Understanding Perceptions of Bus Service Attributes in Major Australian Capital Cities

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Abstract

This paper explores user and non-user perceptions of bus service attributes in Melbourne, Sydney and South East Queensland (SEQ). A key aim of this study was to understand the relative importance and performance of various bus service attributes and how they vary by city, by socio-economic cohort and also between user and non-user groups. Primary data was collected in two stages. A screening component enabled the collection of a large sample (n=13,537). A smaller, more representative subset[1] was then selected to complete a more detailed survey (n=2,420).

Personal safety stood out as a key bus service attribute of importance in all three regions. Specifically, safety while travelling on the bus during the daytime and at night, and safety getting to and from the bus stop were ranked as very important attributes of the bus network. There were some differences in findings between regions: bus service levels, such as punctuality, frequency and timetable adherence (reliability), were rated relatively high in importance but low in performance in Sydney and Melbourne compared to SEQ. This suggests that Melbourne and Sydney might require service-level improvements more immediately than SEQ.

Implications for policy for each Australian metropolitan region (Sydney, Melbourne and SEQ) are discussed further in this paper.

1. Introduction

For over 70% of the Australian population buses are the only form of public transport within walking distance. Despite the high level of accessibility, buses are often an underutilised and underappreciated mode of transport.

This paper aims to explore both user and non-user perceptions of bus service attributes in Melbourne, Sydney and South East Queensland (SEQ). A major motivation for the research is to understand what features of services are considered more important and to see how this varies both within cities, by socio-economic cohorts and also between user and non-user groups.

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[1] Representative of the age, income and gender distribution in each geographic region

The research is part of a project commissioned by Roads Australia to explore perceptions of buses. The project was undertaken by Movement & Place Consulting in association with the Public Transport Research Group at Monash University.

The paper is structured as follows: a short literature review, an outline of the research methodology, presentation of results, discussion of key findings and policy implications, followed by the conclusion.

2. Literature Review

Published research literature was examined to identify bus service attributes which can influence perceptions and use of services. A summary of key findings is listed below.

2.1. Service Frequency and Span

Service frequency was identified to be the most important attribute influencing ridership in an international study of factors affecting bus ridership (Currie and Wallis, 2008) and is confirmed by many studies in the field (Devney, 2011, van Lierop et al., 2018, Islam et al., 2016). A range of studies also identified greater user satisfaction, across various socio-demographic cohorts, linked with higher frequency services (Islam et al., 2016, van Lierop et al., 2018).

Islam et al. (2016) and Güner (2018) also suggest service span (length of hours operated) is another important user service trait, although both studies note it has a lesser effect on bus service satisfaction compared to service frequency.

2.2. Punctuality

Han et al. (2018) defines service punctuality as the amount of delay in arrival time, operation speed of the bus and bus stop waiting time. Many studies have found a positive correlation between service punctuality with ridership and user satisfaction levels (Currie and Wallis, 2008, Clayton et al., 2017).

2.3. Directness

Service directness and competitive travel times are another important factor in influencing bus service patronage. de Oña et al. (2013) noted service directness played an important role in fostering an attractive bus service. Direct services can reduce travel times – ensuring the time taken for a given journey is more competitive against shorter journey times by private vehicle. Jansson (2003) identified that straightening out routes (to make services quicker and more direct) can offer travel time savings in the order of 30%.

2.4. Accessibility

Accessibility to, from and between services had mixed effects on ridership. Clayton et al. (2017) found that frequent and direct services were preferable, and attracted higher patronage levels, compared to services that were closer to a users' place of origin or destination.

2.5. Knowledge & Information

Legibility of the network or the ease of which the network can be understood by users and potential users plays a role in improving bus service attractiveness (Daniels and Mulley, 2012). Scott et al. (2016) identify the importance that knowledge of a public transport system has on the choice to use public transport. This suggests simple, clear and easy-to-understand public communication tools are needed to promote bus service awareness. Devney (2011) identified

the importance of branding, distinct colour schemes, logos, signage and information display boards in improving awareness and attractiveness of service.

2.6. Comfort

Bus users' sense of comfort was found to be an important quality affecting the perception of bus services. Islam et al. (2016), (van Lierop et al., 2018, Carreira et al., 2014) identified factors including availability of a seat, ride quality, crowding and overall commuting experience as highly influential factors that affect user satisfaction. Higher levels of comfort can also improve users' perception of operational characteristics like bus speed and journey time. Negative perceptions of services can be mitigated through comfort related improvements including installing weather protection features, provision of seating and ensuring cleanliness at bus stops.

2.7. Safety & Security

The sense of security, both in terms of road safety and personal security, was found to influence individual's perception of bus service quality (Scott et al., 2016). Negative perceptions of personal safety on public transport were found to be a major concern in both Australian and international cities (Currie G and Delbosc A, 2015).

3. Methodology & Analytical Framework

The research method is outlined in Figure 1 below. Key components are a primary survey of both bus users and non-users in Melbourne, Sydney and SEQ, and an analysis of the survey results by socio-economic, city and user/non-user groups. A performance importance analysis was undertaken to assess the evaluation of several bus service attributes (Currie G and Delbosc A, 2015).

Figure 1: Research method
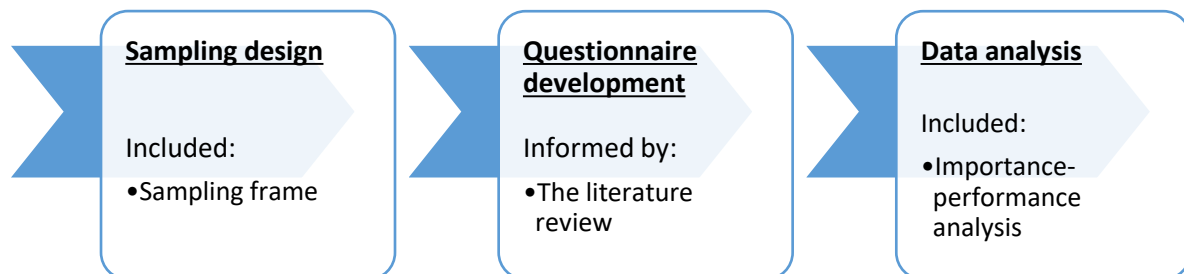
3.1. Sampling Design

The survey was designed to be representative using a random sampling frame structured by age, income and gender. This included the following components:

Target population (population of interest):
- Bus users and non-users residing in metropolitan Melbourne, metropolitan Sydney and SEQ

Sampling frame (accessible target population for the study):
- IPSOS survey respondents living in the cities of interest

Sampling (method to draw sample from the frame):
- Bus users and non-users
- Representative of residential age, income and gender patterns

Sample (participants selected for the study):

- A minimum of 400 bus users and 400 non-users for each geographic region of interest

A screening survey first covered a much larger sample including their attitudinal responses to a range of service attributes. These results are reported separately. Respondents who met the sampling criteria were then selected to complete a longer and more detailed survey -these results are reported separately.

The survey was undertaken in October-November 2021 and as such was influenced by the COVID-19 pandemic and peoples concerns about fear of infection on public transport during the pandemic. The results should be considered in light of this issue.

3.2. Questionnaire Development

The questionnaire was informed by the literature review and explored public transport use, attitudes towards buses and socio-demographic attributes. Importance-performance perceptions of various bus service attributes were measured. A 7-point Likert scale was used to measure the *attitudes towards buses* and the *performance-importance analysis* theme. Key dimensions and scoring ranged from -3 for strongly disagree/extremely unimportant to +3 for strongly agree/extremely important. A score of 0 would indicate a *neither agree nor disagree/neither important nor unimportant*.

3.3. Analysis Approach

Two key approaches were adopted:
- Disaggregate attribute analysis by
    - Socio-demographic characteristics (age, gender, occupation and income)
    - Transport habits (bus use frequency, frequency of use for other public transport modes, drivers licence ownership and access to a car)
    - Attitudes towards buses
- Performance-Importance Analysis (perceived importance of specific service attributes and the perceived performance of buses in their area in relation to a specific service attribute)

The survey data was analysed using various statistical analysis approaches. This enabled investigation of whether statistically significant relationships or differences across groups exist. Post hoc analysis was performed to identify specific group that have significant differences at a 95% confidence interval. The statistical analysis involved Chi-square tests and Analysis of Variance (ANOVA) tests.

4. Results

This section outlines the key findings from the survey data analysis. The first section focuses on the insights from the screening survey (n=13,537), and the second section presents the analysis of the detailed survey (n=2,420).

4.1. Screening survey results

4.1.1. Demographic analysis

There was a similar number of respondents in Melbourne (n=4,789) and Sydney (n=4,878), but a smaller number of respondents from SEQ (n=3,870). Around 8% of screening survey respondents did not own or have access to a car, aligning with Census figures on household car

ownership (9.2% of dwellings in the 3 regions have no car). This indicates the sample relevance and highlights that while car ownership is prevalent in Australia, one in every ten households do not own a car – these households are heavily reliant on public transport such as bus services.

4.1.2. Attitudes towards buses

The screening survey included questions about respondents' attitudes and perceptions of buses. A one-way ANOVA test was performed to determine if socio-demographic characteristics were significantly linked to differences in attitudes towards buses. A post- hoc test was used to explore these differences in detail. Table 1 summarises the ANOVA results.

Table 1: Statistical differences between the groups using ANOVA

	Age	Gender	Income	Location	User/Non-User
Buses help to reduce road congestion	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)
Buses do not improve social inclusion	There is no significant difference exist between groups (p=.976)	Significant difference exists between the groups (P<.001)	There is no significant difference exist between groups (p=.077)	There is no significant difference exist between groups (p=.32)	Significant difference exists between the groups (P<.001)
Buses do not contribute to social well-being in my city	There is no significant difference exist between groups (p=.229)	Significant difference exists between the groups (P<.001)	There is no significant difference exist between groups (p=.454)	There is no significant difference exist between groups (p=.33)	Significant difference exists between the groups (P<.001)
Buses help me to access opportunities, such as jobs and education	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)	There is no significant difference exist between groups (p=.101)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)
Overall, buses are worthwhile	There is no significant difference exist between groups (p=.102)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)	Significant difference exists between the groups (P<.001)

The aggregated mean scores for each statement are outlined below from highest to lowest (from greatest level of agreement to the least):

- 'Overall, buses are worthwhile' (mean=1.60)
- 'Buses help to reduce road congestion' (mean=1.05)
- 'Buses help me to access opportunities, such as jobs and education' (mean=0.60)
- 'Buses do not improve social inclusion' (mean=-0.27)
- 'Buses do not contribute to social well-being in my city (mean=-0.50)

This indicates that while respondents generally believe that buses have a positive role in their cities, they are less likely to believe that buses have a social equity function.

Gender and indication of bus use were found to result in statistically significant differences in responses to all five of the above statements. Men were more likely to believe that buses

contribute to reducing congestion, while women were more likely to believe that buses play a social equity role including improving access to opportunities and improving social well-being and inclusion. Bus users were significantly more likely to believe that buses play a positive role, scoring all the statements more highly than non-users.

Age significantly influenced responses to the statements on congestion reduction and access to opportunities. Respondents aged 35 and over were more likely to agree that buses help to reduce congestion while respondents aged 18 to 34 were more likely to agree that buses improve access to opportunities.

Income significantly influenced responses to statements on congestion reduction and the worthwhileness of buses. Higher income groups were more likely to believe that buses are worthwhile and help to reduce traffic congestion.

Location significantly influenced responses to the statements on congestion reduction, access to opportunities, and the worthwhileness of buses. Respondents from Sydney and SEQ were more likely to believe that buses contribute to reducing congestion, improve access to opportunities, and are overall worthwhile. It is possible that negative attitudes towards buses are contributing to a lower bus mode share in Melbourne compared to Sydney and SEQ. Another perspective is that in Melbourne, buses play a tertiary role behind rail and tram. Whereas they have a primary role in much of Sydney and Brisbane. This may also affect perceptions. It is also likely that high quality BRT style bus services (Finn B. et al., 2012) which are only available in Brisbane and Sydney but not Melbourne and are known to generate higher ridership benefits (AECOM, 2009) and volume (Currie and Delbosc, 2011) may also impact perceptions of service quality between the three cities.

4.2. Detailed survey results

A total of 2,420 respondents were selected for the second stage of the survey based on the sampling criteria. In total, 1,555 men and 860 women participated in the detailed survey. Due to the disproportionate difference in the number of male and female respondents, responses were weighted by gender. Responses were also weighted by age and income to emulate population distributions. There were a similar number of respondents from Melbourne (n=801), Sydney (n=812) and SEQ (807). Table 2 provides a summary of the demographic composition of the respondents selected for the detailed survey.

Table 2: Demographics of the respondents across three locations

	Age (weighted)	Gender (weighted)	Income (weighted)
Melbourne	18 to 34=271(33.8%), 35 to 54=284(35.4%), 55 or over=247(30.8%)	Female=405(51.1%), Male=388(48.9%)	$1000 or more a week=286(35.8%), $400 to $999 a week=271(34%), Less than $400 a week=241(30.2%)
Southeast Queensland	18 to 34=265(33.1%), 35 to 54=288(36%), 55 or over=247(30.9%),	Female=404(50.9%), Male=390(49.1%)	$1000 or more a week=297(37.1%), $400 to $999 a week=287(35.9%), Less than $400 a week=216(27%)
Sydney	18 to 34=265(33.2%), 35 to 54=284(35.5%), 55 or over=250(31.3%)	Female=408(50.8%), Male=396(49.3%)	$1000 or more a week=312(38.9%), $400 to $999 a week=261(32.5%), Less than $400 a week=229(28.6%)

Table 3: Bus service attributes - IPA Analysis & overall score			
Items	Importance	Performance	Quadrant
A. I usually do not have to wait long for a bus	1.71	0.49	C
B. Buses arrive frequently	1.80	0.52	A
C. Buses often run late	1.96	0.39	A
D. Buses show up when they are supposed to	2.00	0.55	A
E. Travel times on buses are too long	1.78	0.28	C
F. Travel times on buses are consistent from one day to the next	1.84	0.72	A
G. Buses get me where I need to go when I need to be there	1.80	0.69	C
H. It is convenient to get to and from my nearest bus stop	1.72	1.06	D
I. Waiting at bus stops is uncomfortable	1.75	0.35	C
J. I feel safe travelling on the bus during daylight*	2.11*	1.40	B
K. I feel safe travelling on the bus at night*		0.05	A
L. Buses are clean and hygienic	1.90	0.67	A
M. Bus trips are comfortable	1.65	0.79	D
N. Buses are crowded	1.79	0.11	C
O. Bus service information is easy to find	1.74	0.78	D
P. Bus service information is easy to understand	1.74	0.81	D
Q. Bus fares are affordable	1.91	0.78	B
R. I can easily get on and off the bus	1.81	1.38	D
S. Bus services operate in my area at night	1.32	0.58	C
T. Bus services operate in my area on the weekend	1.58	1.18	D
U. I can easily connect from buses to other public transport lines, such as trains, trams or other buses	1.84	0.92	B
V. It is easy to purchase a [Myki/Opal/Go Card]	1.74	1.10	D
W. I feel safe getting to and from the bus stop	1.89	1.04	B
* A single attribute was used to measure the importance of feeling safe. This was used for both the feeling of safety at night and during the day			

Figure 2: Overall IPA score distribution (Item codes listed in Table 3)

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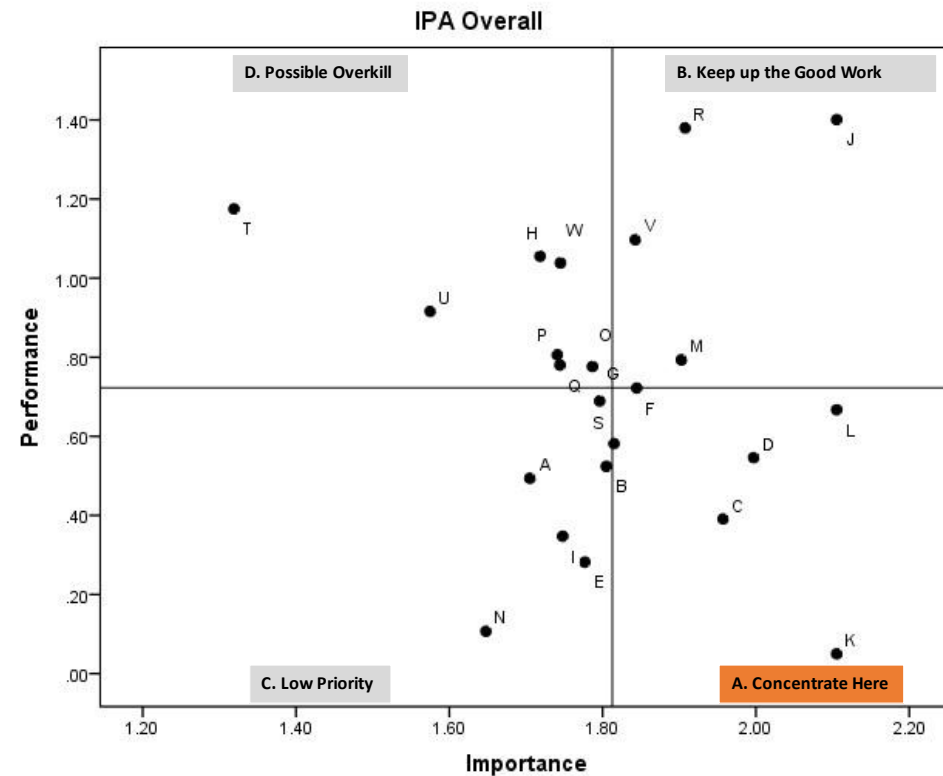
4.2.1. Importance performance analysis results - overall

An importance performance analysis (IPA) was performed on the detailed survey responses. This analysis aimed to identify the perceived importance and the perceived performance of 23 bus service attributes (see items column in Table 3).

A key goal of the research was to investigate the variation in the IPA across different cohorts. The cohorts investigated included:
- An overall cohort (n = 2,420)
- By geographic region.
- By user/non-user segmentation

Figure 2 overleaf shows the IPA distribution across the overall cohort. This analysis focuses on the attributes which fall within "Quadrant A: Concentrate here", because respondents rated them as the most important but deemed them to be low performing.

Personal safety, both perceived and actual, was found to be the most important attribute overall. Interestingly, this attribute's performance varied markedly by time of day. Safety was a high-performing attribute during the daytime (see attribute J), but plunged to the worst performing attribute at night (see attribute K).

Other attributes Quadrant A relate to bus service-levels. Bus service frequency, punctuality and timetable adherence (reliability) were found to be relatively important but poor performing attributes (see attributes B, C & D). Journey time reliability and in-vehicle cleanliness were also considered relatively important but had poor performances (see attributes F & L).

A one-way ANOVA test was conducted to determine if age and gender significantly influence performance/importance scoring for Quadrant A attributes (see Table 4).

There was a significant difference in how women and men experienced night-time safety. Women scored night-time safety poorer on performance than men, but had higher scores in importance.

Age also significantly influenced the perceived importance and performance of night-time safety. The importance score of night-time safety increased from youngest to oldest age cohort, indicating that older commuters deem night-time safety more important than younger commuters. However, respondents aged 35 to 54 scored night-time safety performance much higher than those aged 18 to 34 and those aged 55 and over. This indicates that age and gender should be considered during the implementation of safety improvements.

Women rated the importance of bus service attributes, such as frequency, punctuality, timetable adherence (reliability) and in-vehicle travel times higher than men did, potentially indicating that women are more time-sensitive than men are.

Age also significantly influenced the perceived importance of bus service attributes, such as frequency, punctuality, timetable adherence (reliability) and in-vehicle travel times. Respondents aged 18 to 34 rated these attributes as less important than those aged 35 and over, potentially indicating that older commuters are more time-sensitive.

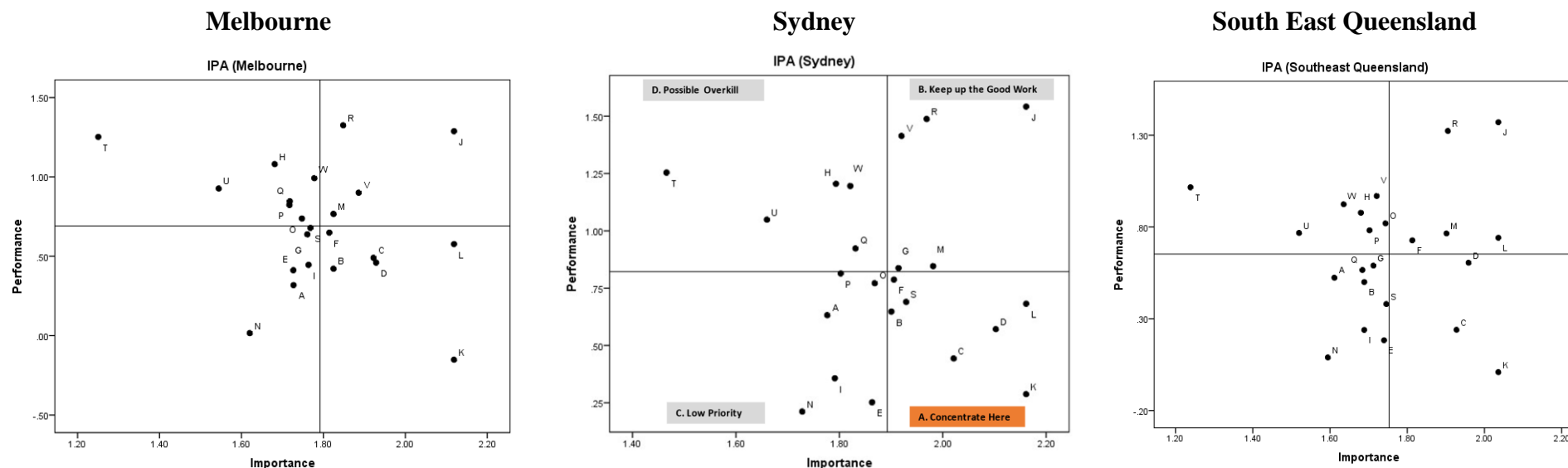**Table 4: ANOVA results for importance/performance scores by age and gender**

	Age		Gender	
	Importance	Performance	Importance	Performance
B. Buses arrive frequently	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 1.69, 35 to 54 is 1.86, and 55 or over is 1.86	No significant differences between Age Groups. Mean score for age group 18 to 34 is 0.57, 35 to 54 is 0.47, and 55 or over is 0.54	Significant differences exist between Male and Female groups. Mean score for gender group Female is 1.9, Male is 1.64	No significant differences between Male and Female. Mean score for Gender group: Female is 0.51, Male is 0.55
C. Buses often run late	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 1.81, 35 to 54 is 2.01, and 55 or over is 2.06	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 0.6, 35 to 54 is 0.46, and 55 or over is 0.08	Significant differences exist between Male and Female groups. Mean score for gender group Female is 2.06, Male is 1.76	No significant differences between Male and Female. Mean score for Gender group: Female is 0.43, Male is 0.33
D. Buses show up when they are supposed to	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 1.79, 35 to 54 is 2.05, and 55 or over is 2.16	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 0.43, 35 to 54 is 0.47, and 55 or over is 0.75	Significant differences exist between Male and Female groups. Mean score for gender group Female is 2.08, Male is 1.85	Significant differences exist between Male and Female. Mean score for Gender group: Female is 0.5, Male is 0.63
F. Travel times on buses are consistent from one day to the next	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 1.73, 35 to 54 is 1.9, and 55 or over is 1.91	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 0.5, 35 to 54 is 0.38, and 55 or over is -0.07	Significant differences exist between Male and Female groups. Mean score for gender group Female is 1.87, Male is 1.61	No significant differences between Male and Female. Mean score for Gender group: Female is 0.32, Male is 0.22
K. I feel safe travelling on the bus at night	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 1.92, 35 to 54 is 2.12, and 55 or over is 2.28	Significant differences exist between Age groups. Mean score for age group 18 to 34 is -0.07, 35 to 54 is 0.14, and 55 or over is 0.09	Significant differences exist between Male and Female groups. Mean score for gender group Female is 2.24, Male is 1.86	Significant differences exist between Male and Female. Mean score for Gender group: Female is -0.27, Male is 0.63
L. Buses are clean and hygienic	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 1.73, 35 to 54 is 1.93, and 55 or over is 2.06	Significant differences exist between Age groups. Mean score for age group 18 to 34 is 0.35, 35 to 54 is 0.68, and 55 or over is 1.01	Significant differences exist between Male and Female groups. Mean score for gender group Female is 2.03, Male is 1.67	Significant differences exist between Male and Female. Mean score for Gender group: Female is 0.56, Male is 0.86

Women rated the importance of bus cleanliness higher but rated its performance lower than men did. Age also significantly influenced the importance/performance scoring of bus cleanliness, with older cohorts deeming it more important but poorer performing than younger cohorts.

Figure 3 shows the importance and performance scores for Melbourne, Sydney and SEQ respectively. Respondents from all three locations consistently rated day-time and night-time safety, and bus cleanliness as the three most important attributes. Respondents also consistently rated night-time safety as one of the worst performing attributes, indicating that night-time safety is a key attribute requiring improvement across all three regions.

Respondents from Sydney and Melbourne identified more attributes as relatively high in importance but low in performance compared to SEQ. These attributes were largely related to bus service levels, such as punctuality, frequency and timetable adherence (reliability), suggesting that Melbourne and Sydney might require service-level improvements more immediately than SEQ does.

Figure 3: IPA score distribution for Melbourne, Sydney and South East Queensland

Melbourne	Sydney	South East Queensland

Attribute Key:

A. I usually do not have to wait long for a bus
B. Buses arrive frequently
C. Buses often run late
D. Buses show up when they are supposed to
E. Travel times on buses are too long
F. Travel times on buses are consistent from one day to the next
G. Buses get me where I need to go when I need to be there

H. It is convenient to get to and from my nearest bus stop
I. Waiting at bus stops is uncomfortable
J. I feel safe travelling on the bus during daylight*
K I feel safe travelling on the bus at night*
L. Buses are clean and hygienic

M. Bus trips are comfortable
N. Buses are crowded
O. Bus service information is easy to find
P. Bus service information is easy to understand
Q. Bus fares are affordable
R. I can easily get on and off the bus
S. Bus services operate in my area at night
T. Bus services operate in my area on the weekend

U. I can easily connect from buses to other public transport lines, such as trains, trams or other buses
V. It is easy to purchase a [Myki/Opal/Go Card]
W. I feel safe getting to and from the bus stop

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A one-way ANOVA test was conducted to determine if location had a significant influence on performance and importance scores on Quadrant A attributes as shown in Table 5 below.

Table 5: ANOVA results for importance/performance scores by location

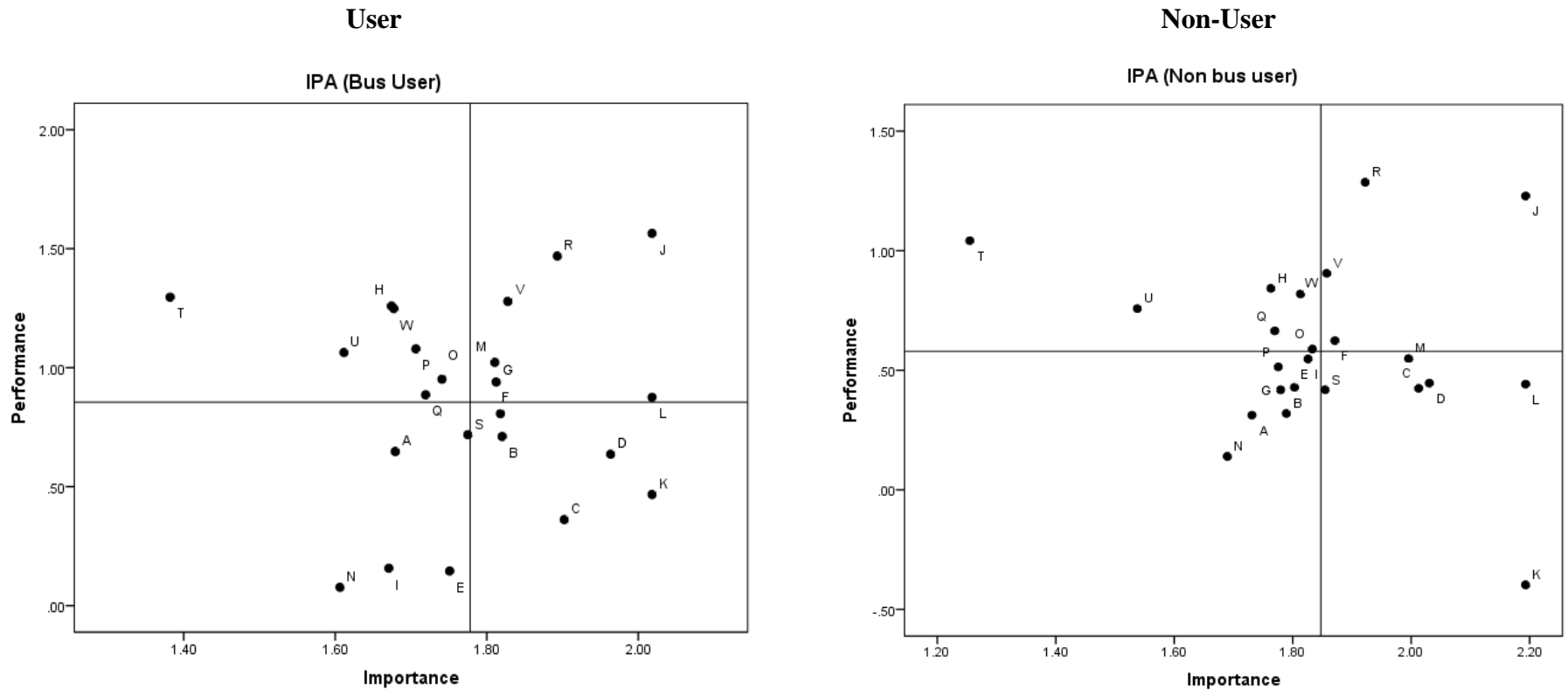| Items	Importance (ANOVA)	Performance (ANOVA)
B. Buses arrive frequently *(Melbourne; Sydney)*	Significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 1.9, Melbourne is 1.82, and Southeast Queensland is 1.69	Significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.65, South East Queensland is 0.5 , and Melbourne is 0.42
C. Buses often run late *(Melbourne; Sydney & SEQ)*	There is no significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 2.02, Melbourne is 1.92, and Southeast Queensland is 1.93	Significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.44, South East Queensland is 0.24 , and Melbourne is 0.49
D. Buses show up when they are supposed to *(Melbourne; Sydney& SEQ)*	Significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 2.1, Melbourne is 1.93, and Southeast Queensland is 1.96	There is no significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.57, South East Queensland is 0.61 , and Melbourne is 0.46
F. Travel times on buses are consistent from one day to the next *(Melbourne; Sydney)*	There is no significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 1.91, Melbourne is 1.82 , and South East Queensland is 1.81	There is no significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.79, South East Queensland is 0.73 , and Melbourne is 0.65
K. I feel safe travelling on the bus at night* *(Melbourne; Sydney& SEQ)*	There is no significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 2.16, Melbourne is 2.12 , and Southeast Queensland is 2.04	Significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.29, Southeast Queensland is 0.01 , and Melbourne is -0.15
L. Buses are clean and hygienic *(Melbourne; Sydney)*	Significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 1.98, Melbourne is 1.82 , and Southeast Queensland is 1.91	There is no significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.85, Southeast Queensland is 0.77 , and Melbourne is 0.77
S. Bus services operate in my area at night *(Sydney; SEQ)*	Significant difference exists for mean Importance score across Location. Mean score for location group Sydney is 1.47, Melbourne is 1.25 , and South East Queensland is 1.23	Significant difference exists for mean Performance score across Location. Mean score for location group Sydney is 0.69, South East Queensland is 0.38 , and Melbourne is 0.68

This indicates that:
- Night-time safety is equally important across all three jurisdictions, but respondents from Melbourne feel more unsafe than those in SEQ and Sydney.
- Travel time consistency is similarly important across all three jurisdictions, with respondents also scoring its performance similarly across all jurisdictions.
- Punctuality is similarly important in all three jurisdictions, but respondents from SEQ rated punctuality more poorly compared to those from Melbourne and Sydney.
- Night services, bus cleanliness, timetable adherence (reliability) and frequency are more important to respondents in Sydney than those in SEQ and Melbourne.
- Low service frequencies are a relatively greater concern for respondents in Melbourne than those in SEQ and Sydney.
- Tardiness and a lack of night services are a relatively greater concern for respondents in SEQ than those in Sydney and Melbourne.

4.2.2. Importance performance analysis results – bus user/non-bus users

Figure 4 shows the importance/performance score distributions for bus users and non-users respectively.

Figure 4: IPA score distribution for User/Non-User Groups

User **Non-User**

Attribute Key:

A.I usually do not have to wait long for a bus
B.Buses arrive frequently
C.Buses often run late
D.Buses show up when they are supposed to
E.Travel times on buses are too long
F.Travel times on buses are consistent from one day to the next
G.Buses get me where I need to go when I need to be there

H.It is convenient to get to and from my nearest bus stop
I.Waiting at bus stops is uncomfortable
J.I feel safe travelling on the bus during daylight*
KI feel safe travelling on the bus at night*
L.Buses are clean and hygienic

M.Bus trips are comfortable
N.Buses are crowded
O.Bus service information is easy to find
P.Bus service information is easy to understand
Q.Bus fares are affordable
R.I can easily get on and off the bus
S.Bus services operate in my area at night
T.Bus services operate in my area on the weekend

U.I can easily connect from buses to other public transport lines, such as trains, trams or other buses
V.It is easy to purchase a [Myki/Opal/Go Card]
W.I feel safe getting to and from the bus stop

There are some differences in the Quadrant A attributes for bus users and non-users.

- Consistent with previous sections, night-time safety was deemed to be an important but poorly performing attribute by both users and non-users. Both cohorts also think running night buses is important and there are currently not enough services at night.
- Bus cleanliness and journey comfort were both deemed important by users and non-users, but non-users felt they were both underperforming attributes while the bus users did not.
- Frequency and timetable adherence (reliability) were more important to bus users than non-users, with bus users rating these attributes' performance more poorly in comparison.

A one-way ANOVA test was conducted to determine if bus use significantly influences performance/importance scoring for Quadrant A attributes as shown in Table 6.

Table 6: ANOVA results for importance/performance scores by bus use and non-use

Items	Importance (ANOVA)	Performance (ANOVA)
B. Buses arrive frequently *(User)*	There is no significant difference exists for mean Importance score across User/Non user. Mean score for user/non-user group: User is 1.81, Non-user is 1.8	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.37, User is 0.78
C. Buses often run late *(User; Non-user)*	Significant difference exists for mean Importance score across User/Non-user. Mean score for user/non-user group: User is 2, Non-user is 1.88	There is no significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.38, User is 0.41
D. Buses show up when they are supposed to *(User; Non-user)*	There is no significant difference exists for mean Importance score across User/Non-user. Mean score for user/non-user group: User is 2.03, Non-user is 1.93	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.48, User is 0.66
F. Travel times on buses are consistent from one day to the next *(User)*	There is no significant difference exists for mean Importance score across User/Non user. Mean score for user/non-user group: User is 1.88, Non-user is 1.78	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.65, User is 0.84
K. I feel safe travelling on the bus at night* *(User; Non-user)*	Significant difference exists for mean Importance score across User/Non user. Mean score for user/non-user group: User is 2.18, Non-user is 1.97	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is -0.27, User is 0.6
L. Buses are clean and hygienic *(User; Non-user)*	Significant difference exists for mean Importance score across User/Non user. Mean score for user/non-user group: User is 1.98, Non-user is 1.77	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.53, User is 0.91
M. bus trips are comfortable (Non-user)	Significant difference exists for mean Importance score across User/Non user. Mean score for user/non-user group: User is 1.7, Non-user is 1.56	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.64, User is 1.06
S. Bus services operate in my area at night *(User; Non-user)*	Significant difference exists for mean Importance score across User/Non user. Mean score for user/non-user group: User is 1.27, Non-user is 1.41	Significant difference exists for mean Performance score across User/Non user. Mean score for user/non-user group: Non User is 0.44, User is 0.8

Night-time safety ratings on both importance and performance were significantly different between bus users and non-users. While non-users rated night-time safety as less important than bus users, non-users identified night-time safety as the worst performing attribute.

Non-users also identified journey comfort as a problem, even though it was overall less important to non-users than users.

Timetable adherence (reliability) and punctuality were similarly important to bus users and non-users. However, non-users rated their performance poorly compared to bus users.

5. Discussion and Conclusions

This paper aims to explore both user and non-user perceptions of bus service attributes in Melbourne, Sydney and South East Queensland.   A major motivation for this research is to understand what service attributes are considered important and to see how this varies both within cities, by socio-economic cohorts and also between user and non-user groups. Survey findings indicate that socio-demographic characteristics significantly mediate respondents' perceptions and attitudes towards buses.

This section provides policy and practice recommendations to encourage greater bus patronage and improve perceptions of bus services. Growing patronage requires buses to meet more people's transport needs and is thus closely linked to improving service levels/quality.

5.1 Policy and practise implementations

5.1.1 Safety

Personal safety stood out as the key concern for respondents across multiple demographic groups. All safety attributes, namely safety while travelling on the bus during the daytime and at night, and safety getting to and from the bus stop, were ranked as very important attributes of the bus network.

While daytime safety and safety accessing bus stops were considered relatively well-performing attributes, night-time safety was the worst performing attribute overall. Demographic variables, such as gender and age, significantly influence how night-time safety is perceived. In particular, female respondents were more likely to feel unsafe at night. Age was also a contributing factor, with respondents aged 18 to 34 years and 55 years and over more likely to feel unsafe at night.

Interestingly, bus non-users believe that travelling on the bus at night is more unsafe than bus users, suggesting that perceived safety–especially at night–could be inhibiting greater bus patronage. While night-time safety was a poorly performing attribute in all locations, respondents in Melbourne rated night-time safety much more poorly than respondents in SEQ and Sydney. This suggests that Melbourne has a greater task to improve perceptions of night-time safety than other cities.

Addressing perceived night-time safety from a gender and age perspective will be critical to encourage more people to view the bus as a viable transport alternative. Previous research has found that feeling safe has a positive influence on how often people use public transport. Improving commuters' sense of personal safety could therefore potentially encourage bus users to travel more frequently by bus, and might even encourage some non-users to travel by bus (Delbosc and Currie, 2012).

Research indicates that Crime Prevention through Environmental Design (CPTED) approaches can improve commuters' sense of safety, especially at night. These include:
- Well-lit footpaths, stations and stops
- CCTV
- The presence of staff, such as customer service staff and security personnel
- Emergency call-points
- Safety audits

Sydney, Melbourne and SEQ have implemented various safety improvement initiatives, such as the use of Protective Services Officers (PSOs) in Melbourne. However, the general consensus of responses highlighting safety while travelling on the bus at night as a key concern indicates that targeted personal safety programs for buses should be considered as a core part of public transport policy in Australia.

5.1.2 Service levels and quality

Service levels and quality stood out as issues across all locations, for bus users and non-users alike.

In Melbourne, the service level attributes which require the most attention are:
- Service frequency
- Punctuality
- Timetable adherence (reliability)
- Travel time consistency.

In Sydney, the service level attributes which require the most attention are:
- Service frequency
- Punctuality
- Timetable adherence (reliability)
- Travel time consistency
- Night bus service operation.

In SEQ, the service level attributes which require the most attention are:
- Punctuality
- Timetable adherence (reliability).

Previous research has demonstrated that increasing service levels, particularly frequency, results in commensurate increases in bus patronage. Increasing headways to every 10-15 minutes, especially for bus routes which run in areas which have a high propensity to use public transport, will be especially beneficial for increasing bus patronage. This should be considered in Sydney and Melbourne, where service frequency is a concern for commuters.

Service punctuality and timetable adherence (reliability) are key concerns in all locations. Limited on-road bus priority provision results in bus services being ensnared in traffic congestion, particularly during the AM and PM peak periods. Comprehensive on-road bus priority provision, such as bus lane and priority signalling, should be considered in Sydney, Melbourne and SEQ, especially in areas where congestion is significantly impacting bus service reliability.

Night bus service provision should be expanded in Sydney, especially in areas with an established or emerging night-time economy. The planning of such services must prioritise night-time safety in all elements of the bus journey, such as in-vehicle safety and safety while accessing the bus stop.

5.1.3 Comfort

One of this study's key objectives is to determine the factors which contribute to the underutilisation of buses. This will identify key areas of recommendation that will increase bus patronage and improve the overall perception of buses.

Understanding the distinctions between bus user and non-user perceptions is therefore critical to this project's objectives. Journey comfort was identified as a major concern by bus non-users. This differed significantly from bus users, who rated comfort as a less important and higher performing attribute than non-users did.

The comfort attributes which require the most attention are:
- Cleanliness and hygiene
- In-vehicle comfort
- Comfort while waiting at the bus stop
- Vehicle crowding.

Since the COVID-19 pandemic, cleanliness and hygiene has become a chief concern, with all states ramping up public transport cleaning programs to minimise infection risk. Interestingly the results suggested that non-users were more concerned about cleanliness than users; perhaps influencing non-use. While cleaning awareness campaigns have publicised the steps taken to keep commuters safe from COVID-19, other general concerns such as removing graffiti should be enforced to keep the branding of bus services strong.

Zero emissions buses (ZEB) have the potential to significantly improve in-vehicle comfort because they lack the vibration of an internal combustion engine, and contribute to the overall sustainability of the public transport network. Sydney, Melbourne and SEQ have ZEB fleet rollover plans, with NSW the most ambitious of the three States.

The provision of high-quality bus stops and interchanges will also be an important way to improve overall perceptions of bus journey comfort. Quality bus stops will need to provide:
- Comfortable seating that is accessible for all
- Easy-to-understand commuter information
- Effective shelter from the weather which includes consideration of thermal comfort.

Improved service frequencies and reliability will contribute to a more consistent passenger load across vehicles, reducing the likelihood of services being overcrowded. Melbourne is currently trialling real-time crowding tracking on public transport, including on several bus routes. This has the potential to improve public perceptions of crowding on public transport, generating more positive perceptions on buses.

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