimum requirements.

The way that fares are framed and presented can often be just as important as the actual changes themselves. Bonsall et al (2004; 2007) suggest that people deal better with complex fare structures when they follow an obvious logic. This is supported by qualitative research prepared by the UK Office of Rail Regulation (2011) which finds that people can identify logical elements of a fare structure, such as:

- higher prices for longer journeys;
- peak being more expensive than off peak; and
- discounts for tickets purchased in advance.

The transaction system itself can have an impact on how travellers respond to different transport pricing fares. When the NSW Government introduced the Opal smartcard system, people became less sensitive to price because they were less engaged with the actual payment process. However, lower income earners, students and pensioners did maintain price sensitivity due to their lower disposable income. This indicates part of the effectiveness of a fare structure depends heavily on how well it is supported by promotional activities and cues/changes in the system.

Overall though, fare structure complexity is only one of many factors directly influencing user decision making and behaviour (Liu et al, 2017). Other commonly accepted factors include the reliability of service, comfort levels, safety, over-crowding, wait times, transport mode and journey times.

Experiment

The project team worked with IV to design an online experiment to rigorously test how different fare structures affect comprehension and user ability to apply fares to journeys. The experiment complemented the earlier stages of the project and the user consultation by providing an unbiased quantitative analysis of behaviour. In addition, the nature of the randomisation allows us to draw causal conclusions about the role of complexity on decision-making.

EXAMPLE INSTRUCTIONS

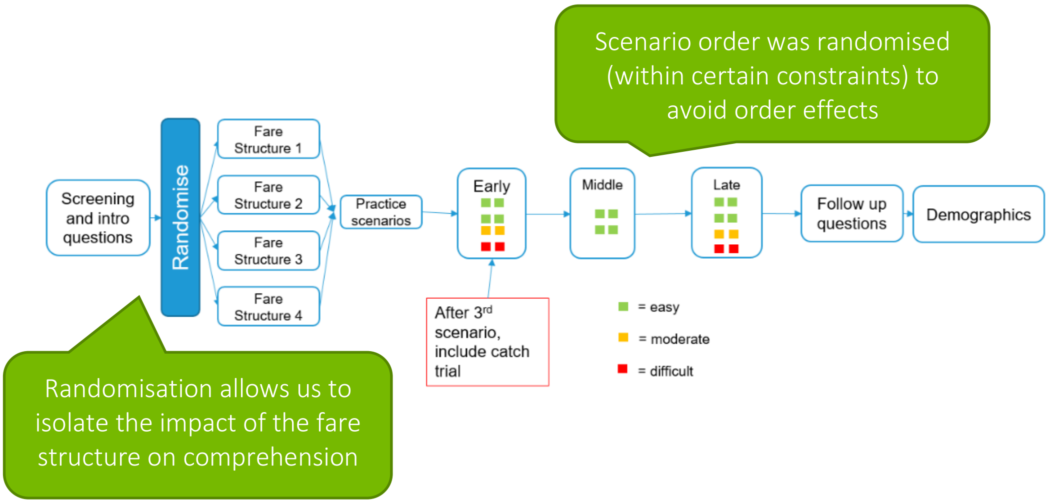
> We would like you to think of a friend who is trying to understand public transport in a new city. We are going to show you the public transport fares for the city, and some potential options for taking trips via public transport in that city. We would like you to imagine that a friend has asked you **find the cheapest journey for them**, and is not concerned about the time, route, or mode of transport.

After the introductory and screening questions, respondents were provided with instructions for the task. This asked them to imagine that they were advising a friend from another city on how to use the public transport system. We specified that the friend was not concerned about distance or timing – the only concern was finding the cheapest journey.

Respondents were advised that they would see a range of scenarios with potential journey options, and that they would need to choose the cheapest. Following this, respondents were shown one of four possible fare structures. A visual summary of the trial is below.

Broadly, the fare structures in the experiment were:

- A peak charge;
- A peak charge, plus a modal charge;
- A peak charge, plus a distance-based charge; and
- A peak charge, plus a modal charge, plus a distance-based charge.



User consultation

The project team engaged with public transport users to explore the thinking behind their responses to complex public transport fares. This involved a combination of focus groups (with nine to ten participants each) and ten phone interviews (one-on-one).

Like the online experiment, participants were presented with fare structures of differing complexity and a scenario with journey options. However, unlike the experiment, the user consultation focussed on the qualitative feedback from participants over a smaller number of scenarios. Participants were asked to discuss how difficult it was to engage with the fare structures and why. They were also asked about the factors or 'rules of thumb' they used to work out the advice they would give their friend.

Broadly, the fare structures in the user consultation were:

- A peak charge;
- A peak charge, plus a modal charge;
- A peak charge, plus a distance-based charge;
- A peak charge, plus a modal charge, plus a distance-based charge; and
- A peak charge, plus a modal charge, plus a distance-based charge, plus a multi-modal trip.

Findings and conclusions

All of the research streams gave consistent findings about the response to complexity. These findings have formed the conclusions below.

Simpler elements are easier to understand.

Modal and peak charges were relatively easy to understand for participants in both the experiment and user consultation. Distance charges were the hardest element to understand. Given the difficult nature of this calculation (which took longer to compute), participants often left consideration of this fare element till last.

This was the case despite having simple multipliers, for example, 10 cents per kilometre. This indicates that distance charges are likely to be even more difficult to calculate in a real world application that would probably require multipliers that don't have round numbers, for example 7 centre per kilometre.

Distance charges are more likely to be successful in combination with very simple elements, particularly a flat base fare. As noted in the literature review, harmonizing flag fall prices across modes in Sydney helped users to understand distance-based charges across a whole trip. This corresponds with participants in the user consultation who struggled to add a distance-multiplier on top of a base fare that differed for modes or peak times. Still, however it is simplified, any distance charge is likely to be understood less easily than other fare elements.

Simple fixed zones (similar to Melbourne's current system) may result in a better understanding of the fare structure than a straight distance charge. However, we would expect zonal distance charges (similar to Sydney's current system for trains) would likely still result in poor comprehension. Firstly the literature suggests that individuals can more easily comprehend prices that are fixed amounts (scalars), as opposed to sliding scales (vectors). Secondly, there is likely to be a lack of understanding of what exactly 5 or 10 kilometres looks like in practice, as opposed to understanding a fixed zone.

As complexity increases, comprehension declines

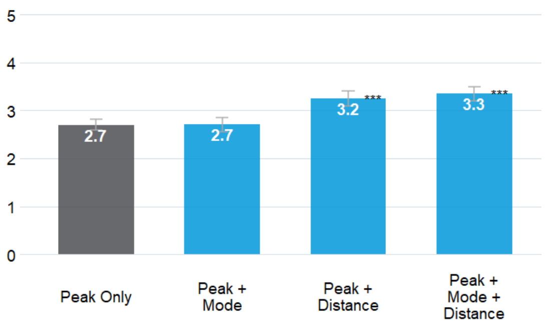
Extensive literature supports the idea that consumers do not deal with complexity well, and typically do not choose the best prices when faced with more complex pricing structures. The experiment and user consultation confirmed the literature. Comprehension[1] was lower and there were slower reactions times for the more complex fare structures.

Combining multiple elements in the one fare structure particularly resulted in a decline in comprehension. Most users could handle two elements in the one fare but three elements seemed to be a tipping point, especially when the third element was a distance charge.

[1] Fare structure comprehension was measured by the number of scenarios which experiment respondents correctly chose as the cheapest transport journey.

On more subjective measures, more complex fare structures also did poorly. We asked respondents to rate (out of 5) how difficult they found the fare structure – once again, the most complex structure was perceived as the most difficult. And, when asked at the end of the task to recall what sorts of rules applied in their scenario, more complex fare structures had lower rates of recall. In fact, each additional feature in a fare structure led to approximately 15 per cent fewer people able to correctly recall all the rules that applied.

ONLINE EXPERIMENT: REPORTED DIFFICULTY (OUT OF 5)



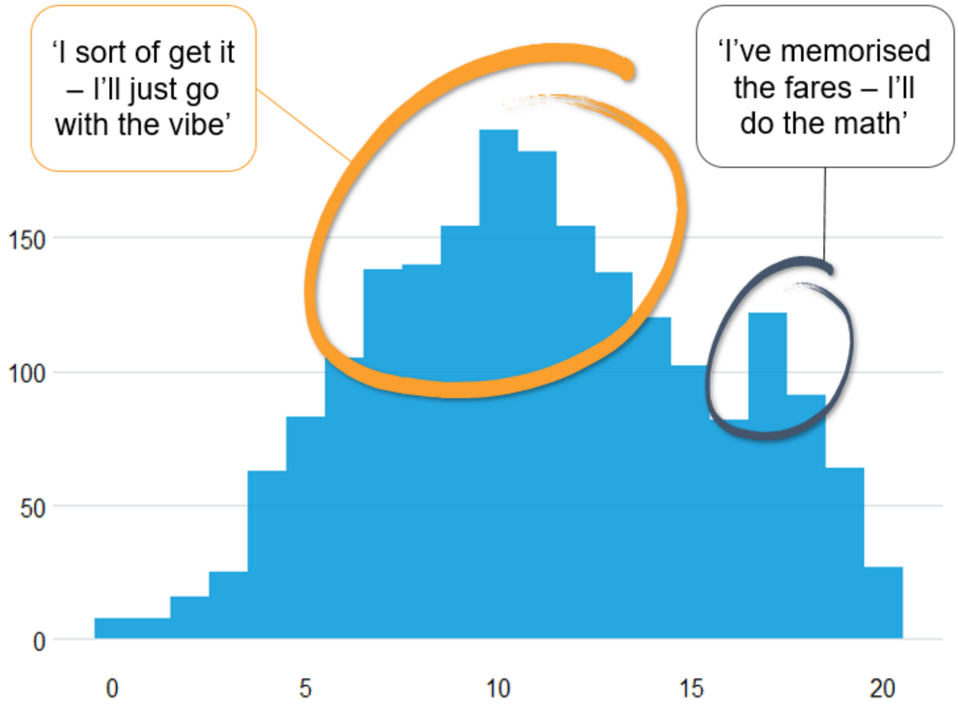
***p=0.001

Some participants also showed frustration and even disengagement from the activities when presented with the most complex fare structures. This indicates that public transport users may not fully engage and respond to a system that is overly complex and combines multiple elements. However, as noted further below, regular users may learn just enough over repeated trips to respond and choose the best option for them.

Users approach the tasks differently

Different people use different approaches when trying to understand fare structures and make travel decisions. The image below provides a histogram of scores across all treatments in the experiment – there appear to be two distributions overlayed on top of each other. Our hypothesis is that these distributions (or peaks) represent at least two different approaches to the task.

EXPERIMENT: HISTOGRAM OF SCORES (OUT OF 20, ALL TREATMENTS)



The peak on the right may represent "problem solvers" – people who internalised the fare structure as best they could and sought to "do the math". Notably, there were fewer people in this group as complexity increased. This may represent people deciding to avoid trying to calculate the exact fares as complexity increased.

The peak on the left may represent "intuitors" a broad group that takes a less calculated approach, and rely more on "heuristics" or mental shortcuts – simple rules of thumb that allow a person to approximate what the right answer is. The specific approach may vary from respondent to respondent – user consultation suggests that some might focus on a single element, whilst others might focus more on their general "feelings".

Participants in the user consultation identified a range of rules of thumb and approaches that intuitors adopt. These included those motivated by a single fare element, those motivated by feeling, those who ignore seemingly irrelevant information and those who ignored overly difficult elements. The table below gives a summary of these styles.

Notably, it appears from the experiment that the majority of respondents are intuitors of some sort, and this group grows as the complexity of the system increases. This suggests that fares likely need to be designed with intuitors in mind, with only the most effective elements and salient, well-explained differences between fare elements.

USER CONSULTATION: FARE CALCULATING STYLES

Style	Findings
Problem solver	As expected, a large number of participants attempted to work out the correct value of the fare to the cent, by using a mental arithmetic or by using a mathematical process by developing steps to determine the cheapest travel option.
Motivation by a single fare element	Some participants assumed a certain fare element would make such a significant impact on the total fare, that they could simply ignore other fare structure elements in their calculation. For example, some participants assumed that off-peak is always cheaper, regardless of any other fare structure elements. Another example that came up was that some assumed that trams were always cheaper than trains, regardless of any other fare structure elements.
Motivation by feeling	In contrast, some participants chose their answers based on what they felt may be cheaper by looking at the possible travel options and selecting the choice they believed would be cheaper without consulting the fare structure at all.
Irrelevant information ignorers	Some participants used a system to rule out what they perceived to be irrelevant information. This happened in either one of two cases: When participants anticipated that a certain fare element would be of identical value across travel options. For example, if the base fare was identical across two possible travel options, some participants simply ignored this. When participants perceived that a certain fare element was trivial or insignificant to the overall calculation that they decided to ignore the element due to the overwhelming complexity. For example, the distance component was ignored by some participants when the distance travelled in a certain trip was insignificant.
Difficult element ignorers	Some participants completely ignored the fare element (most often, the distance component) that they perceived would be most difficult to compute and assumed that the other fare structure elements would be sufficient for the calculation.

There is potential for learning, but it depends on feedback

There was no evidence in the experiment that any of the treatments resulted in respondents learning the fare structures faster. However, the design of the task was focused on measuring complexity, with learning a secondary objective. Firstly, the level of feedback provided was limited – this was by design, as we sought to mimic the current set up of the Myki system (where there is minimal direct feedback about how much a particular trip costs).

In contrast, user consultation participants in the focus groups and interviews did report that they were able to learn as they became familiar with the calculation process across the scenarios. This learning process is distinct from that in the experiment because participants in the user consultation received feedback after each scenario and discussed their approaches as a group.

Additionally, it is important to note that the trial was aiming to measure learning *about the system as a whole*. When considering individual travel choices, particularly for regular users, what is relevant is learning *about specific journeys*. Evidence from the literature, and from our discussions with experts, suggests that whilst people may not be adept at learning broader systems, they can typically learn about how those systems impact on them in particular, especially if they interact with the system regularly.

Framing and presentation will impact comprehension in the real world

Literature suggests that more intuitive structures are more easily understood. The experiment found that modal differences were very easy to understand (likely due to the differences being very salient), but there was some confusion about exactly when peak charges applied. Hence, how the elements of the fare structure are presented, and what supporting information and promotion there is in the system, will greatly impact understanding. The results indicate that most user will struggle to understand a fare once a third element is added to the structure, however, this impact may be mitigated by effective framing and presentation.

Initiatives that provide guidance on the features of a system – especially where there may be thresholds or boundaries that could cause confusion, such as zones or peak times – will be particular influential in ensuring users understand how a journey might impact their fare. An example of intuitive presentation is the Free Tram Zone in the Melbourne CBD. Users are given clear and salient signals with on-trip announcements and signage at tram stops – both inside the zone, and just outside it. Again, presenting information like this is especially relevant if a majority of public transport users are intuitors, and are unlikely to completely internalise a fare structure.

There is some potential for the role of technology, such as smart phone applications, in overcoming the complexity, both by providing easy access to information and in presenting the that information in a timely and effective way. The impact of these technological interventions is likely to be limited, however, because interactions with public transport don't require a technology interface. The technology solutions already exist but use is low. Therefore, adoption of the technology is the threshold issue for any impact it may have. Given public transport users are a captive audience who are physically present when consuming the service, more effective interventions are likely to be found in the presentation of information at key locations throughout stations, stops and onboard services.

1. INTRODUCTION

The complexity of public transport fare structures can impact how effective they are in achieving a range of economic, financial and social objectives. This project seeks to understand how people respond to this complexity to help ensure that Victorian fares are efficient, both theoretically and practically.

1.1 Background

The Infrastructure Victoria (IV) is currently undertaking a program of research on possible improvements to the Victorian public transport fare structure for both the metropolitan and regional transport system. As part of this, IV are seeking to understand how people respond to complexity in public transport fares to ensure that fare structures they are considering operate efficiently in theory and in practice.

IV commissioned SGS Economics and Planning (SGS) and the Behavioural Insights Team (BIT) to independently examine how people respond to complexity in public transport fares. The partnering of SGS and BIT has combined complimentary skills in Victoria's transport system and behavioural insights, to align with the needs of this study.

The project involved significant research and stakeholder engagement with:

- Experts in the fields of transport planning, and behavioural science
- People who use public transport, including metropolitan and regional users, and those who only use public transport occasionally.

1.2 Purpose

Public transport fares are often comprised of different structural elements and complex fares can contain several elements. The most typical fare structure elements are described in Figure 1. These elements were the focus of this study.

FIGURE 1: PUBLIC TRANSPORT FARE ELEMENTS

PEAK/OFF PEAK PRICING	MODE-BASED PRICING	DISTANCE-BASED PRICING	ZONE-BASED PRICING
Fare has an additional cost imposed when the system is at or near capacity. There is a reduction in cost for using the system outside times when the system is at or near capacity	Fare is determined by the mode of transport selected, e.g. tram, bus or train travel have different prices	Fare is determined by distance, e.g. per kilometre	Fare is distance-based and determined by the number of zones a trip covers

SGS and BIT are investigating how people respond to complexity, and to understand how much complexity they can handle. This is achieved by analysing how people respond to the various fare structure elements, and the cumulative significance of packaging various elements together to develop an overall fare structure.

The research considers the heuristics and approach to problem solving methodologies used by public transport users to make decisions when faced with complex fare structures. These thought processes can be incorporated to better design a fare structure that makes calculating fares intuitive for an average user.

The project outcomes will help ensure that any proposed options for a new fare structure will operate efficiently both theoretically and practically. This will prevent an overly complex system that discourages use of public transport or leads to public transport users making 'irrational' travel decisions.

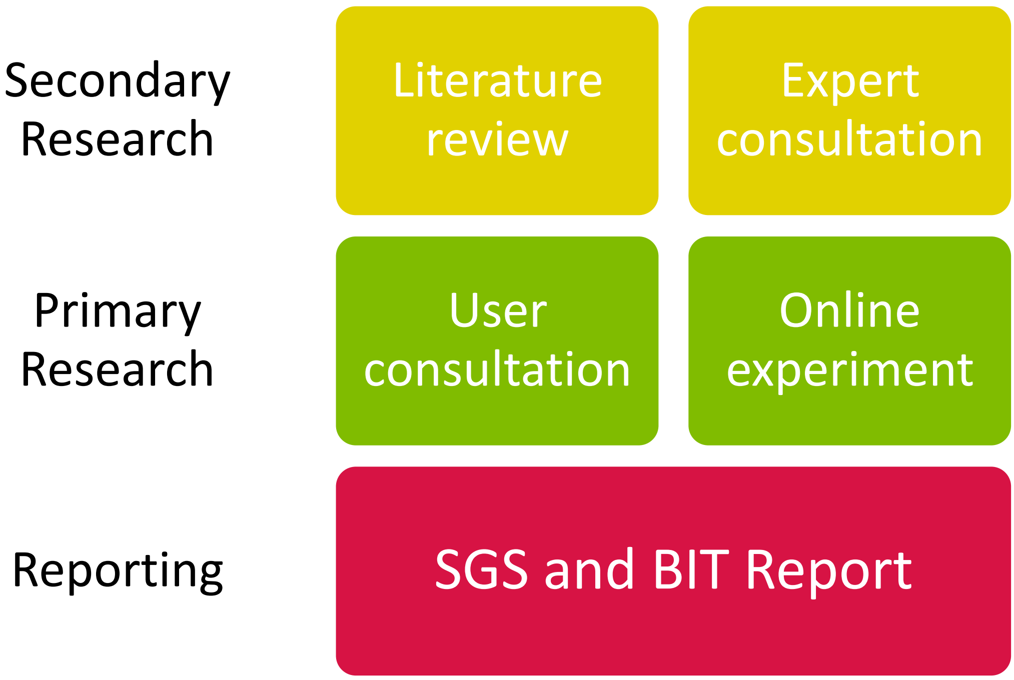
These outcomes are consistent with the objectives set by IV for a new public transport fare:

- To promote the socially optimal use of public transport
- To promote equity and social inclusion.
- To ensure adequate farebox revenue is generated to support government cost recovery objectives and the value and reliability of the revenue stream.

1.3 Research approach

The research approach involved two streams of primary research and two streams of secondary research to investigate fare complexity from several perspectives.

FIGURE 2: RESEARCH COMPONENTS



Secondary Research

- A comprehensive literature review to find the most relevant research on how people engage with complex pricing structures. This research informed the approach and design of the user consultation (primary research tasks).
- Expert consultation with academics and policy makers to uncover additional insights and how these may apply in a specifically Victorian case. This research was used to triangulate the literature review content. Five people were interviewed in total.

Primary Research

- An online experiment designed to test how a panel of public transport user types from across society responded to different levels of complexity in transport fares. The experiment ran from 28 February 2019 to 8 March 2019, and a total of 2011 people participated.
- User consultation (focus groups and phone interviews) involved direct engagement with public transport users on their understanding of, and behaviour in response to, pricing complexity. Through this task the project team explored the impact of discrete individual elements of fare structures as well as the combined effect of complex elements. In total, 39 people were interviewed or participated in a focus group.

Reporting

- The findings are presented in this report, focussed on the areas which are most relevant based on IV's research questions in the project brief.

1.4 Report outline

The remainder of this report is structured as follows:

- Section 2 presents a literature review which examines how people engage with complex pricing structures, with a focus on transport pricing policy in Australia and the behavioural psychology of fare complexity.
- Section 3 outlines the method and design of the online experiment, and a summary of how individuals responded to different levels of complexity in transport fares.
- Section 4 details the user consultation procedure, describes the selection process to obtain the sample of public transport users, and provides a summary of findings from participant responses.
- Section 5 provides conclusions by summarising the insights from the various streams of research conducted as part of the project.

This report is also accompanied by a Data Attachment which provides detailed results of the online experiment.

2. LITERATURE REVIEW

Public transport fares can be designed to promote socially optimal use of services, social equity and cost recovery. However, complexity in the fare structure can impede decision making and perceived fairness. Behavioural insights can help us understand how and why people respond to complexity in the way they do.

2.1 What are the different features of transport pricing?

Transport fare structures

Public transport fare structures vary across jurisdictions and generally fall into two categories: flat (all users pay the same fare) and differentiated (users pay a fare which varies in response to several factors relating to their trip) (Liu et al, 2017; Yoh et al, 2012). These factors are summarised in the text box below under different 'fare types'. Flat fares, mode-based distance-based fares and zonal fares are used in Australia. The fare types are often combined with additional subsidies and incentives, such as peak surcharges and daily caps.

FARE TYPES

- **Flat fare:** passengers are charged the same fare.
- **Mode-based fare:** different fare for different modes i.e. train, tram or bus.
- **Distance-based fare:** determined by distance for example, per km.
- **Zonal fare:** fares are flat within zones but stepped across zones (for longer distances).
- **Time-based fare:** dependent on how long a trip lasts.
- **Quality-based fare:** related to the service a user receives, for example, express, short turn or local services.
- **Cost-based fare:** based on operating costs, for example, maintenance and wages.
- **Route-based fare:** associated with which zones a bus goes through such as CBD, residential zones, work places or tourist places.
- **Market or consumer-based fare:** depends on the frequency of use, willingness to pay and discounted tickets.

SUBSIDIES AND INCENTIVES

- **Peak surcharges:** additional cost imposed when the system is at or near capacity.
- **Off-peak discounts:** reduction in cost for using the system outside times when the system is at or near capacity.
- **Advance payment savings:** reduction in the cost in exchange for early payment.
- **Daily and weekend caps:** price ceiling for unlimited journeys within a day or hour.
- **Targeted subsidies:** discounts for students, seniors and concession card holders, people with disability and other groups.
- **Reward functions:** for example, lottery-based incentive schemes

Source: SGS Economics and Planning, adapted from Fleishman et al 1996; Liu et al, 2017; Gwilliam, 2017; Rey et al, 2015.

Fare structures in Australia

Australian states and territories use different combinations of pricing features in their capital cities. The fare structures used across jurisdictions are summarised in Table 1 below and described in more detail in the Appendix.

All cities have a smart card system in place. Half of the cities use a flat fare, three use a zonal system and one uses a distance-based fare. Various subsidies and incentives are used in combination with these basic structures. The most common of these were subsidies for specific groups, off-peak discounts and capped fares. The transport experts interviewed for this project generally noted that the current systems are not overly complicated, and more features could be added without substantially reducing user comprehension.

TABLE 1: SUMMARY OF AUSTRALIAN JURISDICTIONS – PUBLIC TRANSPORT FARES

Capital city	Smartcard system	Fare Types	Subsidies and incentives
Sydney	Yes	Distance-based and mode-based	▪ Off-peak discounts ▪ Daily and weekend caps ▪ Advance payment savings ▪ Targeted subsidies
Melbourne	Yes	Zonal	▪ Limited off peak discounts (train only) ▪ Daily and weekend caps ▪ Targeted subsidies ▪ Advance payment settings
Adelaide	Yes	Flat fares	▪ Inter-peak discounts ▪ Targeted subsidies ▪ Advance payment savings
Perth	Yes	Zonal	▪ Savings when using smartcard system ▪ Targeted subsidies
Hobart	Yes	Zonal	▪ Off peak discounts ▪ Weekend cap ▪ Targeted subsidies
Darwin	Yes	Flat fare	▪ Targeted subsidies
Canberra	Yes	Flat fare	▪ Off peak discounts ▪ Calendar month cap ▪ Targeted subsidies

Source: SGS Economics and Planning, collated from relevant State Government public transport web sites.

2.2 Why not a flat fare?

The rationale

There are different rationales for applying both flat and differentiated fare structures. Over recent decades, responsible transport authorities have opted for flat fare structures in favour of simplicity, administrative efficiency, low fare collection costs, risk avoidance and perceived reductions in customer confusion (Huang et al, 2016; Yoh et al, 2012). Flat fares are also used by providers as a measure of cross subsidy in integrated transport systems with varying levels of demand across modes (Gwilliam, 2017).

Some argue that the use of flat fare structures is due, in part, to a lack of understanding of the impacts of implementing distance or time-based pricing (King & Streeting, 2016). Arguments for flexible and differentiated fares date back to the 1980s (Yoh et al, 2012; Cervero 1981). Differentiated fare structures can promote the socially optimal use of public transport, promote equity and social inclusion and generate revenue to support cost recovery. The literature supporting these benefits is outlined further below.

A social optimum

Fares that are differentiated by distance help promote the socially optimal use of public transport because they better reflect the marginal cost of service provision. The literature suggests that this improves allocative efficiency and equity across transport systems (Yoh et al, 2012; Huang et al, 2016; Liu et al, 2017). Yoh et al (2012) argue that varying fares to reflect differences in costs would encourage users to:

- consume more inexpensive trips, and
- use discretion in consuming more expensive trips.

For example, it is possible for distance-based pricing to attract new, inexpensively priced short-trip riders who might have previously found $1.50 for a 'four-block ride' to be too much (Yoh et al, 2012).

A study by Otto and Boysen (2017) found zone-based charges to be more robust and effective at exploiting a user's willingness to pay than traditional distance-based fares. This is supported by Sharby and Shiftan (2012 p.69), who evaluated the introduction of a simple five zone fare system with free transfers in 2008 in Haifa, Israel and found "when a complex fare scheme was simplified to a zonal fare structure and free transfer was introduced, people shift to public from private transport".

Similarly, scarcity in the system can be managed by peak surcharges. When high demand in busy periods cannot be met with the limited capacity, a peak surcharge will encourage flexible users to travel at a less busy period and leave space available for those who must travel at peak hour. Wang et al (2017 p.1571) found that the variation of users' responses to fare change at the station level indicates that a 'more complex fare policy could be implemented for multiple purposes, such as increasing revenue or mitigating crowding'.

Social equity

There is debate about whether distance-based fare structures improve social equity (Huang et al 2016; Faber et al, 2014). A structure that creates higher fares for disadvantaged users can compound income inequality within a city, and one that creates lower fares can effectively reduce inequality. Spatial modelling by Faber et al (2014) found that distance-based fares are beneficial for minority and low-income users in Utah. However, this result is largely dependent on settlement patterns and whether disadvantaged people tend to live in the inner city or urban fringe.

Groups located on the urban fringe can be negatively impacted because they typically travel longer distances (Faber et al 2014; Gwilliam, 2017). As noted in the expert interviews, it is mainly lower income households who live in the outer suburbs of Australian cities like Sydney and Melbourne. These disadvantaged groups would pay higher public transport fares than higher income earners in the inner city under a distanced-based pricing scheme.

While this debate is primarily focused on distance-based fares, social equity can be impacted by any differentiation of fares. For example, the cheaper fare for bus trips in Sydney gives advantage to people with good access to bus services. Zone-based systems have similar equity considerations as distance-based fares because they are 'lumpier' versions of more finely differentiated distance-based fares.

Cost recovery

Liu et al (2017) contends that a differentiated fare structure is more effective at increasing an operator's revenue than a flat fare. Again, this is because the fare revenue is more closely aligned to the cost of providing the service. Gwilliam (2017, p.12) suggests that even if public transport was a 'purely commercial activity, with limited external effects'[2], fare structures

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[2] External effects, or externalities, are the effects of a good or service on a third party that is not directly involved in the productive or consumption of the good or service. Congestion, air pollution and other environmental impacts are typical

would still be complex due to high fixed costs and diverse demand. Indeed, King and Streeting (2016) have observed that commercially oriented transport authorities have retained distance-based fare structures.

Several apparent incentives and subsidies for public transport comply with a "standard commercial rationale within a competitive market regime" (Gwilliam, 2017 p.12). These include peak surcharges, off-peak discounts, location specific fares, targeted subsidies and other variations.

Although not widely used in public transport, Ramsey pricing has been applied in other monopolistic markets such as utilities, telecommunications, railroads and other deregulated industries. Inelastic segments of the market are charged higher prices than elastic segments of the market, generally for the purpose of cost recovery. Ramsey pricing can assist in cost recovery in markets where marginal cost pricing generates a shortfall in revenue to cover the financial costs (average costs) of providing the service. This has potential in the public transport sector where inelastic peak time commuters may pay higher prices than others with more flexibility in their travel options.

Implementation

Despite the opportunities outlined above, the implementation of new ticketing systems has been primarily technology-driven rather than policy-driven (Streeting and Charles, 2006). There is consensus across a number of sources that the introduction of automated fare collection systems or 'smartcards' now allows for the implementation of more complex fare policies (Wang et al. 2017; Huang et al 2016; King and Streeting, 2016). However, barriers to implementing these fares include a lack of market research on non-riders and customer responses to complex fare structures, and risk aversion on the part of transport authorities (Yoh et al, 2012).

Price is one of many factors

Fare structure complexity is one of many factors directly influencing user decision making and behaviour (Liu et al, 2017). Other commonly accepted factors include the reliability of service, comfort levels, over-crowding, wait times, transport mode and journey times. User satisfaction with services can be dependent on a broader range of socio-economic factors, including gender and city of origin.

User responses to fare structure changes can be limited by the flexibility they have in their living and working arrangements. For example, Wang (2017) found that the greatest sensitivity to fare change is shown by weekend users, followed by users in the evening weekday peak time, while the morning weekday peak time users show little sensitivity.

This was echoed in the expert interviews, who said that convenience, frequency, safety and available seats were all more important factors for most travellers than small changes and complexity in pricing. For example, the appeal of more frequent services during peak hour can outweigh the greater cost of travelling if there is a surcharge in place (as long as it is still cheaper than driving). Further, many users don't have any viable alternatives to their current mode of transport, so any pricing changes are unlikely to shift their behaviour.

We conceive these factors in an order of priority in the pyramid diagram below. In a similar way to the food pyramid or Maslow's hierarchy of needs, the pyramid reflects the factors that impact user decisions from the most fundamental at the base to higher order considerations at the top. Some of these priorities would of course carry different weight for different users.

At the base are the most influential factors, like where you live, the local transport options that are available and the opportunity costs of the options. Moving up the pyramid are factors that are considered within the bounds of the prior constraints. For example, users are likely to

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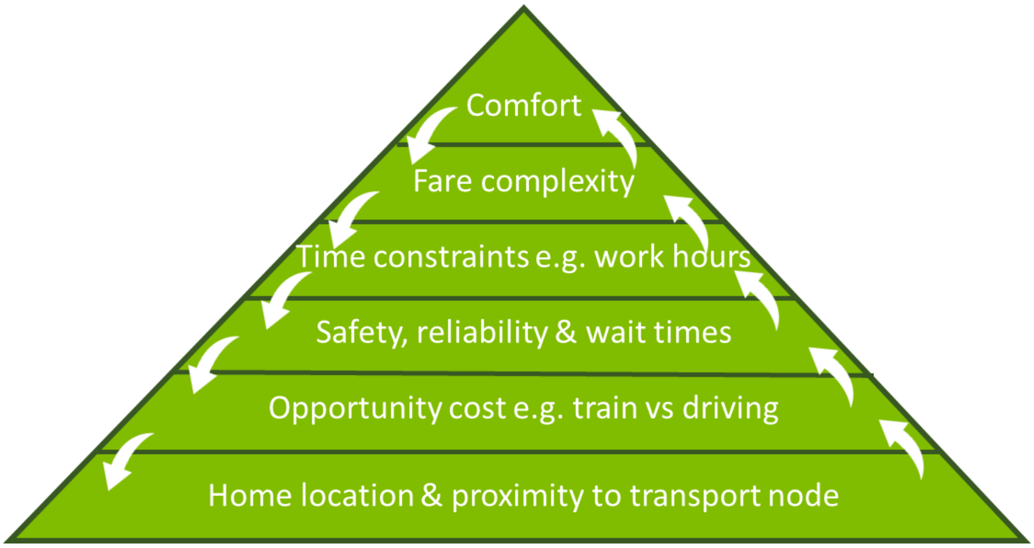
externalities in transport services. They impact people who are not necessarily using the transport service, for example, the residents of a house next to a major road may experience high levels of air or noise pollution.

take safer and more reliable options once they know all the available trips from their place of residence. And the safe option that best matches the time that users must arrive at work could be the next consideration. The complexity of the fares are likely to be later factors, while comfort and over-crowding might follow price. These factors could also switch importance for users depending on the time of day and the nature of the trip.

FIGURE 3: PYRAMID OF FACTORS THAT IMPACT TRANSPORT DECISIONS



Source: SGS Economics and Planning, 2019

2.3 How does user behaviour respond to complexity?

A preference for simplicity

The literature suggests that people prefer 'simple tariffs' and display a general preference for predictable prices across different commercial markets (Bonsall, 2007). Bonsall cites evidence from Nahata et al. (1999) and Szabo (1999) that the extra cognitive effort needed to comprehend overly complex fares can be seen as an added transaction cost. The disutility of the cognitive effort leads to a preference for simpler and more predictable price structures.

This tendency has long been observed in behavioural psychology as ambiguity aversion, or uncertainty aversion. This aversion is simply the tendency to favour to known over the unknown. Easley and O'Hara (2009) showed that people avoid investing in the stock market and Berger at al. (2013) showed that people avoid certain medical treatments, both due the unknown risks.

The preference for simplicity may help explain the preference for zone-based fare structures noted earlier in the Otto and Boysen (2017) study. Zone-based fares are essentially simplified distance-based fares with fewer increments, often bounded by easily identified area. They can therefore be more predictable, easier to calculate – and have a lower cognitive transaction cost – than distance-based fares with increments per km (or other distance).

Poor decision making

Consumers often make poor choices when a pricing system is complex. Across multiple markets, Grubb (2015) argues that consumers are often unsuccessful when selecting the best prices because they:

- search too little;
- are confused comparing prices; and
- show inertia when moving away from past choices and default options.

This is particularly the case when prices are vectors (with multiple components, in this case, a price per unit) rather than scalars (with a single price)[3]. Grubb (2015) proposes a "simple linear distance charge on its own is easier to comprehend than a combined distance charge with a peak surcharge component". Likewise, Morwitz (1998) suggests that partitioned pricing[4] in retail goods is likely to result in people underestimating the impact of surcharges.

Sitzia et al (2015), when modelling an experiment in the UK electricity and gas markets, found that complexity causes consumers to make worse choices, particularly when price structures are nonlinear, have unusual jumps or multiple parts. Importantly, decision-making is even poorer in instances where consumers are inattentive.

Feedback from the expert interviews was that multi-modal trips are another common source of complexity when different modes have different prices. Users in Sydney found this particularly confusing during the introduction of the Opal card. Harmonizing flag fall prices across modes and treating multi-mode trips as a single journey (with a distance charged across the whole journey) helped users to understand the system.

Greater fare complexity leads to more mistaken tickets but travellers learn from their mistakes. The United Kingdom (UK) Office of Rail Regulation found that users learn from these mistakes through a process of trial and error rather than seeking information about a fare system (ORR, 2017). They did not find any instances of repeated mistakes.

Large variation

Bonsall et al (2007) suggest that individuals differ in their response to complexity in fare structure. Wang et al (2017) maintain that the replacement of simple with more complex fare structures can result in different responses from different sub-populations. Users' responses can be granular and spatial, down to the station level: "different stations serve different types of land usage and generate trips with distinct purposes at different times" (Wang et al, 2017, p.1560).

Framing, presentation and system effects

Bonsall et al (2004; 2007) suggest that people deal better with complex fare structures when they follow an obvious logic. This is supported by qualitative research prepared by the UK Office of Rail Regulation (2011) which finds that people can identify logical elements of a fare structure, such as:

- higher prices for longer journeys,
- peak being more expensive than off peak, and
- discounts for tickets purchased in advance.

The transaction system itself can have an impact on how travellers respond to different transport pricing fares. When the NSW Government introduced the Opal smartcard system, people became less sensitive to price because they were less engaged with the actual payment process. However, lower income earners, students and pensioners did maintain price sensitivity due to their lower disposable income.

Similarly, the way that changes are framed and presented can often be just as important as the actual changes themselves. One expert noted features of Sydney's transport system, such as the Sunday travel cap (currently a flat cap of $2.70, originally $2.50), and the weekly travel cap (originally, all trips after the first 8 were free). This expert cited the fact that both were highly promoted and taken advantage of – the Sunday travel cap was a legacy of previous fare structures but was heavily promoted and well-known amongst the community. The weekly

[3] A scalar is a one-dimensional measurement of a quantity and a vector is multi-dimensional measurement, sometimes with several pricing parameters.

[4] Partitioning pricing is the term for when a price is divided into two components: a large base price and a comparatively small surcharge. This is different from all inclusive pricing which involves the use of single, all inclusive price that covers all costs.

cap became famous as the media and even politicians referenced it publicly – so much so that eventually the cap was modified (now, all trips after the first 8 are charged at half price).

These examples demonstrate that a part of the effectiveness of a fare structure depends heavily on how well it is supported by promotional activities and cues/changes in the system. For example, if every train station was to have a neon sign that turned red when peak hours were in effect (and was green during off-peak times), and trains included announcements about when peak times were in effect, it is likely that knowledge of peak times would spread fairly rapidly. Similarly, if Melbourne trams did not announce the free tram zone, and stops inside and outside the CBD did not include explicit information about whether they were inside or outside the free tram zone, it is likely that understanding of the free tram zone would be much poorer.

Optimizers versus satisficers

Lyons (2006), when discussing choice-making behaviour, reveals individuals are not necessarily making decisions based on the most cost-effective options. Rather, public transport users choose options that satisfy the minimum requirements. This means that people are not motivated to search for more information or explore alternatives once they find an option which meets their minimum requirements.

The 'satisfaction approach' makes sense in a context when faced with numerous and complex pieces of information that demand their daily attention. However, it indicates that overly complex features of a transport fare may be ignored once users find a good enough transport option.

Alternatively, experts noted that users are likely to more actively research transport information at key decision points. These points are likely to be when a user changes their regular trip, for example, when moving to a new house or changing jobs. An optimizer might initially research and even try multiple routes before settling on a regular route, while a satisficer might only investigate a single route. For both approaches, transport behaviour effectively becomes set and sensitivity to price reduces.

Feedback and learning

A key part of understanding and learning about pricing systems in the long run is feedback. Smith et al (2014) show that feedback is central to how individuals learn – in particular, creating "blocked" feedback (where feedback is not given in individual instances, but for several instances as a group) makes it harder for individuals to learn more complex systems. This suggests that the way in which information is presented could affect learning – for example, specific feedback after each trip about the amount spent would be expected to lead to faster learning.

Hence, adjustments to pricing changes can be a slower process in a smartcard system where travellers only make infrequent payments which are commonly automated via direct debits. A survey of British rail passengers found that users often learn the more complex elements of a fare via trial and error (ORR, 2011). Given this, complex fare structures could take longer to learn as users get feedback through their monthly payments (or other payment cycle).

Experts also noted that travellers are likely to learn the general rules of the system through this feedback cycle rather than identifying the individual components of their fare. One expert cited the example of effective marginal tax rates (EMTRs) as an analogy – whilst most individuals are not explicitly aware of the full range and impact of EMTRs, it is likely that individuals are at least generally aware of some of the potential impacts on themselves personally. For example, they may have learned from past experience that taking an extra shift causes them to lose access to certain welfare benefits or family payments, even though they don't know the full EMTR schedule.

In a similar way, it is likely that regular users will gradually learn the contours of the fare system to the extent it impacts on them – that is, they will likely learn about the relative impacts of taking an earlier train as part of their commute, but they may not learn enough to be able to advise a friend visiting their city on the best transport route to take to visit a major attraction.

Fairness

Across the literature, the relationship between complexity and fairness in public transport pricing is raised by multiple sources. Bonsall et al (2007) present two case studies whereby the introduction of variable pricing resulted in negative public opinion, the German Rail Operator Deutsche Bahn's introduction of capacity related discounts and advance booking incentives and French Rail Operator SNCF's introduction of yield management pricing.

In each case study, perceived unfairness shared some correlation with fare complexity. Bonsall suggests that price structures that are hard to navigate can result in the perception that achieving the optimal price is not possible and deemed unfair (Bonsall et al, 2007). Furthermore, users found it unreasonable to be expected to "work out when to travel, what type of ticket to purchase or which service to use as to avoid the perceived price penalties" (Bonsall, 2007, p.677). In both cases, fare differentiation was also considered an "unfair penalty on those who were unable to book ahead or avoid using the peak-rate services" (Bonsall et al, 2007 p.677).

Greenleaf et al (2016) suggest surcharge perception correlates to how 'small and salient' it is. Smaller charges take less to process, and users will 'ignore surcharges when the cognitive demands of processing the surcharge are higher'.

3. EXPERIMENT

BIT conducted an online experiment to test how users comprehend and apply a mix of fare structures, from very simple to very complex. The experiment found that more complexity leads to poorer outcomes, simpler elements are easier to understand, people approached the experiment in different ways and there was little evidence of learning.

3.1 Overview of experiment

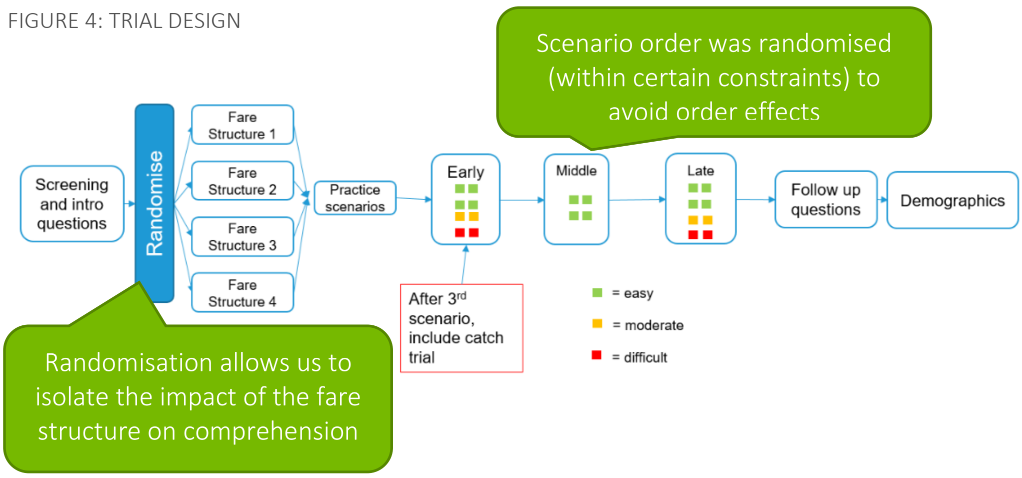
The project team worked with IV to design an online experiment to rigorously test how different fare structures affect comprehension and ability to apply fares to journeys. Fare structure comprehension was measured by the number of scenarios which experiment respondents correctly chose as the cheapest transport journey. The experiment complemented the earlier stages of the project and the user consultation by providing an unbiased quantitative analysis of behaviour. In addition, the nature of the randomisation allows us to draw causal conclusions about the role of fare complexity on decision-making. The full detail on the experiment design is available at Appendix 3.

The experiment saw respondents answer a series of introductory and screening questions. These were designed to ensure that we had a representative spread of respondents, as well as meeting some minimum criteria that we had specified in consultation with IV. In line with our criteria, the experiment included:

- An overall sample population that was representative of the Victorian population (with respect to age groups and gender).
- At least 80% of respondents from Victoria (remainder from outside Victoria).
- Approximately 15% of respondents who did not use public transport.

These criteria were specified after discussion with IV, and were designed to capture the main target audience (Victorians who use public transport), as well as others who may interact with the public transport system and its fares (such as non-Victorians or those who don't currently use public transport). A visual summary of the trial is below:

FIGURE 4: TRIAL DESIGN



After the introductory and screening questions, respondents were provided with instructions for the task. This asked them to imagine that they were advising a friend from another city on how to use the public transport system. We specified that the friend was not concerned about distance or timing – the only concern was finding the cheapest journey. Respondents were advised that they would see a range of scenarios with potential journey options, and that they would need to choose the cheapest.

FIGURE 5 EXAMPLE INSTRUCTIONS

> We would like you to think of a friend who is trying to understand public transport in a new city. We are going to show you the public transport fares for the city, and some potential options for taking trips via public transport in that city. We would like you to imagine that a friend has asked you **find the cheapest journey for them**, and is not concerned about the time, route, or mode of transport.

Following this, all respondents were randomised to one of four treatment groups, where they saw one of four possible fare structures. Broadly, the fare structures were:

- A peak charge;
- A peak charge, plus a modal charge;
- A peak charge, plus a distance-based charge; and
- A peak charge, plus a modal charge, plus a distance-based charge

FIGURE 6: PEAK ONLY

Travel type	Fare
Single trip – off-peak	$2
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $2

FIGURE 7: PEAK + MODE

Travel type	Fare
Single trip – Bus	$2
Single trip – Tram	$3
Single trip – Train	$4
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $1

FIGURE 8: PEAK + DISTANCE

Travel type	Fare
Single trip – off-peak	$1 PLUS $0.10 per kilometre
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $1

FIGURE 9: PEAK + MODE + DISTANCE

Travel type	Fare
Bus Single trip – off-peak	$1 PLUS $0.10 per kilometre
Tram Single trip – off-peak	$2 PLUS $0.10 per kilometre
Train Single trip – off-peak	$3 PLUS $0.10 per kilometre
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $1

Once they had reviewed the fare structure, respondents saw two practice scenarios. They then saw all 20 scenarios, of varying difficulty, in a random order. All respondents saw the same 20 scenarios, but the order of scenario presentation was randomised to avoid order effects. Specifically, scenarios were categorised based on their level of difficulty as 'easy', 'moderate', and 'difficult'. Based on scenario difficulty, scenarios were then pseudo-randomised into three trial 'buckets' for each participant (early, middle, and late), with the constraint that each trial bucket needed to contain a pre-specified number of scenarios of each difficulty.

Each of the 20 scenarios was designed to have differing answers across the different fare structures, where possible. Respondents received generic trial-by-trial feedback, confirming only whether or not they had picked the cheapest fare; this feedback read “You chose the cheapest option” for correct responses, and “You did not choose the cheapest option” for incorrect responses. After the respondents saw three scenarios, we asked a confirmation question – respondents were asked to confirm on what basis they were choosing the journeys from a range of options (for example, distance, price, timing, or a combination of factors). Only respondents who stated they were choosing based on the cheapest journey were allowed to continue with the experiment.

Once a respondent had seen all 20 scenarios, we concluded with some follow-up questions and additional demographic questions.

3.2 Results

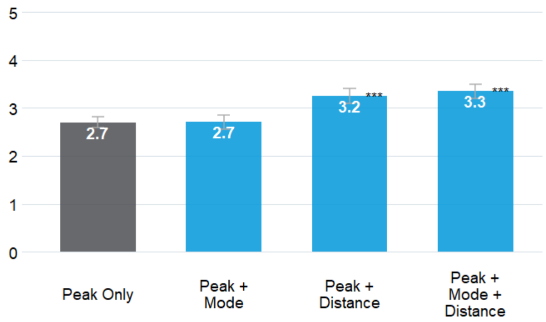
The experiment ran from 28 February 2019 to 8 March 2019 on the Pureprofile platform. A total of 2,011 people took part in the experiment and completed all aspects. Below, we summarise the key results of the experiment – for full regression outputs and all results and analysis, please refer to the Data Attachment that accompanies this report.

More complexity leads to poorer outcomes

In general, as the complexity of the fare structure increased, outcomes tended to worsen. Comprehension, as measured by the number of correct scenarios out of 20, was lowest in the most complex fare structure (peak + mode + distance), whilst average response times were the highest. Notably, average response times steadily increased as complexity increased, both for all answers, and for correct answers. In other words – despite taking on average longer to analyse scenarios under more complex scenarios, respondents still had poorer results overall.

On more subjective measures, more complex fare structures also did poorly. We asked respondents to rate (out of 5) how difficult they found the fare structure – once again, the most complex structure was perceived as the most difficult. And, when asked at the end of the task to recall what sorts of rules applied in their scenario, more complex fare structures had lower rates of recall. In fact, each additional feature in a fare structure led to approximately 15 per cent fewer rules correctly recalled.

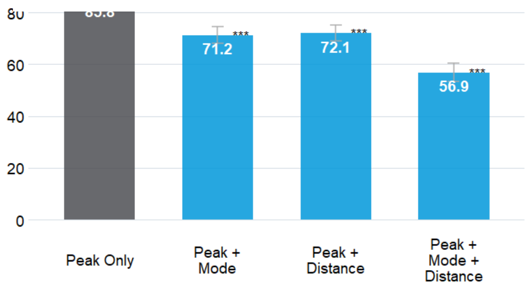
FIGURE 11: REPORTED DIFFICULTY (OUT OF 5)



***p=0.001

Importantly, there was a clear threshold effect at play in terms of moving beyond two elements. For example, including a modal charge on top of the peak charge did not appear to worsen comprehension. However, including a modal charge to system that already has peak and distance charges does appear to make a negative impact. That is, the addition of a third element seems to be the point where complexity starts becoming overwhelming.

FIGURE 10: PERCENTAGE OF RULES CORRECTLY RECALLED



***p=0.001

Simpler elements are easier to understand

The evidence also suggests that the nature of the specific elements in a fare structure affect comprehension, and that simpler elements are typically easier to understand and process.

In particular, **modal differences were easy to understand**. When asked about perceived difficulty, respondents rated the peak only and peak + mode fare structures equally. That is, adding a simple modal charge did not increase perceived difficulty, as compared to a peak charge on its own. Indeed, on overall scenarios correct out of 20, those in the peak + mode treatment actually scored the highest overall.

However, it is worth noting that this is likely due in part to the fact that the differences between the modes was large and salient. For example, a bus was always cheaper than a train, even with the peak surcharge. If the differences between modes was smaller, we may have seen different results. Nonetheless, there is a clear benefit to modal charges in that the differences between modes are relatively clear and salient – most users are able to understand that modes of transport are different, and indeed are likely to have emotional associations with, and a "mental picture" of, the different modes.

Similarly, **peak charges are easy to understand**. In general, the concept of a peak charge seems to be well understood by the general population, and respondents generally moved through scenarios faster under a peak-only fare structure.

The main source of confusion for peak charges appears to be in relation to when precisely they applied. In the experiment, we specified peak charges applying for trips between **7am and 9am**, and **4pm and 6pm**. We also asked respondents to explain the rules after they had seen all scenarios. These free text scenarios suggest that whilst respondents understood the structures, and absorbed the concept of a peak charge, some respondents may not have remembered the precise start and end times. For example, each of the following appeared in the free text responses as times when peak charges applied:

- 7am-9am, and 5pm-7pm;
- 7:30am-9am, and 4:30pm-6pm;
- 6am-9am, and 4pm-7pm; and
- 9am-6pm.

This is particularly relevant as a number of scenarios straddled these boundaries – for example, one scenario had a journey at 5:45pm, and the other at 6:15pm. Hence, some respondents may have mistakenly thought that both journeys were in peak time (when in fact only one was).

This highlights the importance of framing and presentation of fare structures – in the real world, the understanding of a peak charge will likely be tied closely to how well it is explained, presented and reinforced by the system.

> ***"I've forgotten the peak period times, I'd need to look that up."***

In contrast to the above, however, **kilometre based distance charges are hard to understand**. Fare structures with distance elements were rated as the most difficult, and saw the poorest results overall, both in terms of comprehension and response times. It is likely that this is driven in part by the fact that distance is simply not a salient feature – users (and people more generally) rarely think in distance in terms of kilometres (they are more likely to think in terms of time, or in terms of number of stops/stations). Users also rarely receive feedback in terms of distance, and hence are unlikely to have a sense of what the difference is between, say, 10 and 20 kilometres in a practical sense.

Importantly, it is worth noting that distance charges were presented in a relatively simplified and stylised fashion. Each kilometre was charged at 10 cents, and all distance figures used were in multiples of 10 kilometres – leading to distance charges that were even dollar amounts. Hence, the results for distance in this experiment to some extent represent the “best case scenario”, and real-world outcomes are likely to be even poorer. This is because in reality, distance charges are almost always going to involve non-round numbers and distances. That represents an additional layer of complexity that will almost certainly make comprehension and calculation of distance charges more difficult.

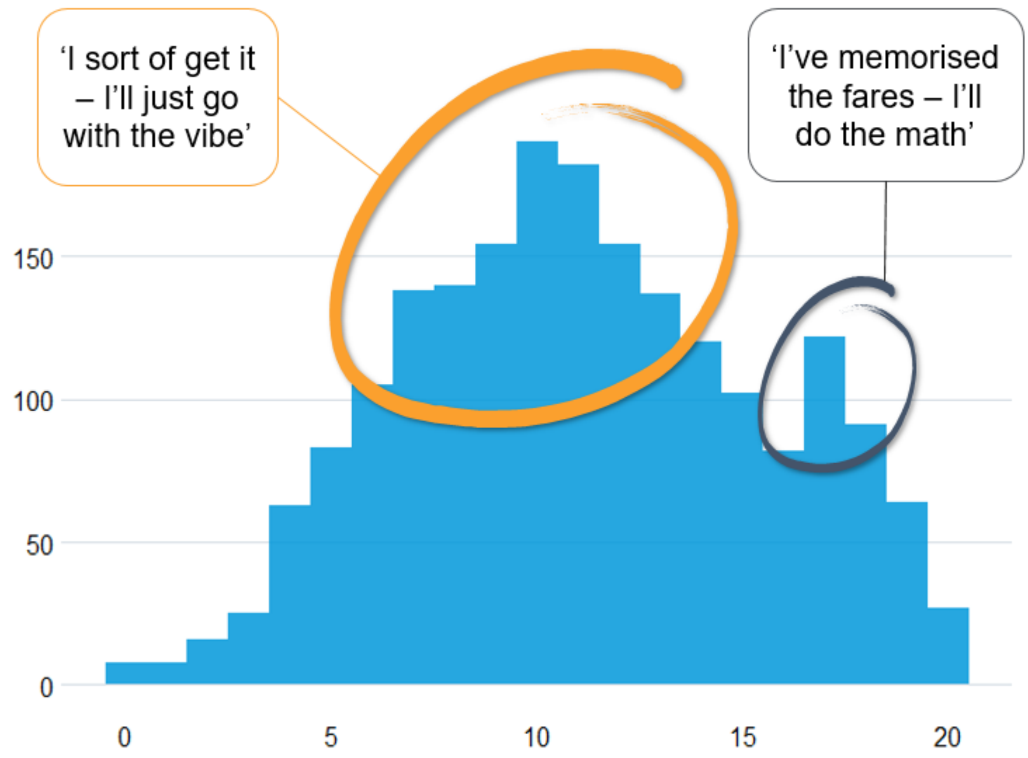
Note that as we were interested in gaining a deeper understanding of distance charges and how they might operate, we focused on per-kilometre charges, rather than zonal charges (in agreement with IV). Simple fixed zones (similar to Melbourne’s current system) may result in better comprehension, but we would expect zonal distance charges (similar to Sydney’s current system for trains) would likely still result in poor comprehension. This is likely driven by a number of factors – firstly, the literature suggests that individuals can more easily comprehend prices that are fixed amounts (scalars), as opposed to sliding scales (vectors). Secondly, there is likely to be a lack of understanding of what exactly 5 or 10 kilometres looks like in practice, as opposed to understanding a fixed zone.

We saw some evidence of different approaches

Respondents appear to have taken different approaches to the task, based on the results. The image below provides a histogram of scores across all treatments – there appear to be two distributions overlayed on top of each other.

Our hypothesis is that these distributions or peaks represent at least two different approaches to the task. The peak on the right may represent “problem solvers” – people who internalised the fare structure as best they could and sought to “do the math”. Notably, there were fewer people in this group as complexity increased. This may represent people deciding to avoid trying to calculate the exact fares as complexity increased.

FIGURE 12: HISTOGRAM OF SCORES (OUT OF 20, ALL TREATMENTS)



The peak on the left may represent "intuitors" a broad group that takes a less calculated approach, and rely more on "heuristics" or mental shortcuts – simple rules of thumb that allow a person to approximate what the right answer is. The specific approach may vary from respondent to respondent – user consultation (discussed in the next section) suggests that some might focus on a single element, whilst others might focus more on their general "feelings".

Notably, it appears that the majority of respondents are intuitors of some sort, and this group grows as the complexity of the system increases. This suggests that fares likely need to be designed with intuitors in mind, with relatively few elements and salient, well-explained differences between fares.

We saw little evidence of rapid learning – but this may be a function of the design

There was no evidence that any of the treatments resulted in respondents learning the fare structures faster. However, there are a number of factors that likely contributed to this result.

The design of the task was focused on measuring complexity, with learning a secondary objective. Firstly, the level of feedback provided was limited – this was by design, as we sought to mimic the current set up of the Myki system (where there is minimal direct feedback about how much a particular trip costs). A trial with more detailed feedback may have resulted in more learning. Secondly, the rapid nature of the trial meant that there was only a limited window for learning – there were only 20 scenarios, which had a varied range of features. Hence it is not as surprising that limited learning effects appeared – in reality users would have weeks or even months to learn and adapt, and would be focused on a smaller number of more consistent journeys. A longer experiment, or one with more consistent journeys, might have resulted in more learning.

However, it is important to note that the trial was aiming to measure learning *about the system as a whole*. When considering individual travel choices, particularly for regular users, what is relevant is learning *about specific journeys*. Evidence from the literature, and from our discussions with experts, suggests that whilst people may not be adept at learning broader systems, they can typically learn about how those systems impact on them in particular, especially if they interact with the system regularly. Hence, the nature of this trial was such that it was seeking to identify a broader type of learning, when in fact for regular users, a narrower and more personalised type of learning may be more relevant.

Even for broader learning, there are a range of channels that can impact people's understanding of a fare structure, beyond just repeated experience. One expert highlighted the fact that public awareness of some features of Sydney's public transport system (for example, the now abolished system of all trips after the first 8 in a week being free, or $2.50 all day tickets on Sunday) were driven by wider forces such as media attention and promotional activities. Indeed, the potential confusion around peak times that appears to have come through suggests that these broader forces for shaping public understanding will be key in creating an effective fare structure. In addition, the fact that there was a fairly broad spread of results suggests that it is possible for changes in understanding to be made – had results fallen more consistently in a narrower range, there may have been cause for concern about learning, but this does not appear to be the case.

In addition, there is evidence that many people were still able, at a high level, to recall the features of the fare system. In all but the most complex treatments, respondents were able to correctly identify all the main features of the fare system (i.e., whether it had a peak charge, a modal charge, and/or a distance charge) at a rate of over 70%. Reviewing the qualitative responses, a number of respondents were in fact able to list the precise features of their particular fare structure – including the exact costs. Errors made by these respondents may have been driven not so much by a lack of understanding, but rather by errors in calculation.

A different trial design might be better suited to determine this narrower type of learning. This would likely involve providing a respondent with the same small set of scenarios repeatedly, but including a larger range of potential journeys (and a longer experiment, to allow for more exposure to the task). For example, it might provide 5-10 different options for travelling, and ask the respondent to try and learn which option led to the cheapest outcome.

The trial could also provide regular feedback in the form of a declining Myki card balance – over time, we would expect that respondents would explore different options and come to understand, for them, what the cheapest option was. Typically trials such as these would measure how quickly respondents got to the point where they consistently chose the right answer. We could also ask respondents to try and rank what they thought the cost of the different journeys was, to help identify any broader learning.

The learning process was also investigated in the user consultant task. The finding from this is described in the next section.

4. USER CONSULTATION

SGS engaged with public transport users through focus groups and interviews to explore the thinking behind their responses to complex public transport fares. The engagement revealed difficult elements in fares, difficult combinations of elements, the rules of thumb that users apply, as well as frustration and disengagement when fare structures become overly complex.

4.1 Overview of method and participant recruitment

The project team directly engaged with public transport users about their understanding and behaviour regarding pricing complexity. Through phone interviews and focus group workshops, the team observed the nuance in people's decision-making when faced with individual fare elements, as well as combining the effects of multiple fare elements. A summary of the approach (used in both activities) is shown in Table 2.

User consultation involved a combination of focus group meetings (three workshops with nine to ten participants each) and ten phone interviews (one-on-one), conducted over February 2019.

TABLE 2: USER CONSULTATION QUESTIONS

Task	Purpose/aim	Activity
Expectation setting, purpose of the workshop	Explain how information collected will be used for the project Help participants understand the level of influence they will have over the project outcomes	Facilitator/presenters provide background (with IV deidentified) about the project and what information will be collected, along with an explanation as to how information gathered will be used
What's your understanding of the current system?	Explore participants' familiarity and comprehension of the existing system	How does the current fare system work in Victoria? (Multiple choice options) Discussion to turn to which aspects are easy and which aspects are hard to understand.
Hypothetical scenarios	Explore participants' ability to engage with varying degrees of complexity in transport fare structures Capture each stage of people's comprehension process that they will have to experience in the online experiment	Using prompt scenarios (a sample from the online experiment), participants will explain each fare structure to a friend, for example: 'Your friend wants to know what the cheapest fare is, and doesn't mind when they travel'
Wrap up and feedback	To reflect on 'what we heard' and allow participants to share any further/final feedback To collect session evaluations from participants and improve (as relevant) each group discussion based on feedback	'What we heard' (Facilitator summary) Opportunities for final comments from participants

Source: SGS Economics and Planning, 2019

In total, 39 people were consulted as part of this project task. Participants were recruited for the project using a market research team, and represented diverse ages, life stages, and geographies. Some were frequent users, while others rarely used public transport.

This section presents the engagement activity scenario details and detailed findings from the user consultation. In line with the brief, activities were designed to draw out how people react and why they make certain decisions when faced with increasingly complex problems to solve. Further details of the detailed methodology, the specific parameters considered when recruiting and characteristics of the realised participant sample can be found in Appendix 4.

4.2 Scenarios

Focus group and one-on-one interview participants were presented with five hypothetical scenarios. Each scenario explored participants' ability to engage with varying degrees of complexity in transport fare structures.

All hypothetical scenarios were set up to be in an unfamiliar overseas country's transport system where the only factor affecting mode choice was the cost of travel. This allowed participants to remove themselves from their knowledge of the Victorian public transport system and its fare structure, as the facilitators encouraged them to remove themselves from their personal preferences.

> ***"You've moved overseas, and a friend is visiting you. They need to get from A to B."***

As illustrated in Table 3, the hypothetical scenarios were presented to participants with increasing complexity as follows:

- **Scenario 1** presented a simple single-layered hypothetical fare structure with a single peak/off-peak pricing element.
- **Scenarios 2 and 3** increased the level of complexity by adding an extra fare structure element to form a two-layered fare structure.
  - **Scenario 2** added a distance-based pricing element on top of Scenario 1.
  - **Scenario 3** added a mode-based pricing element on top of Scenario 1.
- **Scenario 4** further increased the level of complexity by adding both the distance-based pricing element and the mode-based pricing element on top of Scenario 1 to form a three-layered fare structure.
- **Scenario 5** added a final layer of extra complexity to the three-layered fare structure by incorporating a multi-modal journey as part of the mode-based pricing element on top of Scenario 4, in order to analyse participants' comprehension of complex fares.

TABLE 3: FARE ELEMENTS CONSIDERED, BY SCENARIO

	Peak and off-peak pricing	Distance-based pricing	Mode-based pricing	Multi-modal journey
Scenario 1	✓	×	×	×
Scenario 2	✓	×	✓	×
Scenario 3	✓	✓	×	×
Scenario 4	✓	✓	✓	×
Scenario 5	✓	✓	✓	✓

Source: SGS Economics and Planning, 2019

4.3 Responses

Validation

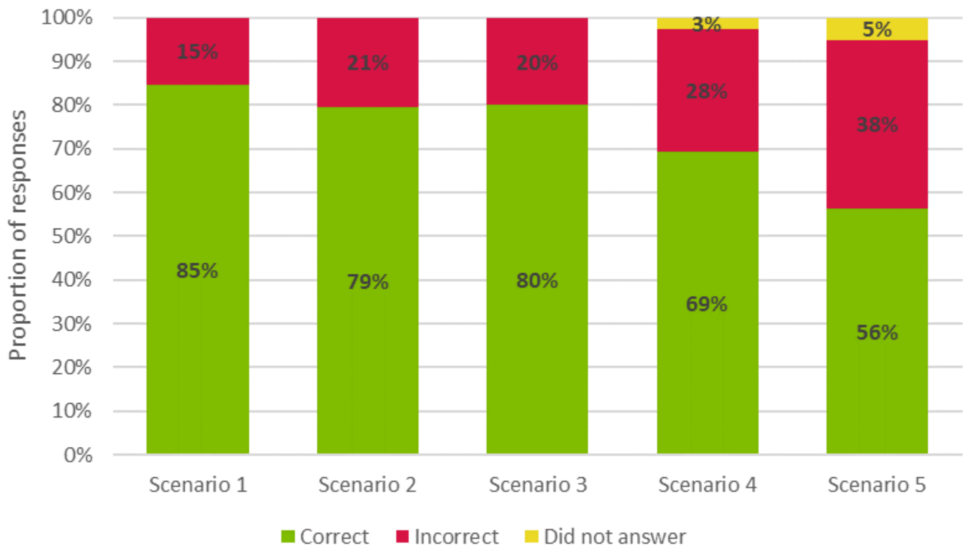
The following data captures the key responses to the scenarios and participants numerical difficulty ratings for each. Given the small sample, small number of scenarios, lack of randomisation and qualitative focus of the user consultation component of this research project, the data is supplied for in-principle validation of the main trends across scenarios and feedback throughout the exercises. We do not test for statistical significance of any of the quantitative results from the user consultation or imply that any differences are significant.

Accuracy

Using hypothetical scenarios, participants were provided with two alternative travel options and asked to choose their travel choice based on their calculation of the cheapest fare using the hypothetical fare structure provided.

Throughout the exercise, participants were reminded that the focus of the activity was to be an information-gathering exercise, rather than a maths test. This was to ensure that responses captured would more likely represent what an individual would likely choose if they experienced and needed to respond to varying degrees of complexity in real life.

FIGURE 13: SCENARIO RESPONSE ACCURACY



Source: SGS Economics and Planning, 2019

As illustrated in Figure 13, a trend clearly exists where fewer people correctly chose the cheapest travel option as each additional layer of fare complexity was added. While 85 per cent of participants correctly computed the fare for a single-layered fare structure, this reduced to around 79 to 80 per cent for a two-layered fare structure, and even more significantly to 69 per cent for a three-layered fare structure. This level of accuracy furthermore substantially decreases when considering a multi-modal journey (56 per cent).

Despite Scenario 3 having a more difficult design than Scenario 2, participants had near equal results. This is hard to explain given the evidence that distance-based pricing (Scenario 3) is considered more complex than mode-based pricing (Scenario 2). As noted above, we do not expect statistically significant differences between the scenarios and instead highlight the overall trends across the data.

A small percentage of individuals did not to answer the more complex scenarios, possibly indicating that there was too much complexity. This could have been due to insufficient time to perform the necessary calculations, or perhaps disengagement due the level of complexity.

Difficulty

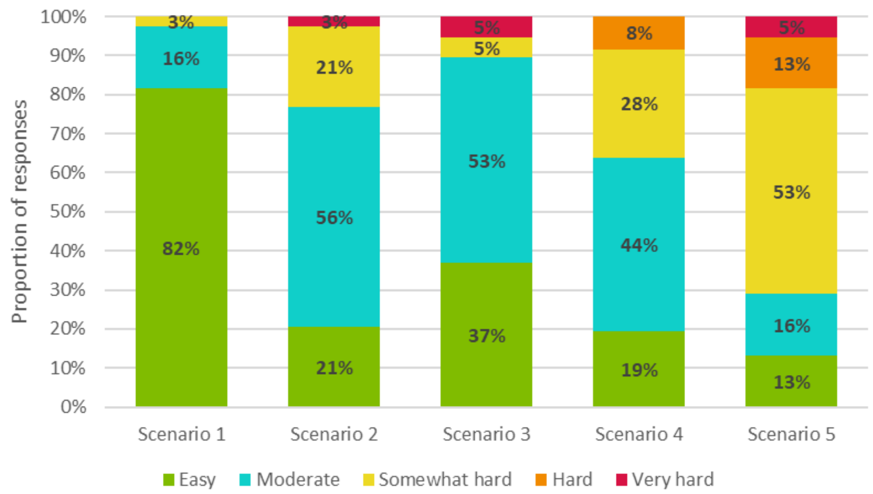
After collecting the selected travel option response for each hypothetical scenario, participants were asked how difficult it was to engage with each fare structure, and why. They were given a difficulty scale of one to five, where one was easiest (where participants were able to compute the cheapest fare almost instantaneously) and five was the hardest (where participants would require a spreadsheet to calculate the cheapest fare).

Figure 14 shows the distribution of responses to the level of difficulty for each scenario. As additional layers of complexity were added onto each successive scenario, there was a clear trend showing that increased fare complexity resulted in greater difficulty in calculating fares. As a consensus, participants found a single-layered fare structure to be simplest to understand (with an average difficult rating of 1.21) with an upwards difficulty trend towards the multi-modal three-layered fare structure (with an average difficult rating of 2.82).

It is interesting to note that although Scenario 2 and Scenario 3 had a similar number of correct responses, participants found Scenario 3 (average difficulty rating of 2.08) substantially easier than Scenario 2 (average difficulty rating of 1.84). This is likely due to one of two reasons:

- Participants possibly found distance-based pricing to be more complicated to process than mode-based pricing,
- Or, through learning-by-doing, where participants were more easily able to comprehend the third scenario having explored one additional scenario.

FIGURE 14: SCENARIO DIFFICULTY RATINGS



Source: SGS Economics and Planning, 2019

> *"I left the distance bit until last, it was the hardest"*

4.4 Experience of complexity

Difficult elements

In examining the complexity of the different fare structures, it was clear from the discussions that participants found some elements more difficult to comprehend than others. A summary of participant's responses to each of the fare structure elements is presented in Table 4 below.

TABLE 4: DIFFICULT ASPECTS OF THE FARE STRUCTURES

Features	Findings
Base fare	Essentially all participants agreed that the base fare component was the easiest fare element to understand, given there was no variation in this component regardless of their travel decisions. Being the easiest fare component, participants almost always started their calculations with the base fare and added other components onto this base fare.
Peak/off-peak pricing	Most participants found peak/off-peak pricing relatively simple to understand, as it only required the acknowledgement of their time of travel, and if it was during peak hours, to add the peak charge onto their base fare. Participants often completed this stage of their calculation by adding it onto their base fare first.
Distance-based pricing	The majority of participants found distance-based pricing the most difficult pricing element to understand given the need for multiplication, prior to adding this onto the total fare. Given the difficult nature of this calculation (which took longer to compute), participants often left this fare element till last. Another consideration to this difficulty is that participants exclaimed that they did not know the specific distance of their various public transport trips, as most people think about their travel time between origin and destination rather than the travel distance.
Mode-based pricing	A large proportion of participants also found mode-based pricing to be somewhat difficult, although easier than distance-based pricing. While the concept was simple in itself, participants often found it a challenge to add distance charges onto a different base price for different modes. This led to much confusion amongst participants which consequently resulted in incorrect fare calculations.
Multi-modal journeys	In particular, when multi-modal journeys were considered with mode-based pricing, a very large amount of confusion was created, where it was found that participants often used the fare for the wrong mode in their calculations. In practice, given that most public transport journeys are either multi-modal or multi-trip using the same mode, this presents a genuine concern in calculating fares for complex public transport journeys.

Source: SGS Economics and Planning, 2019

Another important consideration is that most of the calculations presented to participants with fare elements in whole dollar increments only (for example, a distance-based charge of $2.00). Only in the final hypothetical scenario were participants introduced to fare elements in fifty cent increments (for example, a distance-based charge of $1.50), and many participants made it clear that it was much more difficult to calculate complex fares with the use of cents rather than dollars. Given in practice that fares are often in five cent increments (for example, a fare of $2.15), and sometimes even in one cent increments (for example, a fare of $2.17), this would clearly make it much more difficult to calculate a fare for a public transport journey.

“Having fare elements in cents would make it impossible to calculate”

Difficult combinations

When dealing with complex fare structure, most participants found that a **single-layered fare structure** (a fare with a base component, plus one other fare element such as a peak/off-peak charge) was simple to understand, allowing many participants to calculate the fares quickly.

Adding a second fare element to form a two-layered fare structure (for example, when a mode-based charge was added), this made computing fares a lot more challenging by converting "simple mental arithmetic" into a "high-school mathematics problem" that required multiple steps to reach a solution.

> ***"Calculating fares has become a high-school mathematics problem"***

The **process** that many of the **participants used** when calculating complex fare was to start with the base fare component, and then progressively add more difficult fare elements to a running total. More than often, the distance-based charge was left to last as the most difficult component to grasp.

Some participants on the other hand focused on the fare element they believed would have the largest influence on the overall fare, then progressively moved to the smaller influencing elements – an approach that is different to the way arithmetic is typically taught at school. Others simply followed the order in which the fare elements were presented to them in the fare structure information.

> ***"There are so many things in my head, I'd really struggle to do this on the fly"***

One difficulty that many participants emphasised was that it would be very difficult to calculate complex fares when using public transport, given that more often than not, **public transport users are often in a rush** to reach their destination. Users will often have insufficient time to calculate their fare total with the need to be on time, and therefore could likely make mistakes with a rushed calculation or simply not calculate their fare at all despite wanting to know it.

Another problem that almost all participants faced when dealing with complex fare structures was **being able to mentally compute the arithmetic** in their head. In calculating these complex fares, most participants required the use of pen and paper, or their mobile phone calculator. While in theory this may not be a significant issue, practically it emphasises the issue that calculating complex fares whilst on the go will be a tedious process that would require more than a simply mental calculation. The issue was amplified by the acknowledgement that participants are highly **unlikely to have a table or matrix of the fare structure handy** when they need to perform these calculations, which furthermore increases the likeliness of public transport users simply avoiding the process of calculating their fare.

> ***"I need a pen and paper for this"***

> ***"I wouldn't have the fares in front of me when I need to calculate them"***

Learning

When working through each successive scenario, participants were able to learn as they became familiar with the calculation process with each successive iteration. This learning process is distinct from that in the experiment because participants in the focus groups and interviews received feedback after each scenario and discussed their approaches as a group.

> *"Last time the scenario was trickier but this time I learned how to do it"*

Throughout the consultation process, a few participants stated that the **calculation process became easier** after they had become familiar with the background information and had worked through one or two examples. Some participants even developed methodical processes to help them work through the problems and not miss any specific details, generally by following the structure of how information was set out in the question. This was evident as some participants were able to work through the later scenarios faster than some of the earlier ones, given they no longer needed to grasp the contextual matter of the calculation.

Another example is that some participants who originally calculated a fare **corrected their own mistakes** once asked to step through their calculations step-by-step. This issue could potentially highlight that complex fares are hard to calculate with quick mental arithmetic on the go, however, is more easily calculatable if sitting down where each step is worked through methodologically.

> *"Oh... I was rushing so I missed a step"*

In a practical sense, learning-while-doing may have a **smaller impact in the real world**, given that calculation of public transport fares to impact mobility choice is likely to be a long-term process; users are unlikely to change their mobility decisions unless some significant change occurs, such as change in residential or workplace location, change in car ownership, or change in the public transport system (for example, with the fare structure).

Rules of thumb

The focus group discussions revealed that people tended towards several different styles of approaching the scenarios.

Some participants were problem solvers who were very methodical in their approach. This group aligns with the more accurate problem-solving group identified in the experiment.

Other participants were less analytical in their style and followed simple rules of thumb. These participants align with the second group identified in the experiment – the "intuitors". They can be split into a number of sub-groups, including those motivated by a single fare element, those motivated by feeling, those who ignore seemingly irrelevant information and those who ignored overly difficult elements. These thinking styles are described in Table 5.

> *"I just pick the one I think is going to be cheaper"*

TABLE 5: FARE CALCULATING STYLES

Style	Findings
Problem solver	As expected, a large number of participants attempted to work out the correct value of the fare to the cent, by using a mental arithmetic or by using a mathematical process by developing steps to determine the cheapest travel option.
Motivation by a single fare element	Some participants assumed a certain fare element would make such a significant impact on the total fare, that they could simply ignore other fare structure elements in their calculation. For example, some participants assumed that off-peak is always cheaper, regardless of any other fare structure elements. Another example that came up was that some assumed that trams were always cheaper than trains, regardless of any other fare structure elements.
Motivation by feeling	In contrast, some participants chose their answers based on what they felt may be cheaper by looking at the possible travel options and selecting the choice they believed would be cheaper without consulting the fare structure at all.
Irrelevant information ignorers	Some participants used a system to rule out what they perceived to be irrelevant information. This happened in either one of two cases: ▪ When participants anticipated that a certain fare element would be of identical value across travel options. For example, if the base fare was identical across two possible travel options, some participants simply ignored this. ▪ When participants perceived that a certain fare element was trivial or insignificant to the overall calculation that they decided to ignore the element due to the overwhelming complexity. For example, the distance component was ignored by some participants when the distance travelled in a certain trip was insignificant.
Difficult element ignorers	Some participants completely ignored the fare element (most often, the distance component) that they perceived would be most difficult to compute and assumed that the other fare structure elements would be sufficient for the calculation.

Source: SGS Economics and Planning, 2019

Frustration

Frustration was a common occurrence across many of the participants as they worked towards the scenarios that contained greater complexity. As fare structures became more complicated with a larger number of fare elements to consider, it was clear that **participants were not able to immediately deduce an answer** and had to instead take the time to develop a methodological process to calculate their answers. This led to participants becoming more 'annoyed' and 'frustrated' with the scenarios as they became increasingly complex.

Furthermore, many participants emphasised that using a complex fare structure in their daily lives would make it **extremely difficult to work out their fare on the platform or 'on the fly'**, further increasing their levels of frustration. In particular, some participants who became extremely frustrated exclaimed their **frustration at the fare-setting public transport statutory authority** by proclaiming that anyone who implements a complex fare structure has "rocks in their head" which furthermore could lead to scepticism about the organisation.

> ***"If anyone implements this, they've got rocks in their head"***

> *"The more complicated this gets, the more sceptical you get about the organisation"*

Disengagement

As an extension to the frustration that participants felt from the increased complexity in fares, this further spurred disengagement with the scenarios.

Some participants exclaimed that if the fare structure were to become too complex, they would simply **not catch public transport at all**, and instead consider alternative modes of travel such as driving or catching an uber. This is evidenced by fact that as the scenarios and fare calculations were becoming more complex as part of the consultation, it was found that some participants would simply guess the answer to the problem rather than taking the time to work them out simply because they could not be bothered.

This level of disengagement links to evidence that individuals prefer known risks over unknown risks, otherwise known as **'uncertainty aversion'**. Henceforth, if fare structures were to become too complicated for travellers to comprehend and compute, this would mean that they may not know the cost of their trips, and therefore could lead to disengagement from the system.

> *"I'd just tell my friend not to catch public transport"*

The participants' quoted alternative of catching an uber is an interesting comparison because the fare structures of ride sharing services are substantially more opaque and complex than public transport. However, a direct comparison is inappropriate because users have different sets of expectation for each option. In an uber, the disutility of a higher and more complex price is offset by the utility of a more comfortable and direct ride. On public transport, the disutility of longer and less convenient trips are offset by a lower and predication price. If that public transport fare is no longer cheap or predictable, the opportunity cost (both financial and to utility) of travelling via an uber is much smaller and some users are likely to shift to the ride sharing service.

Additionally, ride sharing services often now give a price estimate before a trip starts. This helps address the ambiguity aversion for those transport options. If public transport services become more complex, similar steps to help address ambiguity aversion would assist users.

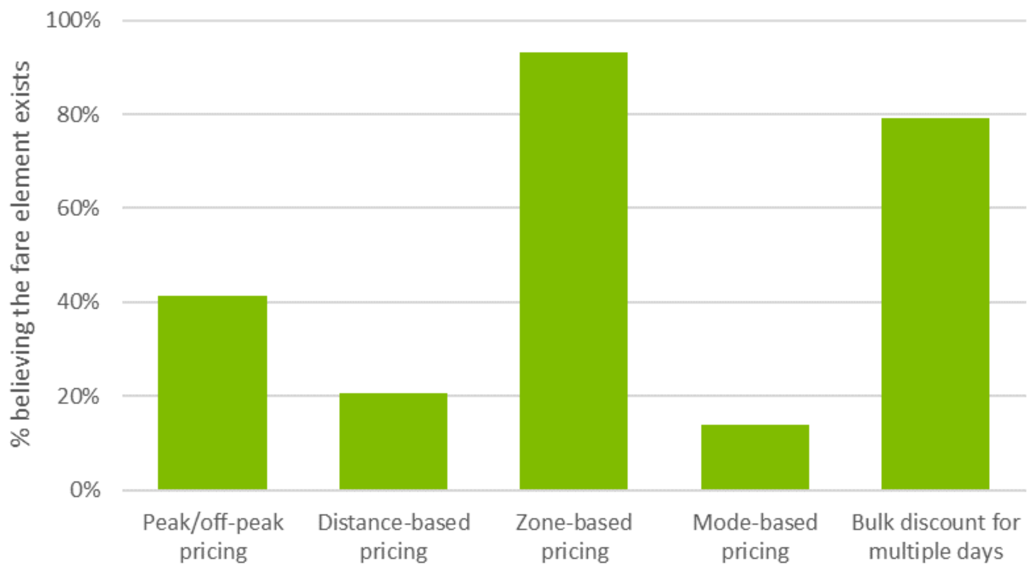
4.5 Other findings

Participants' understanding of the current fare system

As a warm-up activity through the consultation process, participants were asked a multiple choice question to identify the current fare structure elements in the Victorian system. This discussion allowed the focus of the session to move towards determining which fare structure elements are the easiest and which are the hardest to understand, as well as to provide an opportunity to explain what each type of complexity means.

It also to helped test participants' familiarity and comprehension of the existing system. The proportion of individuals who identified each element as part of the current Victorian fare system is illustrated in Figure 15. And the responses are analysed below in Table 6. Some elements are clear (such as zone-based pricing) and others are debatable (such as peak pricing). The results here highlight the practical complexity for users of otherwise simple fare structures for policy makers.

FIGURE 15: PARTICPANTS' UNDERSTANDING OF VICTORIAN FARE STRUCTURE



Source: SGS Economics and Planning, 2019

TABLE 6: FARE ELEMENTS IN THE VICTORIAN PUBLIC TRANSPORT SYSTEM

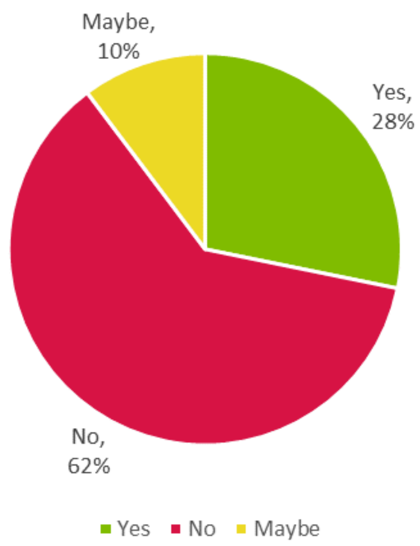
Fare element	Presence in Victorian system	Identification by participants
Peak/off-peak pricing	The Victorian regional fare structure currently has a peak/off-peak charge, while the metropolitan Melbourne fare structure has a looser off-peak saving with the availability of the Early Bird train ticket, providing free travel to train users completing their journey before 7:15am.	Given the limited publication of the peak/off-peak charge in metropolitan Melbourne, it is not surprising that less than half of participants identified this in the current system. The Early Bird fare is also debatable because it does not follow a clear AM/PM peak structure.
Distance-based pricing	A distance-based charge does not currently exist in the Melbourne Metro public transport fare structure but it does in the regional system	Although 21 per cent of participants identified this as an element of the current fare structure, it is likely that confusion existed between the definition of a distance-based charge and a zone-based charge amongst some of these participants.
Zone-based pricing	A zone-based charge does exists in the Melbourne Metro public transport fare structure but not in the regional system.	A very large majority, 93 per cent of participants, identified that the current system uses a zone-based charge.
Mode-based pricing	A full mode-based charge does not currently exist in the Victorian public transport fare structure, although it could be argued that Melbourne's Free Tram Zone and the Early Bird train ticket represent loose forms of a mode-based charge.	14 per cent of participants identified this as an element of the current fare structure; perhaps some of these individuals considered Melbourne's Free Tram Zone or the Early Bird train ticket.
Bulk discount for multiple days	A bulk discount for multiple days of travel exists in the Victorian public transport fare structure with the availability of Myki Pass, although the travel must be pre-purchased with the specific number of days pre-paid for in advance.	A majority, consisting of 79 per cent of participants were aware that the current system has a bulk discount for multiple days of travel available.

Source: SGS Economics and Planning, 2019

Fare complexity impact on travel decisions

As a wrap-up activity through the consultation process, participants were asked whether their travel choices would change if the most complex fare structure (consisting of a peak/off-peak charge, distance-based charge and mode-based charge) applied to their current commute. The distribution of responses is illustrated in Figure 16.

FIGURE 16: PARTICPANTS WHO WOULD CHANGE THEIR JOURNEY



Source: SGS Economics and Planning, 2019

Participants who **would not change their journey** explained that there are other more important factors influencing their travel choices (than fare structure), some of which include:

- **Price:** Participants explained that they did not mind the complex fare structure as long as they did not have to pay more for their public transport trip than alternatives like driving. This was particularly prominent for inner city residents with shorter trips who benefited from the smaller distance-based charge.

  Given that the **opportunity cost** of switching to self-drive or taxi/uber results in significantly higher travel costs, most participants stated that they would stick with public transport despite detesting more complex fares.

- **No other options available:** Some participants, particularly those who lived in middle or outer suburban areas exclaimed that they would not have the option to change their commute given no other public transport modes are available to reach their destination. This was particularly more prominent for younger participants, perhaps whom are yet to have access to driving.

- **Convenience:** Some participants acknowledged that their current travel choices are most convenient for travelling between their origin and destination, and therefore even with the existence of a complex fare structure, would not change their travel decisions.

- **Travel time savings:** A few participants who had the option to choose between alternative public transport modes stated that they would prefer to choose a more expensive mode (e.g. train) over a less expensive mode (e.g. tram) if the more expensive option provided a reasonable travel time saving.

- **Activities during travel:** Participants identified that their travel is not purely 'utilitarian travel' and that there is scope to undertake activities (or 'anti-activities') when travelling, such as reading, accessing social media, or simply as an opportunity for down-time when using their current mode. Therefore, it would not be ideal to change their travel behaviour.

- **Trip purpose:** Some public transport trips taken by participants include 'undirected trips', where the travel is a part of the activity (for example, in a leisure/social trip). In these circumstances, the participants would not change their travel choices given there is positive utility in undertaking the travel.
- **Travelling disengaged:** Some participants acknowledged that they would not bother calculating their fare and continue to use their current mode choice given it is the most suitable mobility choice.
- **Peace of mind:** Participants stated that would not change their current travel choices due to ease of getting from origin to destination. There are no concerns with car accidents or breakdowns as perceived with driving.

Reasons that some participants **would change their journey** with a complex fare structure include:

- **Cheaper options now available:** A few participants acknowledged that with the new fare structure, cheaper options would now be available (for example, switching from the train to a tram/bus, or switching from peak to off-peak) and therefore given that price is an important factor, would switch to the cheaper option. This was particularly the case for inner city residents.
- **Frustration and disengagement:** Some participants found that having a complex fare structure made them more 'annoyed' and 'frustrated' at the public transport system given that it would make it extremely difficult to work out their fare on the platform or 'on the fly'. These participants explained that given such a system, they would simply not catch public transport at all and instead consider alternative modes of travel such as driving or catching an uber.
- **Unfair for low-income earners in outer suburbs:** Participants living in the outer suburbs stated that they are unlikely to continue using public transport if a distance-based charge were to be incorporated. Given that these individuals are likely to be younger persons with a lower income where every dollar count, a distance-based charge could create controversy as an equity issue.

Some participants stated that they **may change their journey** with a complex fare structure. Factors impacting this include:

- **Accessibility of the fare structure:** Some participants acknowledged that despite a complex fare structure, if the fare structure was accessible at train stations, tram stops and bus stops to allow travellers to have the information to calculate their fares on the platform or at their stop, then this would be a redeeming quality that perhaps could convince them to not change their travel choices.
- **How the fare structure is presented:** A few participants acknowledged that the presentation of a complex fare structure is an extremely important and influential factor on their travel choices. A poorly presented fare structure would create even more confusion in the fare calculation process and cause an even greater deterrence from public transport.

Age impact

An interesting finding that was noted during the user consultation process was that participants within younger age groups (18-30 years of age) often found it easier to compute fares based off complex fare structures than participants within older age groups. Perhaps this is the case because younger public transport users are more engaged with the current public transport fare system and are therefore more familiar with fare calculations, or alternatively perhaps they are more in tune with performing mental arithmetic in light of being a current or recent student.

5. CONCLUSIONS

SGS and BIT conducted four streams of research to investigate how people respond to complexity in public transport fare structures. The findings were consistent across the research streams: simpler elements are easier to understand, comprehension declines as complexity increases, users approach the tasks differently, and framing of the fare structure will impact comprehension in the real world.

5.1 Overview

The objective of this project was to inform IV's program of research on possible improvements to the Victorian public transport fare structure for both the metropolitan and regional transport system. It will help ensure that fare structures operate efficiently in theory and in practice.

To meet this objective, SGS and BIT have explored how people respond to complexity in public transport fares across four streams of research. A literature review and expert interviews made up the secondary research, and an online experiment and user consultation made up the primary research.

All of the research streams gave consistent findings about the response to complexity. These findings have formed the conclusions below.

5.2 Conclusions

Simpler elements are easier to understand.

Modal and peak charges were relatively easy to understand for participants in both the experiment and user consultation. Distance charges were the hardest element to understand despite having simple multipliers, for example, 10 cents per kilometre. This indicates that distance charges are likely to be even more difficult to calculate in a real world application that would probably require multipliers that don't have round numbers, for example 7 centre per kilometre.

Distance charges are more likely to be successful in combination with very simple elements, particularly a flat base fare. As noted in the literature review, harmonizing flag fall prices across modes in Sydney helped users to understand distance-based charges across a whole trip. This corresponds with participants in the user consultation who struggled to add a distance-multiplier on top of a base fare that differed across modes or peak/off-peak times. Still, however it is simplified, any distance charge is likely to be understood less easily than other fare elements.

As complexity increases, comprehension declines

Extensive literature supports the idea that users do not deal with complexity well, and typically make do not choose the best price when faced with more complex pricing structures. The experiment and user consultation confirmed the literature. Comprehension was lower and there were slower reactions times for the more complex fare structures.

Combining multiple elements in the one fare structure particularly resulted in a decline in comprehension. Most users could handle two elements in the one fare but three elements seemed to be a tipping point, especially when the third element was a distance charge.

Some users also showed frustration and even disengagement from the activities when presented with the most complex fare structures. This indicates than users may not respond to a system that is overly complex and combines multiple elements.

Users approach the tasks differently

Different people use different approaches when trying to understand fare structures and make travel decisions. The experiment identified two main groups: problem solvers who were very methodical in their approach, and intuitors who relied more on rules of thumb or more basic approaches.

Participants in the user consultation identified a range of rules of thumb and approaches that intuitors adopt. These included including those motivated by a single fare element, those motivated by feeling, those who ignore seeming irrelevant information and those who ignored overly difficult elements.

The experiment suggests that most users are intuitors rather than problem solvers. Importantly, as complexity increases, it appears that problem solvers decline in number. Fare structures should be designed with intuitors in mind to ensure that the basic rules of thumb that they follow are likely to lead to efficient transport decisions.

There is potential for learning, but it depends on feedback

There was no evidence in the experiment that any of the treatments resulted in respondents learning the fare structures faster. However, the design of the task was focused on measuring complexity, with learning a secondary objective. Firstly, the level of feedback provided was limited – this was by design, as we sought to mimic the current set up of the Myki system (where there is minimal direct feedback about how much a particular trip costs).

In contrast, user consultation participants in the focus groups and interviews did report that they were able to learn as they became familiar with the calculation process across the scenarios. This learning process is distinct from that in the experiment because participants in received feedback after each scenario and discussed their approaches as a group. This learning process is also more akin to that observed in the ORR (2014) study, whereby they observed trial and error learning for users over a number of trips.

Additionally, it is important to note that the trial was aiming to measure learning *about the system as a whole*. When considering individual travel choices, particularly for regular users, what is relevant is learning *about specific journeys*. Evidence from the literature, and from our discussions with experts, suggests that whilst people may not be adept at learning broader systems, they can typically learn about how those systems impact on them in particular, especially if they interact with the system regularly.

Framing and presentation of fares will impact comprehension in the real world

Literature suggests that more intuitive structures are more easily understood. The experiment found that modal differences were very easy to understand (likely due to the differences being very salient), but there was some confusion about exactly when peak charges applied. The results indicate that most user will struggle to understand a fare once a third element is added to the structure, however, this impact may be mitigated by effective framing and presentation.

Hence, how the elements of the fare structure are presented, and what supporting information and promotion there is in the system, will greatly impact understanding. An example of intuitive presentation is the Free Tram Zone in the Melbourne CBD. Users are given clear and salient signals with on-trip announcements and signage at tram stops. Again, presenting information like this is especially relevant if a majority of public transport users are intuitors, and are unlikely to completely internalise a fare structure.

There is some potential for the role of technology, such as smart phone applications, in overcoming the complexity, both by providing easy access to information and in presenting the that information in a timely and effective way. The impact of these technological interventions is likely to be limited, however, because interactions with public transport don't require a technology interface. The technology solutions already exist but use is low. Therefore, adoption of the technology is the threshold issue for any impact it may have. Given public transport users are a captive audience who are physically present when consuming the service, more effective interventions are likely to be found in the presentation of information at key locations throughout stations, stops and onboard services.

REFERENCES

Berger, L., Bleichrodt, H., & Eeckhoudt, L. (2013). Treatment decisions under ambiguity. Journal of Health Economics, 32, 559-569.

Bonsall, P., Shires, J., Matthews, B., Maule, J. and Beale, J. (2004). Road User Charging – Pricing Structures. Report submitted to the Department for Transport.

Bonsall P., Shires J., Maule J., Matthews B., Beale J., (2007) "Responses to complex pricing signals: Theory, evidence and implications for road pricing". Transportation Research Part A 41, 672–683.

Easley, D., & O'Hara, M. (2009). Ambiguity and nonparticipation: the role of regulation. The Review of Financial Studies, 22(5), 1817-1843.

Greenleaf, E. A., Johnson, E. J., Morwitz, V. G., & Shalev, E. (2016). The price does not include additional taxes, fees, and surcharges: a review of research on partitioned pricing. Journal of Consumer Psychology, 26(1), 105-124.

Grubb, M. D. (2015). Failing to choose the best price: Theory, evidence, and policy. Review of Industrial Organization, 47(3), 303-340.

Gwilliam K., (2017). Transport pricing and accessibility: moving to access. Brookings Institute. Available online: https://www.brookings.edu/wp-content/uploads/2017/07/pricing_and_accessibility-paper_web.pdf

Huang, D., Liu, Z., Liu, P., & Chen, J. (2016). Optimal transit fare and service frequency of a nonlinear origin-destination based fare structure. Transportation Research Part E: Logistics and Transportation Review, 96, 1–19.

King D., and Streeting M., (2016). "Ticket to ride: reforming fares and ticketing for sustainable public transport". Tourism and Transport Forum (TTF) Australia in partnership with PWC

Liu B-Z, Ge Y-E, Cao K, Jiang X, Meng L, Liu D, et al. (2017). Optimizing a desirable fare structure for a bus-subway corridor. 12(10)

Morwitz, V. G., Greenleaf, E. A., & Johnson, E. J. (1998). Divide and prosper: consumers' reactions to partitioned prices. Journal of Marketing Research, 453-463.

Nahata, B., Ostaszewski, K., & Sahoo, P. (1999). Buffet pricing. Journal of Business 72 (2), 215–228.

Lyons, G. (2006). The role of information in decision making with regard to travel. Intelligent Transport Systems, 153 (2). pp. 199-212.

Otto B., Boysen N., (2017). Zone-Based Tariff Design in Public Transportation Networks.

Rey D., Dixit V., Ygnace J., Waller T., (2015). An endogenous lottery-based incentive mechanism to promote off-peak usage in congested transit systems. Transport Policy 446:46-55.

Streeting M., Charles P., (2006). Developments in transit fare policy reform. The Australasian Transport Research Forum.

Sitzia, S., Zheng, J., & Zizzo, D. J. (2015). Inattentive consumers in markets for services. Theory and Decision, 79(2), 307-332.

Smith, J. D., Boomer, J., Zakrzewski, A. C., Roeder, J. L., Church, B. A., & Ashby, F. G. (2014). Deferred feedback sharply dissociates implicit and explicit category learning. Psychological science, 25(2), 447-457.

Szabo, N., (1999). Micropayments and mental transaction costs. Presented at 2nd Berlin Internet Economics Workshop, May 1999. Available online: www.best.com/~Szabo

Office of Rail Regulation (ORR) (2011). Understanding and testing passenger perceptions of complexity in relation to fares and ticketing. Prepared by ORR by SPA Future Thinking.

Wang A., Chen F., Wang B., Huang J., (2017). Passengers' response to transit fare change: an ex post appraisal using smart card data.

Yoh A., Taylor B., Gahbauer, J., (2012). Does Transit Mean Business? Reconciling academic, organizational, and political perspectives on Reforming Transit Fare Policies.

APPENDIX 1:
EXPERT BIOGRAPHIES

As part of our secondary research to support the literature, SGS and BIT consulted with a number of experts from academia and policy fields to uncover additional insights and how these may apply in a specifically Victorian case.

Dr Robin Goodman

Dean of School of Global, Urban and Social Studies, RMIT University

Robin is an urban planner who has taught a number of undergraduate and postgraduate courses on transport and urban planning. She has led many study tours to China, Vietnam and Germany and supervised PhD students on topics relating to transport policy and provision.

Elizabeth crouch

Ex-Chairman, NSW Public Transport Ticketing Corporation

Elizabeth is the Deputy Chancellor of Macquarie University and currently chairs a number of Audit and Risk Committees in transport. She has previously served as the Chairman of the NSW Public Transport Ticketing Corporation at a time of when the entire ticketing process was overhauled and updated, RailCorp, and other various transport audit committees.

Jim Glasson

Former Director General, NSW Ministry of Transport

Jim Glasson is an experienced Senior Executive with over 40 years broad experience across the transport sector in Australia, including strategic planning, public policy, infrastructure design and transport operating environments, covering both the public and private sectors.

Marion Terrill

Transport & Cities Program Director, Grattan Institute.

Marion is a leading policy analyst with a wide range of experience. She joined the Grattan Institute in April 2015 to establish the Transport Program, and has published on investment in transport infrastructure, cost overruns, value capture, congestion and discount rates.

Professor Corinne Mulley

Professor Emerita, University of Sydney.

Professor Emerita Corinne Mulley was the inaugural Chair of Public Transport at the Institute of Transport and Logistics Studies at the University of Sydney. Corinne is a transport economist and was active in transport research at the interface of transport policy and economics.

APPENDIX 2: STATE AND TERRITORY FARE STRUCTURES

TABLE 7: SUMMARY OF AUSTRALIAN JURISDICTIONS

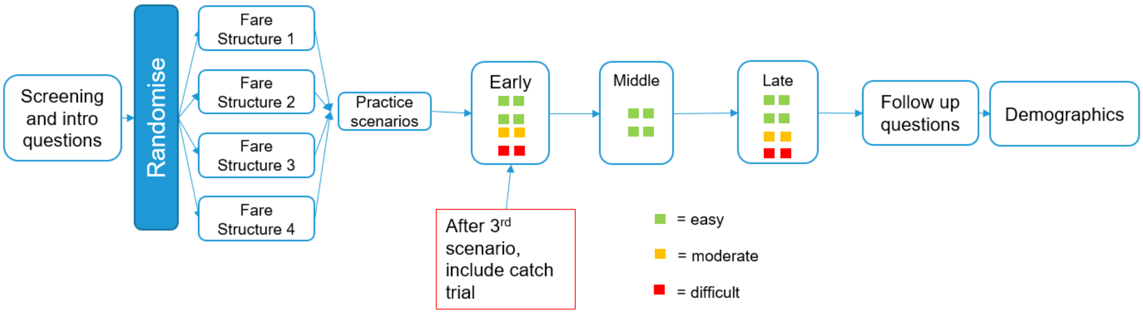
City	Name	Mode	Type	Peak/off peak and incentives
Sydney	▪ Opal smartcard system	▪ Various	▪ Distance based. ▪ The correct amount of fare is automatically deducted based on distance travelled. ▪ Four different fares available: Adult, child/youth, concession and pensioner.	▪ Off-peak fare is 70% of the peak fare. The off-peak periods are outside the peak periods of 7:00 to 9:00 AM and 4:00 to 6:30 PM for Sydney train services, and outside the peak periods of 6:00 to 8:00 AM and 4:00 to 6:30 PM for intercity train services. ▪ There is a $ 2.50 cap for all Opal trips taken on Sundays, and a weekly travel reward for travellers who make eight paid trips in a week ▪ Travellers are entitled to save around 20% by using their Opal card rather than purchasing single trip tickets.
Melbourne	▪ MYKI smartcard	▪ Various	▪ This card automatically deducts the lowest fare possible, based on the travellers' departing and alighting locations. ▪ Two fare bands, Zones 1+2 and Zone 2 are available for Myki money for both 2-hour usage and daily fare. Zone 1 of Melbourne's train, tram, and bus networks is the CBD and inner-city suburbs, an approximately 12 km radius. Zone 2 covers the middle and outer suburbs ▪ Divided into two categories - MYKI money and MYKI pass. ▪ Full fare and concession available for each. ▪ A free tram zone applies to the tram only in the CBD	▪ There is a cap of $6 for a day fare during the weekend and public holiday when using Myki across Zones 1 and 2. ▪ Travellers who have touched off before 7:15 AM are eligible for a free early bird train travel.
Adelaide	▪ Metrotickets: paper tickets for both single and day trips across metro trains, trams and buses (suited to infrequent users) ▪ Metrocard is an electronic smartcard designed for multiple public transport trips	▪ Various	▪ Fares are not calculated on distance travelled. ▪ Four different fare offers: regular fares, concession and tertiary student fares, primary and secondary student fares, and senior Metrocard.	▪ The interpeak, regular Metrocard fares are 55% - 75% of the regular peak fares. The peak periods are before 9:01 AM and after 3:00 PM on weekdays, and all day Saturday. Inter peak periods are Monday to Friday 9:01 AM to 3:00 PM, and all day Sundays and public holidays.
Perth	▪ 'Go Card' smartcard system	▪ Various	▪ The Go Card automatically calculates and deducts the overall fare at either an adult or concession rate, based on the number of zones travelled through the trip. ▪ The expiry times are two hours for a trip of one to four zones, and three hours for a trip of five or more zones. ▪ Total 9 zones ▪ Free zone in the city CBD where all public transport is free	▪ Entitled to savings when they use a Go Card rather than paper tickets.

City	Name	Mode	Type	Peak/off peak and incentives
Hobart	▪ Metro – Greencard	▪ Various	▪ **1 Zone** fares can be used within a single zone only, without crossing a zone boundary. ▪ **2 Zones** fares can be used to travel between two zones, crossing one zone boundary. ▪ **All Zones** fares can be used to travel between more than two zones. ▪ Greencard automatically caps urban fares at the maximum daily rate. Greencard customers will not pay more than the maximum daily rate for multiple trips in the same day. ▪ Student and concession customers pay a flat fare regardless of number of zones travelled.	▪ Weekday full fare daily cap is $9.40 if the first boarding is prior to 9am, or $4.70 if the first boarding is after 9am. Saturday, Sunday and Public Holiday full fare daily cap is $4.70. ▪ ▪ Greencard allows you to transfer between services for free within 90 minutes of the first boarding.
Brisbane	▪ TRANSlink Go card (Smartcard) and single price paper tickets.	▪ Various	▪ Based on the number of zones travelled through. ▪ 8 Zones in South East Queensland. 11 zones in Cairns, 15 zones in Mackay, 11 zones in Toowoomba. ▪ Adult and concession rates.	▪ Peak and off peak applies to the go card. Off peak fares are 20% cheaper for go card users. ▪ Off-peak fares apply on: - weekdays: 8.30am–3.30pm and 7pm–6am (next day) - weekends: all day - state-wide Queensland gazetted public holidays: all day. ▪ Based on when you touch on. ▪ After midnight – ticketing 'day starts at 3am.
Darwin	▪ Tap and ride smartcard and a single price paper ticket	▪ Only public buses	▪ Fare options: - Single (unlimited 3hrs) - Daily - Flexi Trip (10 trip x 3hrs) - Weekly (unlimited for seven days including day of purchase) ▪ Concession fares available. Free for seniors card holders, students, children under 5 etc.	▪ Peak/off-peak pricing does not apply.

Source: SGS Economics and Planning, collated from relevant State Government public transport web sites.

APPENDIX 3: EXPERIMENT METHOD

Trial design



Screening and Introductory questions

Age:

Please tell us your age:

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-65
- Over 65

Gender:

Please select your gender:

- Male
- Female
- Prefer not to say

Location:

Where do you live within Victoria?

- Metropolitan suburb
- Regional suburb
- I live outside Victoria

Postcode:

What is your full postcode

[Text entry]

Public transport usage:

How often do you use public transport? By public transport we mean trains, trams, buses, and V/Line or intercity trains and coaches.

- 6-7 days a week
- 5 days a week
- 3-4 days a week
- 1-2 days a week
- Once a fortnight
- At least once a month
- Less often than once a month but more than twice a year
- Once every 6 months
- Once a year
- Less than once a year/never

Purpose of trip:

What are the main reasons that you use public transport? [checkboxes – can select multiple answers]

- Travelling to and from work or business, and/or as part of my job
- Leisure activities, e.g., shopping, seeing friends, going out
- Education or study
- Other personal activities, e.g., errands, picking up children, medical appointments
- I don't use public transport. [If select this option, can't select others]

Time of use:

When do you usually use public transport? [checkboxes – can select multiple answers]

- During peak times – 7am to 9am in the morning, and 4-6pm in the evening.
- During off peak times – before 7am, between 9am and 4pm, and after 6pm.
- I don't use public transport [If select this option, can't select others]

Mode of transport used:

When you use public transport, which do you usually use? [checkboxes – can select multiple answers]

- Trains/heavy rail
- Buses
- Trams/light rail
- Other
- I don't use public transport [If select this option, can't select others]

Pricing question:

What is the maximum amount that you think you have to pay for a day's public transport in your State's capital city?

[Free text entry]

Treatment stage

Preamble - Task Instructions

We would like you to think of a friend who is trying to understand public transport in a new city. We are going to show you the public transport fares for the city, and some potential options for taking trips via public transport in that city. We would like you to imagine that a friend has asked you **find the cheapest journey for them**, and is not concerned about the time, route, or mode of transport.

After we give you the fares, we would like you to look at some potential journeys for your friend, and **choose the cheapest option** for your friend. Your friend is most concerned about travelling as cheaply as possible, even if they have to travel further, travel longer, or arrive at different times throughout the day. Your friend also doesn't mind what form of public transport they take. If you choose multiple modes of transport for your friend's journey, they will pay the relevant amount for each portion of their journey.

Use only the relevant information to choose the cheapest journey for your friend.

[Participants see one of the four possible fare structures]

[Treatment A – simple peak pricing]

Travel type	Fare
Single trip (off-peak)	$2
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $2

[Treatment B – Peak pricing plus Modal difference]

Travel type	Fare
Single trip – Bus	$2
Single trip – Tram	$3
Single trip – Train	$4
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $1

[Treatment C – Peak pricing plus distance charge]

Travel type	Fare
Single trip – off-peak	$1 PLUS $0.10 per kilometre
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $1

[Treatment D – Peak pricing plus distance charge plus mode difference]

Travel type	Fare
Bus Single trip – off-peak	$1 PLUS $0.10 per kilometre
Tram Single trip – off-peak	$2 PLUS $0.10 per kilometre
Train Single trip – off-peak	$3 PLUS $0.10 per kilometre
Additional peak charge - for all trips between **7am to 9am** and **4pm to 6pm**	+ $1

Instructions to participants

You have just seen some public transport fares. We would like you to think of your friend who is trying to understand public transport in a new city now. We will show you some public transport journeys, and we would like you to **choose the cheapest option** for your friend based on the fares you have just seen.

You will see two practice journeys.

Practice scenarios - not for randomisation

[Practice 1]

In this task, you will be presented with several potential journeys for your friend. For example:

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **8:30am,** travelling **10kms**
- A **train** leaving at **10:45am**, travelling **10kms**

*We will always ask you to select which option you believe is **the cheapest**. For this scenario:*

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheaper
b) The train is cheaper
c) Both will cost the same
d) Don't know

[present feedback, relevant for each fare structure/treatment arm]

Treatment A	Treatment B	Treatment C	Treatment D
The correct answer is b) - the train is cheaper. The train costs $2, and the bus costs $4.	The correct answer is a) - the bus is cheaper. The bus costs $3, and the train costs $4.	The correct answer is b) - the train is cheaper. The train costs $2, and the bus costs $3.	The correct answer is a) - the bus is cheaper. The train costs $4, and the bus costs $3.

[Practice 2]

Here is one more practice journey.

Imagine your friend has found two options for a journey. They are:

- A **tram** leaving at **3:30pm,** travelling **10kms**
- A **train** leaving at **4:30pm**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The tram is cheaper
b) The train is cheaper
c) Both will cost the same
d) Don't know

[present feedback, relevant for each fare structure/treatment arm]

Treatment A	Treatment B	Treatment C	Treatment D
The correct answer is a) - the tram is cheaper. The tram costs $2, and the train costs $4.	The correct answer is a) - the tram is cheaper. The tram costs $3, and the train costs $5.	The correct answer is a) - the tram is cheaper. The tram costs $2, and the train costs $3.	The correct answer is a) - the tram is cheaper. The tram costs $3, and the train costs $5.

Scenarios

After choosing a journey for each scenario, participants will be shown feedback about whether they got the answer correct or not

This feedback will depend on the fare structure (treatment arm/condition), and will be either:

"You chose the cheapest option." [correct response]

"You did not choose the cheapest option." [incorrect response]

Scenario randomisation

All scenarios will appear in a random order for all participants, but will be constrained to balance out the scenarios that appear throughout. Specifically, the order of scenarios will be broken into 3 "buckets":

- Early (first 8 scenarios)
- Middle (middle 4 scenarios)
- Late (last 8 scenarios)

For the Early and Late buckets, we specify that each bucket should have (drawn at random, and ordered randomly):

- 4 "easy" scenarios
- 2 "moderate" scenarios
- 2 "difficult" scenarios

The Middle bucket will have 4 random "easy" scenarios.

Instructions to participants:

Your task will begin now. Remember to use only the relevant information to choose the cheapest journey for your friend.

[Scenario 1 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **8:45am,** travelling **10kms**
- A **train** leaving at **9.10am**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

The bus is cheaper

The train is cheaper

Both will cost the same

Don't know

[Scenario 2 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **8:30am,** travelling **10kms**
- A **tram** leaving at **9:30am**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheaper
b) The tram is cheaper
c) Both will cost the same
d) Don't know

[Scenario 3 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **5:45pm,** travelling **10kms**
- A **train** leaving at **6:15pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheaper
b) The train is cheaper
c) Both will cost the same
d) Don't know

[Scenario 4 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **tram** leaving at **5:00pm,** travelling **10kms**
- A **bus** leaving at **4:30pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The tram is cheaper
b) The bus is cheaper
c) Both will cost the same
d) Don't know

[Scenario 5 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **train** leaving at **8:00am,** travelling **10kms**
- A **bus** leaving at **7:30am**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The train is cheaper
b) The bus is cheaper
c) Both will cost the same
d) Don't know

[Scenario 6 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **train** leaving at **5:30pm,** travelling **10kms**
- A **bus** leaving at **6:15pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The train is cheaper
b) The bus is cheaper
c) Both will cost the same
d) Don't know

[Scenario 7 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **train** leaving at **6:30pm,** travelling **10kms**
- A **bus** leaving at **5:45pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The train is cheaper
b) The bus is cheaper
c) Both will cost the same
d) Don't know

[Scenario 8 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **train** leaving at **8:45am,** travelling **10kms**
- A **tram** leaving at **9:15am**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The train is cheaper
b) The tram is cheaper
c) Both will cost the same
d) Don't know

[Scenario 9 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **tram** leaving at **3:30pm,** travelling **10kms**
- A **train** leaving at **3:30pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The tram is cheaper
b) The train is cheaper
c) Both will cost the same
d) Don't know

[Scenario 10 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **tram** leaving at **10am,** travelling **20kms**
- A **train** leaving at **10am**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The tram is cheaper
b) The train is cheaper
c) Both will cost the same
d) Don't know

[Scenario 11 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **5:45pm,** travelling **20kms**
- A **tram** leaving at **6:15pm**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheaper
b) The tram is cheaper
c) Both will cost the same
d) Don't know

[Scenario 12 - Easy]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **8:30am,** travelling **10kms**
- A **bus** leaving at **10am**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus at 8:30am is cheaper
b) The bus at 10am is cheaper
c) Both will cost the same
d) Don't know

[Scenario 13 - Moderate]

Imagine your friend has found two options for a journey. They are:

- A **train** leaving at **8:45am,** travelling **10kms**
- A **bus** leaving at **9:15am**, travelling **10kms** – and then a second **bus** at **9:45am**, travelling another **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The train is cheaper
b) The two buses option is cheaper
c) Both will cost the same
d) Don't know

[Scenario 14 - Moderate]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **5:30pm,** travelling **10kms** – and then a **tram** at **5:50pm**, travelling another **10kms**
- A **bus** leaving at **6:30pm** travelling **10kms** – and then a **train** leaving at **7pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus and the tram option is cheaper
b) The bus and the train option is cheaper
c) Both will cost the same
d) Don't know

[Scenario 15 - Moderate]

Imagine your friend has found two options for a journey. They are:

- A **train** leaving at **5pm,** travelling **10kms** – and then a **train** at **5:30pm**, travelling another **10kms**
- A **bus** leaving at **6:15pm** travelling **20kms** – and then a **bus** leaving at **6:45pm**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The two trains option is cheaper
b) The two buses option is cheaper
c) Both will cost the same
d) Don't know

[Scenario 16 - Moderate]

Imagine your friend has found two options for a journey. They are:

- A **bus** leaving at **8:30am,** travelling **60kms**
- A **train** leaving at **9:15am** travelling **10kms** – and then a **train** leaving at **9:45am**, travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheaper
b) The two trains option is cheaper
c) Both will cost the same
d) Don't know

[Scenario 17 - Difficult]

Imagine your friend has found three options for a journey. They are:

- A **bus** leaving at **5pm,** travelling **10kms**
- A **tram** leaving at **5:30pm** travelling **10kms**
- A **train** leaving at **6:30pm** travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheapest
b) The tram is cheapest
c) The train is cheapest
d) The tram and the train are both the cheapest option
e) All options cost the same
f) Don't know

[Scenario 18 - Difficult]

Imagine your friend has found three options for a journey. They are:

- A **bus** leaving at **8:30am,** travelling **30kms**
- A **tram** leaving at **9:30am,** travelling **10kms**
- A **train** leaving at **10am**, travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheapest
b) The tram is cheapest
c) The train is cheapest
d) The tram and the train are both the cheapest options
e) The bus and the tram are both the cheapest options
f) Don't know

[Scenario 19 - Difficult]]

Imagine your friend has found three options for a journey. They are:

- A **bus** leaving at **6:30pm,** travelling **30kms**
- A **tram** leaving at **6:30pm,** travelling **10kms**
- A **train** leaving at **5:30pm,** travelling **20kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheapest
b) The tram is cheapest
c) The train is cheapest
d) The bus and the tram are both the cheapest options
e) All options cost the same
f) Don't know

[Scenario 20 - Difficult]]

Imagine your friend has found three options for a journey. They are:

- A **bus** leaving at **10am,** travelling **30kms**
- A **tram** leaving at **10am,** travelling **10kms**
- A **train** leaving at **8am,** travelling **10kms**

Which option do you think is the **cheapest**, based on the rules you saw earlier?

a) The bus is cheapest
b) The tram is cheapest
c) The train is cheapest
d) The bus and the tram are both the cheapest options
e) All options cost the same
f) Don't know

Catch trial

[After the 3rd real scenario, participants will be asked the following question:]

Just to confirm, are you choosing your answers based on:

- The shortest journey
- The cheapest journey
- The journey that leaves the earliest
- The most comfortable journey
- A journey that is the best across a range of factors like price, distance, comfort, and time.
- Something else

[All participants who select anything other than "the cheapest journey" are to be screened out.]

Follow up and demographics

[We will ask several questions at the end of the task which tap into participant's rule recall and strategy for selecting answers.]

Q1a: Strategy 1

How did you choose the journeys to recommend to your friend throughout this task?

- The shortest journey
- The cheapest journey
- The journey that leaves the earliest
- The most comfortable journey
- A journey that is the best across a range of factors like price, distance, comfort, and time.

Q1b: Strategy 1

Did this strategy change through the task? If so, how?

[Free text entry]

Q2: Rule recall 1

If you had another friend coming to this city, how would you explain the public transport fares to them?

[Free text entry]

Q3: Rule recall 2

From the list below, which of the rules about public transport fares applied in this scenario?

[Checkbox, can select multiple]

- Trains were more expensive than trams, and trams were more expensive than buses
- If you travelled further, it cost more to travel
- There was an additional peak charge for travelling between 7am to 9am and 4pm to 6pm.

Q4: Perceptions

On a 1 to 5 scale, where 1 is very easy to understand and 5 is very hard to understand, I found the fare system to be:

1. Very easy to understand
2. Easy to understand
3. Neither easy nor hard to understand
4. Difficult to understand
5. Very difficult to understand

Q5: Income:

What is your annual household income before tax?

- Less than $25,000
- $25,000-$49,999
- $50,000-$74,999
- $75,000-$99,999
- $100,000-$149,999
- $150,000-$199,999
- $200,000 or more

Q6: Employment

Which best describes your employment status

- I work full-time (more than 30 hours per week, includes self-employed)
- I work part-time (less than 30 hours per week, includes self-employed)
- I am a student (full-time or part-time)
- I am retired
- I am not working, but I am looking for work
- I am not working, but I am NOT looking for work

Q7: Education Level

What is the highest level of education you have attained?

- Have not completed high school
- Completed high school
- Vocational or technical qualification
- Bachelor's degree or undergraduate diploma
- Post-graduate diploma, Masters or PhD

APPENDIX 4: USER CONSULTATION METHOD

Engagement format

The Project Team directly engaged with public transport users on their understanding of, and behaviour in response to, pricing complexity. Through this task we explored the impact of discrete individual elements of fare structures as well as the combined effect of complex elements.

This stream of research provided a nuanced and detailed understanding of how individuals responded to existing fare structure complexity, how changes in the past have been responded to and how people respond to hypothetical future changes. Hypothetical future changes included five hypothetical scenarios and were consistent with those tested as part of the online experiment.

In total, 39 people participated in focus groups and phone interviews, which were held during the day and after work from 6 February to 14 February 2019. Participants were recruited for the project using a market research team, and represented diverse ages, life stages, and geographies. Some were frequent users, while others rarely used public transport.

User consultation took place in the format of three 90-minute focus groups covering nine to ten people per workshop, as well as one-on-one interviews with a further ten people. This facilitated a consultation format that was able to target groups of interest to IV, including frequent and infrequent public transport users.

Participant recruitment and sample size

Recruitment parameters

A sample of 30 participants from among the general public were recruited for the focus groups, with a proportionate mix of frequent and infrequent public transport users as outlined in Table 8. In total, 29 people attended one of three focus group meetings.

TABLE 8: PUBLIC TRANSPORT USER GROUPS

Frequent public transport users	Infrequent public transport users
▪ Metropolitan users ▪ Regional users ▪ Multi-zone users ▪ Single mode travellers ▪ Multi-mode travellers ▪ On-peak travellers ▪ Off-peak travellers	▪ Visitors ▪ People travelling for education/leisure

Source: SGS Economics and Planning, 2019

The following baseline information was collected as part of the recruitment process:

- Age range
- Origin (home) and destination (work/place of study/other) location
- Frequency of public transport use
- Days and time of public transport use
- Reasons for public transport use.

Due to the small number of participants, the focus group was not a representative sample. However, the following parameters were achieved through the recruitment process, to ensure some diversity in the elements of gender, age, locational and user/non-user attributes:

- Gender mix: Minimum 40 per cent male, and minimum 40 per cent female
- Age mix: Minimum 30 per cent 18-30 years, minimum 30 per cent 31-45yrs, and minimum 30 per cent 46-70 years
- Daily work users (or close to daily): Minimum 50 per cent
- Infrequent (less than twice per week): Minimum 20 per cent
- Students: Minimum 20 per cent
- Desirable attributes, although not mandatory: Peak and off-peak travellers, inner city and outer suburban travellers, and retirees.

For the phone interview recruitment (with the intention to reach regional users and travellers), the following parameters were used:

- Gender mix: Minimum 40 per cent male, minimum 40 per cent female
- Age mix: Minimum 30 per cent 18-30 years, minimum 30 per cent 31-45yrs, and minimum 30 per cent 46-70 years
- One to two regional public transport users from Geelong (prefer regular users)
- One to two regional public transport users from another regional centre (for example, Ballarat, Bendigo) (prefer a regular user)
- Five to six daily work users (or close to daily): Minimum 50 per cent
- Two to three infrequent (less than twice per week): Minimum 20 per cent
- Desirable attributes, although not mandatory: Students, peak and off-peak travellers, inner city and outer suburban travellers, retirees.

Participant characteristics

SGS engaged a market research recruiting service provider, Cooper Symons & Associates Market Research, to recruit its participants. The focus group and phone interview participants represented a mix of people across gender, age, employment status, location, travel frequency and regular travel time patterns. This specifically included:

- **Gender mix (Figure 17):** Approximately an equal split between males (56 per cent) and females (44 per cent).

- **Age group mix (Figure 18):** A majority of persons aged 18-45 years (75 per cent), with some persons aged 31-45 years (31 per cent), and a few older persons aged 46-60 years (13 per cent) and 61+ years (13 per cent).

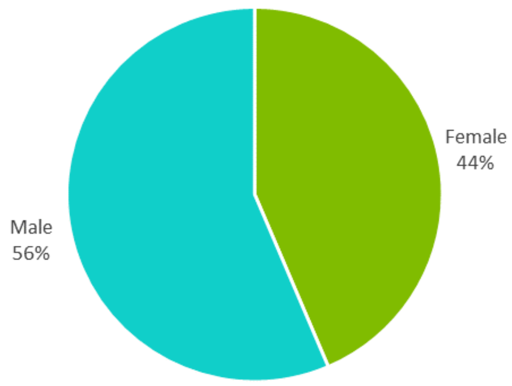
- **Employment mix (Figure 19):** A majority of full-time employed persons (59 per cent), with some unemployed persons (21 per cent), and a few part-time employed persons (10 per cent) and students (10 per cent).

- **Location mix (Figure 20):** A majority of inner metro residents (69 per cent), with some outer metro residents (10 per cent) and a few regional city residents (10 per cent).

- **Travel frequency mix (Figure 21):** A majority of frequent public transport users (67 per cent), with some moderate users (26 per cent) and a few infrequent users (8 per cent).

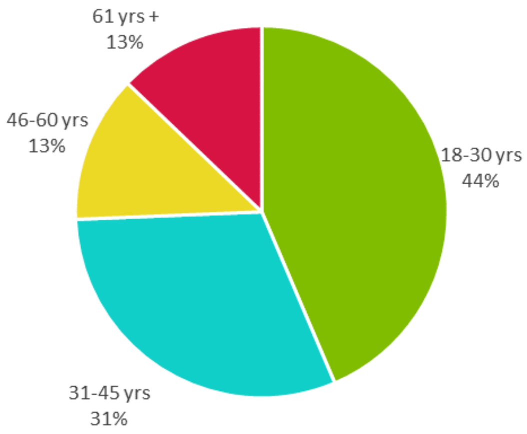
- **Travel time mix (Figure 22):** A majority of peak-period public transport users (59 per cent), with some off-peak users (26 per cent) and some users who travel in both peak and off-peak (8 per cent).

FIGURE 17: SAMPLE GENDER MIX



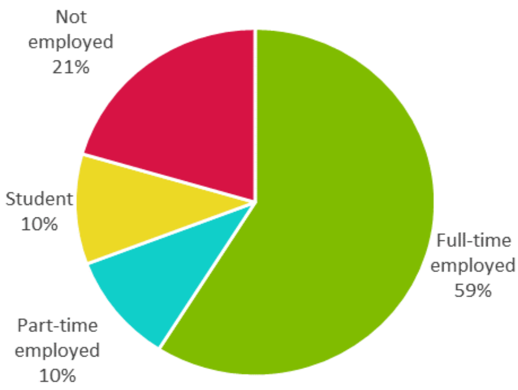
Source: SGS Economics and Planning, 2019

FIGURE 18: SAMPLE AGE GROUP MIX



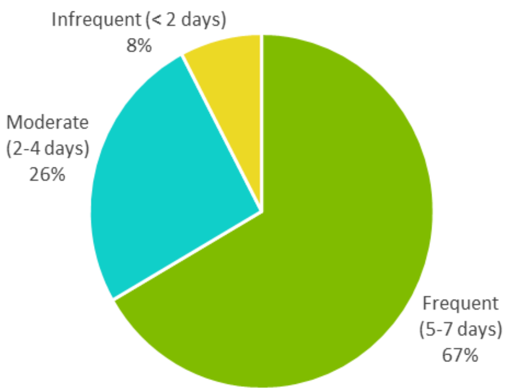
Source: SGS Economics and Planning, 2019

FIGURE 19: SAMPLE EMPLOYMENT MIX



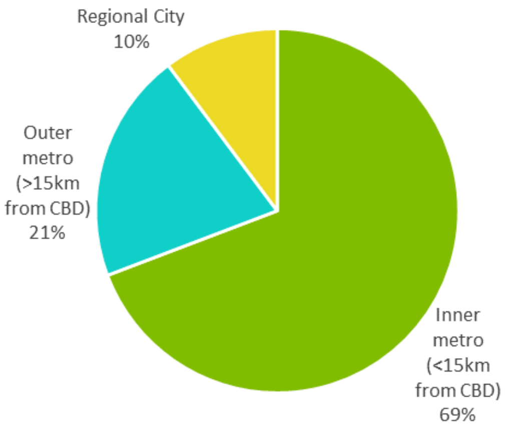
Source: SGS Economics and Planning, 2019

FIGURE 20: SAMPLE TRAVEL FREQUENCY MIX



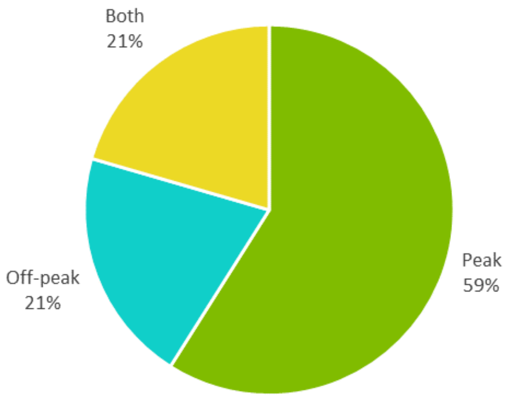
Source: SGS Economics and Planning, 2019

FIGURE 21: SAMPLE LOCATION MIX



Source: SGS Economics and Planning, 2019

FIGURE 22: SAMPLE TRAVEL TIME MIX



Source: SGS Economics and Planning, 2019

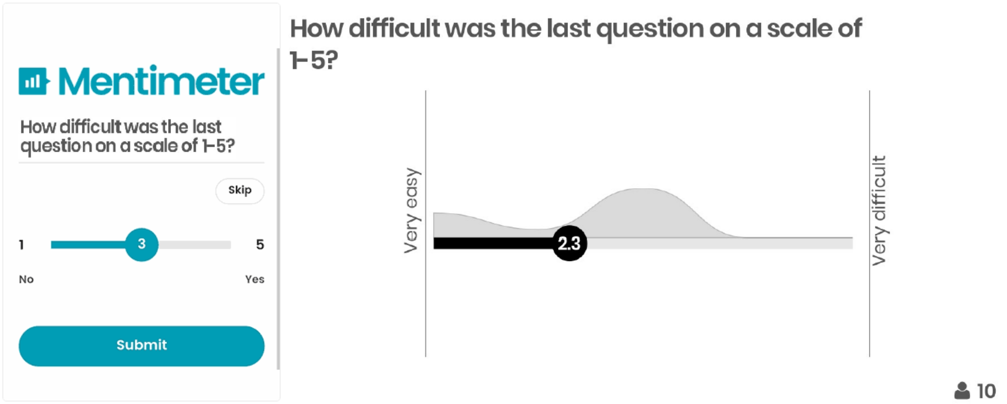
Mentimeter online feedback tool

Mentimeter is an online feedback tool that was used to create interactive presentations and was used as to deliver the presentation and collect participant responses in all focus groups.

The Mentimeter presentation resembled a slideshow with various question types to collect feedback. It facilitated audience participation which allowed participants to login with their web browser on their mobile phone during the workshop.

Using this tool allowed feedback to be collected in real-time, with options to display the results in .jpeg, Excel or .pdf formats.

FIGURE 23: MENTIMETER SCREENSHOTS



Source: SGS Economics and Planning, 2019

Materials

Materials for the focus groups participants

included:

- Name tags
- Sign-in sheet
- Print outs of scenarios
- Texters, pens, stickers, post-it notes
- Project disclosure or explanation brochure - Why we were collecting information, how it will be used, who to contact to find out more information, etc.
- Spare laptops for Mentimeter (for participants without a smart phone)
- Evaluation form

One-on-one interview participants were advised to have a pen and paper handy in order to note down the details of each hypothetical scenario and for any required workings.

User consultation procedure

As outlined above, the focus group discussions and one-on-one interviews involved two main activities:

- A warm up activity, looking at participants' comprehension of the current system.
- A set of hypothetical scenarios, investigating participants comprehension of increasingly complex fare structures.

Information for each activity was gathered in the form of note taking (observation and collecting comments) in both the focus groups and interviews and using the Mentimeter online platform in the focus groups. Mentimeter was also the basis for further discussion with the broader focus group. Participants were encouraged to explore and capture their thought processes and rules of thumb.

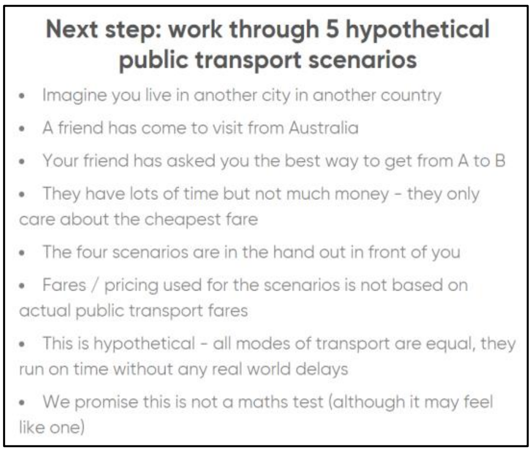
Focus groups

The focus group model enabled observation and engagement with public transport users' behaviour, and the motivation behind certain behaviours. The aim was to collect qualitative information about the different ways people decide how and when they travel, enabling the team to understand how decisions were influenced by complexity. Responses collected in the focus groups can be used to understand the *reasons why* people might choose certain options; information that could not be gathered in the online experiment.

The discussions were designed around two main activities:

- A warm up activity, looking at participants' comprehension of the current public transportation system and what factors influence their decisions.
- A set of five hypothetical scenarios and fare structures, investigating participants comprehension of increasingly complex fare structures and how that might change the way they travel. Figure 24 illustrates the context of hypothetical scenarios provided to participants.

FIGURE 24: HYPOTHETICAL SCENARIO CONTEXT



Source: SGS Economics and Planning, 2019

For each fare structure, participants were given several public transport options and asked to determine which travel option was the cheapest. Throughout the exercise, facilitators continually informed participants that this was an information-gathering exercise and not a maths test.

As responses to each scenario were collected, the group discussed how they reached their result and the level of difficulty in understanding the fare structure.

One-on-one interviews

For one-on-one interviews, participants were interviewed over the phone to facilitate for consultations with a range of public transport users from regional areas. Participants were presented with the same hypothetical scenarios and fare structures as those given to focus group participants, for which participants worked through in a survey-style, rather than face-to-face timed activities.

This stream of research provided a nuanced and detailed understanding of how individuals respond to existing fare structure complexity, how changes in the past have been responded to and how people would respond to hypothetical future changes.

Description of activities conducted

Activity 1: Warm-up activity

This activity was intended to be an 'easy' discussion to put people at ease. It also allowed focus group participants to test out the Mentimeter tool, and interview partcipants to become familiar with the survey-style questions over the phone.

Participants chose which fare elements they believed existed in the current Victorian system. This tested their familiarity with the system and provided them with an opportunity to explain what each type of complexity means.

Participants were provided the following multiple-selection options:

- Peak pricing
- Distance-based pricing
- Zone-based pricing
- Mode-based pricing
- Bulk discount for travelling on multiple days

The data collected will be anecdotal information for Infrastructure Victoria, to determine whether people understand the existing level of complexity within the system.

Activity 2: Hypothetical far structures and scenarios

This activity investigated partcipants' decision-making steps as they engaged with hypothetical questions, relating to public transport fare structures. Focus group participants provided answers to the questions below either in free-form text, voting or multiple-guess responses using Mentimeter. Interview participants responded through survey style questions over the phone. As responses to each scenario were collected, focus group participants openly discussed how they reached their result, and interview participants discussed with their facilitators on how they reached their result.

Five hypothetical scenarios were presented:

- A single-layered fare structure (Peak/off-peak pricing)
- A two-layered fare structure (Peak/off-peak pricing, plus distance-based charge)
- A two-layered fare structure (Peak/off-peak pricing, plus mode-based charge)
- A three-layered fare structure (Peak/off-peak pricing, plus distance-based charge, plus mode-based charge)
- A three-layered fare structure incorporating multi-modal journeys (Peak/off-peak pricing, plus distance-based charge, plus mode-based charge)

The fifth hypothetical scenario was not to test behavioural response but rather to test comprehension of complex fares when a different source of complexity was added.

For each scenario, participants were provided with two alternative travel options (which travel from the same origin and to the same destination) and asked to select which option they believed was the cheapest, based on the fare structure provided.

The choices provided included:

A. Travel option 1 is cheaper
B. Travel option 2 is cheaper
C. Both will cost the same
D. Don't know

Following the collection of responses, participants were prompted in an open discussion (or with facilitators in the interviews) to contribute the factors or 'rules of thumb' they used to work out the advice they would give their friend. They were then asked rate the difficulty of the scenario on a scale of 1 to 5 and discuss how difficult it was to engage with the fare structure, and why.

Throughout the consultation process, facilitators affirmed that the focus of this activity was an information-gathering exercise, rather than a mathematics test that focused on correct answers.

Finally, participants were asked to consider how the most complex fare structure would apply to their current commute.

Fare structures and scenarios

The following fare structures were used as part of hypothetical scenarios activity. Participants were then asked to determine which of the two alternative travel options provided they believed was the cheapest.

Hypothetical scenario 1:
- Single-layered fare structure
- Peak/off-peak pricing

TABLE 9: SCENARIO 1 FARE STRUCTURE

Travel type	Fare
Base fare: all modes	$4
Peak travel single trip (travel between 7am to 9am and 4pm to 6pm)	Plus $1

Source: SGS Economics and Planning, 2019

Travel options:

- A **tram** leaving at **7:30am**
- A **train** leaving at **9:30am**

Hypothetical scenario 2:
- Two-layered fare structure
- Peak/off-peak pricing, plus distance-based charge

TABLE 10: SCENARIO 2 FARE STRUCTURE

Travel type	Fare
Base fare: all modes	$3
Distance charge (as the crow flies)	Plus 10 cents per km
Additional peak travel charge (travel between 7am to 9am and 4pm to 6pm)	Plus $1

Source: SGS Economics and Planning, 2019

Travel options:

- A **tram** leaving at **8:15am,** travelling **10kms**
- A **bus** leaving at **11am**, travelling **30kms**

Hypothetical scenario 3:
- Two-layered fare structure
- Peak/off-peak pricing, plus mode-based charge

TABLE 11: SCENARIO 3 FARE STRUCTURE

Travel type	Fare
Base fare: Train	$2
Base fare: Bus and tram	$3
Additional peak travel charge: Train only (Travel between 7am to 9am, and 4pm to 6pm)	Plus $1

Source: SGS Economics and Planning, 2019

Travel options:

- A **tram** leaving at **8:45am**
- A **train** leaving at **9:15am**

Hypothetical scenario 4:
- Three-layered fare structure
- Peak/off-peak pricing, plus distance-based charge, plus mode-based charge

TABLE 12: SCENARIO 4 FARE STRUCTURE

Travel type	Fare
Base fare: Train	$3
Base fare: Bus and tram	$2
Distance charge: all modes (as the crow flies)	Plus 10 cents per km
Additional peak travel charge: all modes (travel between 7am to 9am and 4pm to 6pm)	Plus $1

Source: SGS Economics and Planning, 2019

Travel options:

- A **train** leaving at **5pm,** travelling **10kms**
- A **bus** leaving at **6:30pm**, travelling **30kms**

Hypothetical scenario 5:
- Three-layered fare structure incorporating multi-modal journeys
- Peak/off-peak pricing, plus distance-based charge, plus mode-based charge

The fare structure for this scenario is as per Scenario 4, with the incorporation of a multi-modal journey. An additional fare structure rule was incorporated with this scenario:

- A multi-modal journey means that you only pay the base fare once, at the base fare of the most expensive mode taken

Travel options:

- A **bus** leaving at **10am,** travelling **5kms** + a **train** leaving at **10:15am** travelling **10km**
- A **tram** leaving at **8am**, travelling **20kms**

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