Public Perceptions of Shared Autonomous Vehicles and the Supplementation of Public Transport Infrastructure in Christchurch City

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Executive Summary

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The Christchurch City Council are considering the introduction of shared autonomous vehicles (SAVs) as a form of public transport in Christchurch. To do this successfully, they are looking at trialling their SAV on a CBD route. This research project focused on gauging public perceptions of AVs and determining if there were any perceived gaps in the public transport infrastructure that could be used to trial them. The research questions were:

-   What is the public perception towards the integration of autonomous vehicles (AV) within Christchurch; and
-   What routes would complement current and future infrastructure?

To gather data, systematic sampling was used when conducting in-person surveys. These were conducted at the Metro Bus Interchange on weekdays. Analysis showed that most people felt safer in a conventional vehicle than in an AV, and on average males feel safer than females in an AV (3.31/5 vs 2.85/5). Two CBD-based trial routes were designed based on survey analysis to meet the current and future transport needs of the public.

Introduction

Autonomous vehicles (AVs) are defined as automobiles that can partially or fully drive themselves without a human driver (Anderson et al., 2014). Though New Zealanders may be a while off owning fully automated private cars; the conversation around the use of shared autonomous vehicles (SAVs) is gathering momentum, with Christchurch leading the way. The Christchurch City Council (CCC) are looking at introducing SAVs as a form of public transport in Christchurch; one of the early stages of this project is the creation of a CBD-based route to trial an SAV on. The CCC want the route to enhance public engagement with the scheme and promote individuals' familiarity with the idea of AVs, while filling any perceived gaps in CBD public transport. Based on this brief, the following research questions were produced:

1. What is the public perception towards the integration of AVs within Christchurch?
2. What routes would complement current and future infrastructure?

The following research objectives were chosen to accompany the questions:

1. When considering the introduction of AVs, what demographic links are observed? Are there specific demographics that are more accepting?
2. What gaps are there in current transport infrastructure?
3. Considering form of transport, frequency, and purpose, how do individuals currently use transport systems?
4. What AV routes could compliment the current transport systems?

This report will detail the research that answers these questions, beginning by reviewing previous literature regarding perceptions of AVs, and subsequently explaining the methods used to gather the data. Following this, results will be presented and analysed; concluding with a discussion of research limitations and suggestions for future research avenues to pursue.

Literature Review

Many countries are considering the introduction of AVs as a more sustainable mass transport option. A wide array of research regarding AVs already exists; however, very few of these studies utilised their data for practical, real-world purposes (such as route generation) – most present summary statistics and only provide basic analysis. Consequently, our work fits into a unique niche within existing literature.

Despite this, previous research into the perceptions of AVs still maintains relevance; it indicates the public's willingness to embrace a new system. The changing disposition of the Christchurch public around AV use will greatly impact the success of this project. This report section will summarise the key findings of the surrounding literature.

The trend that males are more accepting of AVs than females has been observed throughout many studies. Hulse et al., (2018) found that females rated the riskiness of AV travel significantly higher than males, while males were more likely to have a positive attitude towards AVs. Hohenberger et al., (2016) found a reduced likelihood of AV use, and increased anxiety towards AVs from females. Alternatively, males derived pleasure from AV use, and were more inclined to use AVs in most situations. The authors attributed the varying opinions to different natural reactions between the two sexes. Finally, Bansel et al., (2016) investigated the public's willingness to pay (WTP) for AVs in Austin, Texas. The authors considered factors

including age, gender, ethnicity, residential location, income and socioeconomic status when considering one's WTP. They found that young, technologically-inclined males had the highest WTP; this supports the previous findings.

Another pertinent trend concerns the elderly; they are less accepting of AVs compared to younger people, by a wide margin. Hulse et al., (2018) found that older people perceive the risk of autonomous vehicles higher than the younger generations, and have a much lower WTP (Bansel et al., 2016). Vaportzis et al., (2017) noted older people are much later adopters of new technology as well; the findings of previous literature highlight and support this contrast.

Cunningham et al., (2018)'s research focused on awareness, benefits and concerns, WTP and trust in AVs; they used the New Zealand and Australian public, and, when investigating specific perceived issues and benefits, they found that the main concerns were being legally and financially responsible if the vehicle crashed and allowing children to ride by themselves. While valid findings, neither of these fears apply to the CCC project, as their AV will be used for public transport; taking legal responsibility away from users. Other relevant concerns, such as riding in a car with no driver and vehicle security, were still high (67% and 72.1% respectively). Increased mobility for the disabled and lower insurance premiums were the core of the public's perceived benefits. Over a third (37.1%) of respondents said they would not feel comfortable travelling in a driverless form of public transport, a pertinent statistic for our work.

Methodology

Survey Construction and Rationale

The primary method of data collection was a short survey, which was developed on the Qualtrics platform. For the primary data collection method, in-person surveys were chosen, as it was the most practical and time-efficient way of gathering data from the target population (Christchurch residents). This rationale is supported by various literature, such as the work of Gomez & Jones (2010) and McGuirk & O'Neill (2016). The method also allows for flexibility, as it creates a chance for clarification or any questions from the respondent and probing from the researcher. Other methods, including online surveys and observational data gathering, do not allow for this.

The survey comprised of thirteen questions, including fixed multi-choice and open-ended questions, allowing us to gather both quantitative and qualitative data, and giving us the ability for a mixed-methods analysis. The demographic questions are fixed, allowing for responses to be easily interpreted and compared. This rationale is supported by the work of Fink and Kosecoff, (1998), as cited in Clifford et al., (2010). The categories have been derived from the New Zealand Census to ensure clear, comparable, and easily interpreted data. Gathering respondents' demographics allows us to identify any relationships between certain groups and the perceptions of AVs during data analysis. This will also allow us to compare the results of the study to that of the previously mentioned literature, allowing us to see whether the same demographic relationships apply.

Open ended questions have been used in the survey when focusing on perceptions towards AVs and public transport, allowing for qualitative information collection and opinionated responses. Fixed questions were avoided for parts of the survey, as these responses would lack the detail and opinion gained from open-ended questions (Clifford et al., 2010). Scaled questions,

ranging from one to five, were also used to gauge acceptance of the AV technology. Scale-based questions prompts the respondent to think about the question more than a closed answer; providing more detail than a yes/no answer, while avoiding the difficulty of having to analyse large quantities of open-ended responses (Clifford et al., 2010).

Data Gathering and Rationale

Survey respondents were targeted both in person and online to enable a good response rate, as well as encouraging a representative and unbiased sample of the population. In-person responses were collected over several sessions in the Christchurch CBD; the two targeted locations were the Cathedral Square and the Central Bus Interchange. The initial outings resulted in eighteen respondents over a four-hour period, which was a significant underachievement; the decision was made to share the survey online, which was not originally planned. The low response rate also led to the consideration of new locations for the in-person data collection. Thus, with permission from the Christchurch City Council (CCC) the primary survey location was changed to the Central City Bus Interchange.

During the first two data collection sessions at the interchange, approximately sixty responses were gathered over a three-hour period; proving to be a far more efficient location than Cathedral Square. Due to the response rate and time efficiency, it was decided to use the bus interchange for the remainder of the research period. It was noted by the researchers that this location may result in a respondent bias, as all those interviewed were current public transport users. However, it was decided that, overall, this was beneficial, as the respondents were likely more knowledgeable and willing to provide more qualitative detail when it came to the transport use questions. This enhanced the researcher's ability to accurately generate routes that would best serve the public and compliment the current public transport infrastructure.

To obtain data from online respondents, the survey link was shared on multiple Facebook community groups (e.g. Halswell and Bishopdale community pages). These groups comprised of approximately 80,000 people, allowing for an extensive reach. When sharing the survey online, it was noted by the group that the respondents will likely be from a narrow demographic, due to internet accessibility, Facebook's post algorithm and the natural user bias that one encounters on social media; which sees 26% less users in the 65+ age bracket, than those in the 18-29 age bracket (sproutsocial, 2018). This is reinforced by the fact that the response rate was 0.08% for the online survey; 66 responses out of the approximate 80,000 reach.

Data Analysis and Rationale

To begin the data analysis, the open-ended responses were extracted and thematically grouped, which allows for more clarity when recognising trends in the data. The grouped and tallied responses were filtered by discarding the least popular ones, which was defined by those with less than three responses. It was chosen to discard the least popular ones as this was deemed as the most efficient way to interpret the wants of the respondents.

Once the multi-choice question results from the in-person and online survey had been collected, they were ranked by number of responses and their relevance to each research objective, enabling more user-friendly data when searching for relationships between variables and producing the potential routes, elaborated on below.

Route Creation Methodology and Rationale

The essence of the project from the community partners' point of view was to create a series of future routes for the autonomous vehicles to be trialled on; both current and future landmarks were considered with the aim of appealing to as many people as possible; these included sites such as the future sports centre or library in the CBD, as well as deliberation of the current infrastructure and landmarks around the city.

Four of the total 13 questions pertained to current public transport infrastructure and future routes and services; these were:

- Have you ever identified any public transport infrastructure gaps in Christchurch City? i.e. Where a service could be supplied but isn't at the present.
- What are the factors that are most important to you when considering the use of public transport? Pick three.
- Beginning at the bus interchange in the CBD, what locations or areas most appeal to you when considering the development of new public transport routes?
- Are there any other facilities or locations you would like to see included in a future AV routes?

The responses of these were either open-ended qualitative responses, or multi-choice. The open-ended responses were grouped thematically, and those themes acted as a part of our rationale for the way the routes were designed. Coupled with the most common responses from the multi-choice questions, ample information was collected on what the public desired to see in the development of autonomous public transport.

The software that was used to create the routes is QGIS; a base map was imported from OpenStreetMap, this platform allowed the creation of real-world routes that were accurate and to-scale. A new layer was created for each route, and they were digitised from scratch, creating line data on the streets that we felt fit our analysed responses and aligned with our community partner's goals for the project. Originally, three routes were to be created, however once the first two were completed, we decided they covered all the features that were pertinent to the stakeholders of the project; while keeping the routes practical, timely and useful for the users, as well as focusing on their distance, potential vehicle frequency and journey time.

Route 1 (4.51km in length); travels around Hagley and past the hospital, includes stops along Riccarton Avenue, the Botanical Gardens car parking, parking buildings on Montreal and St Asaph streets, and the future Metro sports centre. These were the most important features that were outlined in the survey findings that weren't in the CBD. Route 2 (3.65km in length); which was designed primarily to provide a CBD loop service; includes destinations and landmarks such as the bus interchange, the bars at the Terrace, Victoria street nightlife, Margaret Mahy Family Playground, and through the streets of New Regent and Cathedral Junction. These last two were included despite the tram line running through the streets, as they have a contain a collection of small businesses; we thought there would be financial benefits for both users and business owners if these were contained within the route.

In terms of future improvements to the routes, the introduction of a 'line' route (as opposed to a 'loop' route) could be beneficial to transport infrastructure. The AVs are omnidirectional and would be suited for ferrying individuals along a North-South or East-West route; this would be beneficial for marginalised populations, such as those who are disabled or lack personal transport.
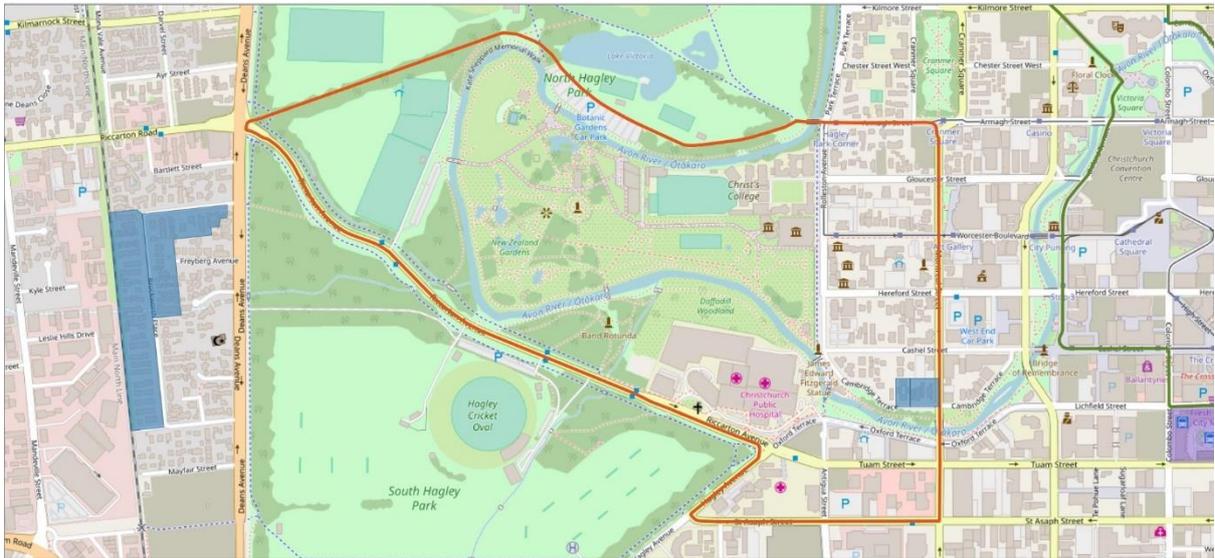
Route 1: Hagley-Hospital Loop
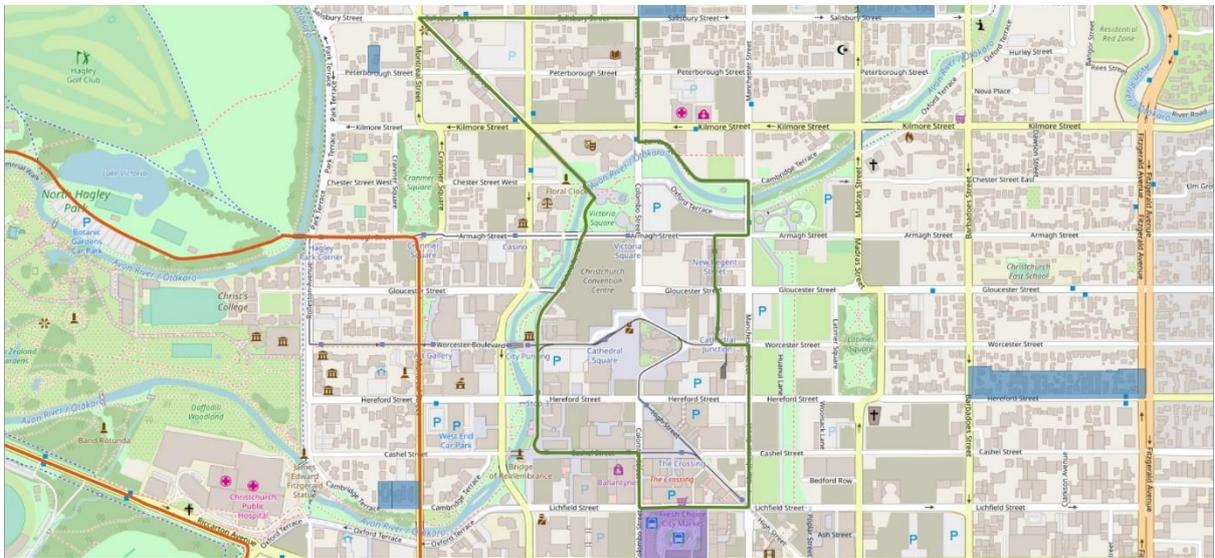
Route 2: Central Business District Loop

Discussion

Demographics Breakdown

A wide range of data was collected from our survey, all the data that is relevant to answering our research objectives and questions was taken and plotted to identify any relationships between demographics and various wants and needs. To start with a demographic breakdown of who answered the survey was completed, this resulted in the following figures:

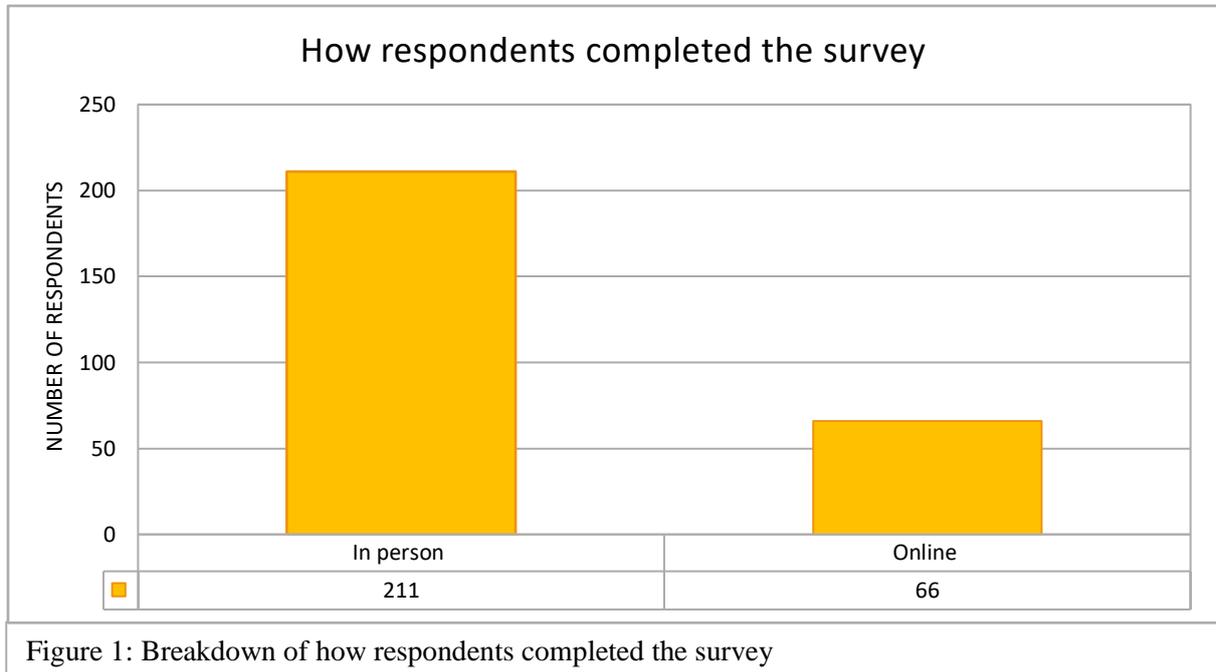Figure 1: Breakdown of how respondents completed the survey

Figure 1 looks at how the respondents completed the survey. In total the group received 277 respondents, 211 of these completed the survey in person, with the remaining 66 completing it online.

Figure 2 shows a breakdown of the ages of people that completed the survey; it was observed that the 18-25 age demographic is overrepresented in our results when compared to other fields and census information for Christchurch (Figure 2). This potentially skewed some of the figures and could be attributed to a range of factors, primarily due to the ages of people completing the survey online and the researchers subconsciously surveying younger people, even though a random sample was taken.
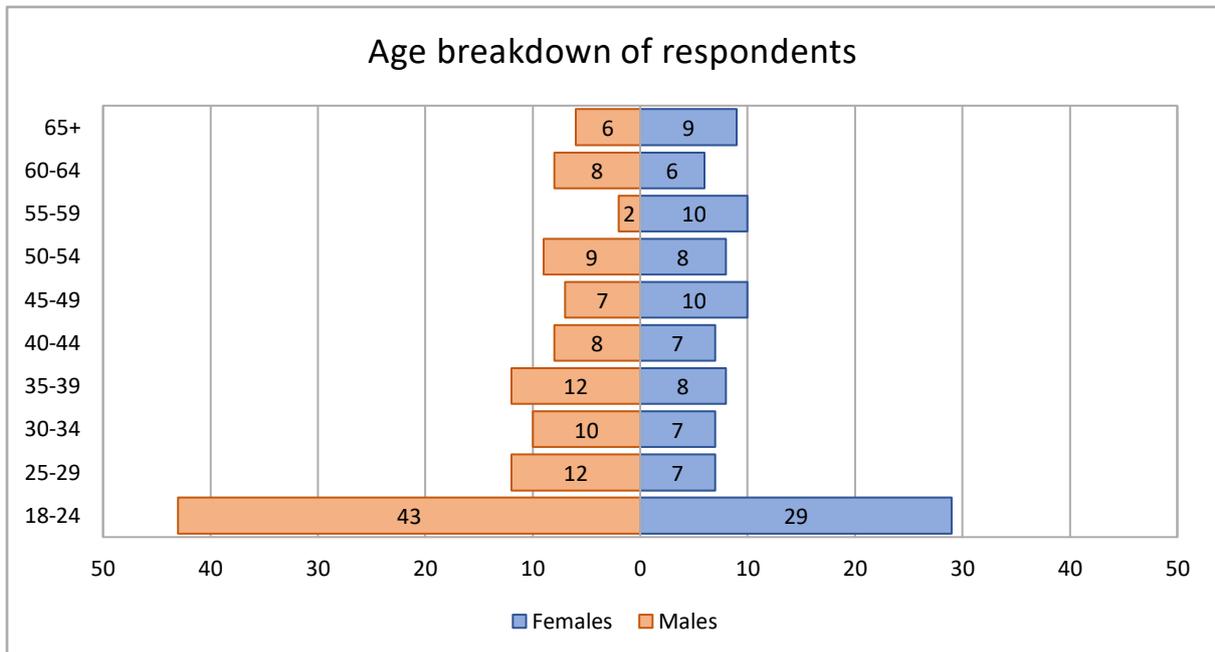

Figure 2: Graph showing a breakdown of the ages of respondents
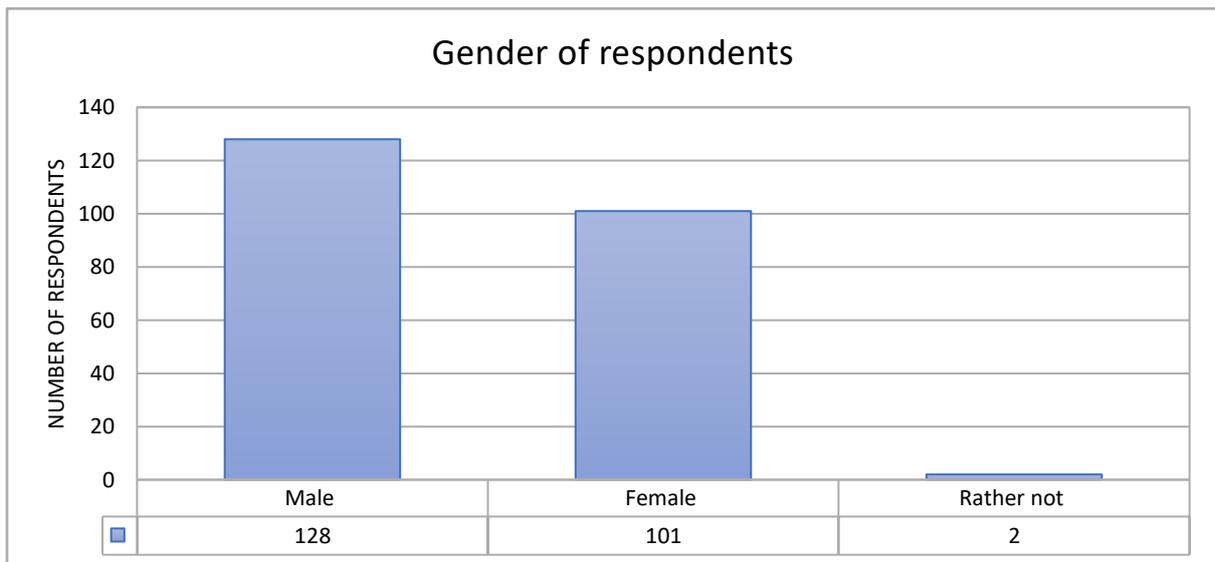

Figure 3: Graph showing a breakdown of the gender of respondents

Figure 3 shows us the genders of the respondents that completed the survey; in total there were 128 Males, 101 Females and 2 that refused to disclose.
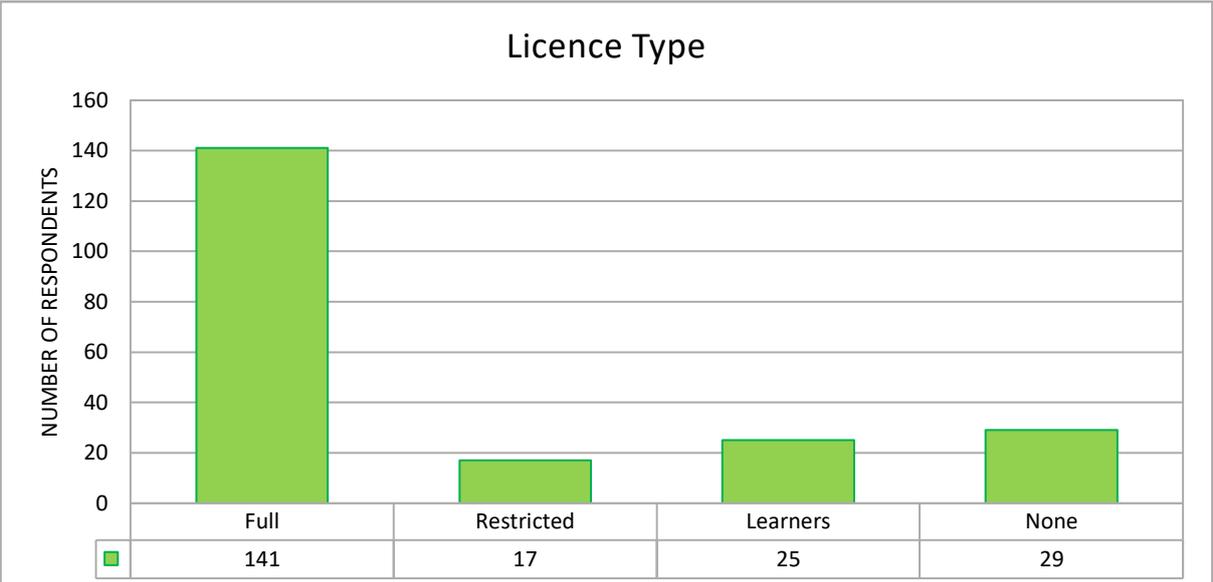
Figure 4: Graph showing a breakdown of the licence type respondents held

Figure 4 shows the type of licence, if any, the respondents had. As seen in the graph above, 141 respondents had full licences, 17 held their restricted, 25 had their learners and 29 held no licence whatsoever. This field could potentially be skewed by our data collection methods, as it is likely that the people surveyed at the bus interchange used public transport because they have no licence, therefore increasing the quantity in this field.

Age/Gender Comparisons

When examining the perceptions of autonomous vehicles, one of the parameters used to gauge respondents' opinions was Question 7, which read 'On a scale of 1-5 how safe would you feel being a passenger in a driverless vehicle, compared to how safe you feel when you're a passenger in a conventional vehicle?'.

This caused some interesting results when comparisons were made between gender, age and how respondents perceived themselves regarding technology adoption. When examining the difference between genders, the mean score for how safe the 100 females felt in autonomous vehicles was far lower when compared with the 126 males; 2.85 and 3.31 respectively. This supports previous research on this topic conducted by Bansal, Kockelman & Singh, 2016; which found that females are more concerned about AV safety than males.

Vehicle Type	1	2	3	4	5	Total
Conventional	1.6%	2.4%	14.3%	49.2%	24.6%	126
Driverless	7.3%	10.5%	33.1%	28.2%	12.9%	124

Figure 5: Graphs depicting the mean score of how safe males felt in conventional and autonomous (driverless) vehicles.

Vehicle Type	1	2	3	4	5	Total
Conventional	0%	1%	12%	60%	27%	100
Driverless	13.5%	22.90%	36.6%	18.8%	8.3%	96

Figure 6: Graphs depicting the mean score of how safe females felt in conventional and autonomous (driverless) vehicles

Similarly, there was a clear link between age and how safe people felt aboard autonomous vehicles, as seen in Figures 7, 8 and 9. People over 50 scored themselves more than 0.5 points lower, on average, compared with people 50 and younger; this was expected, as in general, older people are slower to adopt new technologies. This is supported by studies such as Vaportzis, Giatsi, Clausen, & Gow, (2017), and Schoettle & Sivak, (2014), who found that younger respondents are more willing to and feel safer riding in self-driving vehicles.

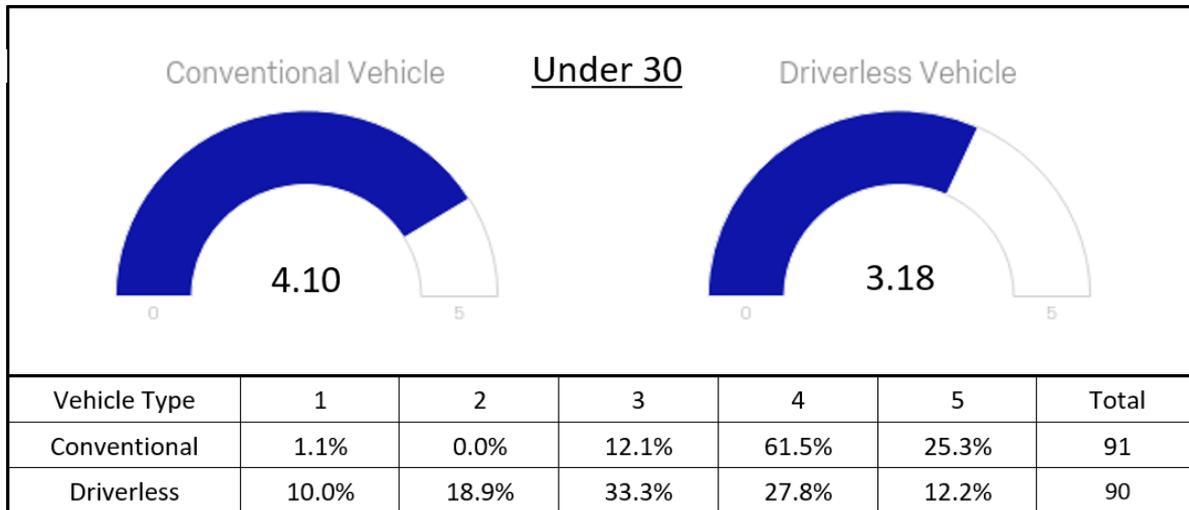| Vehicle Type	1	2	3	4	5	Total
Conventional	1.1%	0.0%	12.1%	61.5%	25.3%	91
Driverless	10.0%	18.9%	33.3%	27.8%	12.2%	90

Figure 7: Graphs depicting the mean score of how safe respondents aged 30 and under felt in conventional and autonomous (driverless) vehicles

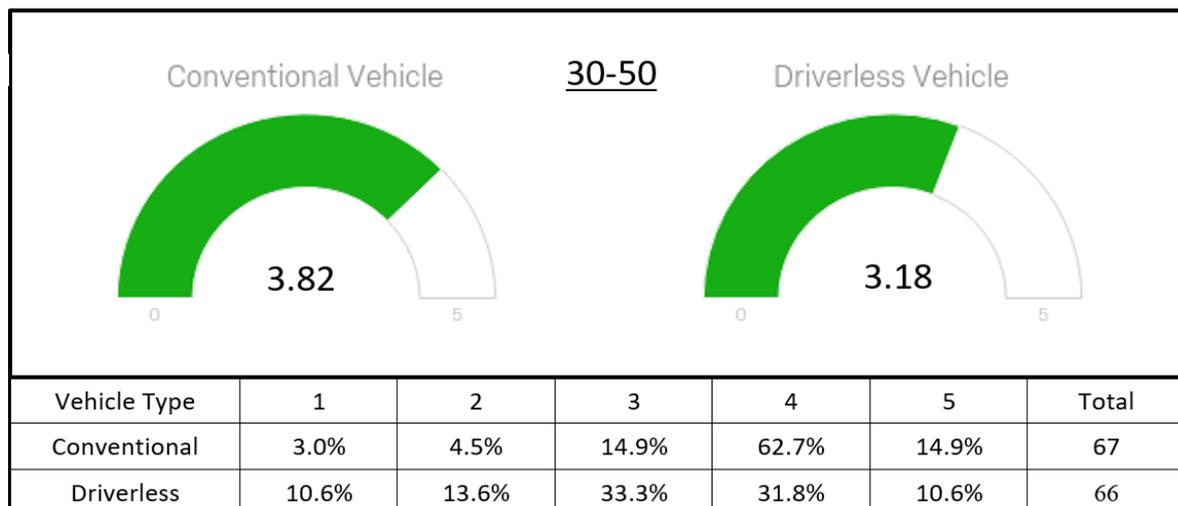| Vehicle Type	1	2	3	4	5	Total
Conventional	3.0%	4.5%	14.9%	62.7%	14.9%	67
Driverless	10.6%	13.6%	33.3%	31.8%	10.6%	66

Figure 8: Graphs depicting the mean score of how safe respondents aged 30-50 felt in conventional and autonomous (driverless) vehicles

Vehicle Type	1	2	3	4	5	Total
Conventional	0.0%	1.7%	13.6%	42.4%	42.4%	59
Driverless	16.4%	16.4%	43.7%	12.7%	10.9%	55

Figure 9: Graphs depicting the mean score of how safe respondents aged 50 and above felt in conventional and autonomous (driverless) vehicles
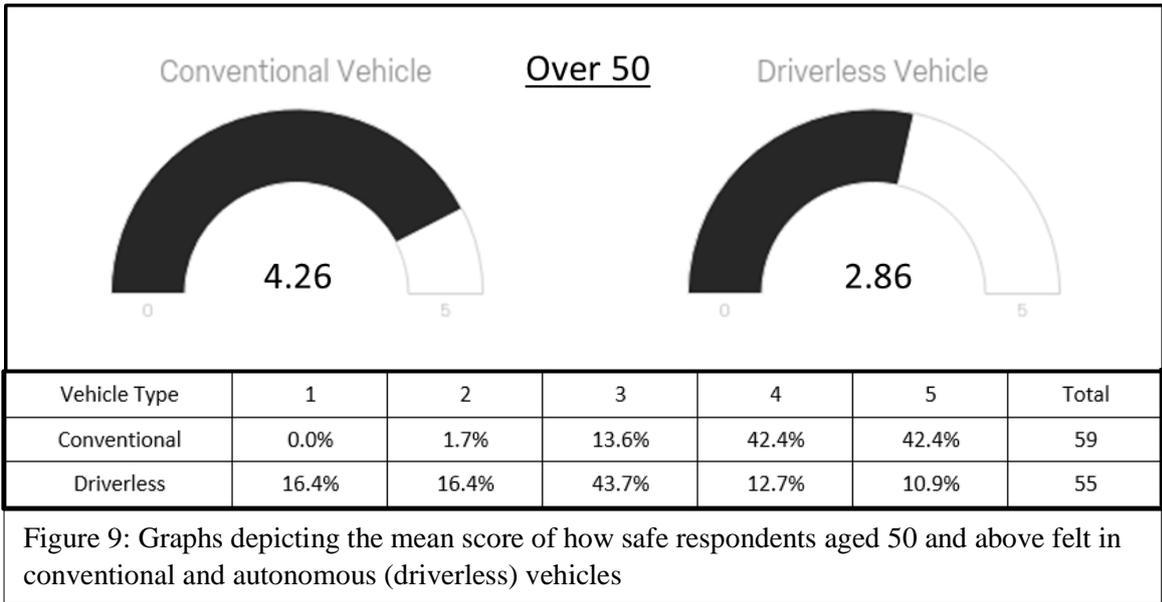
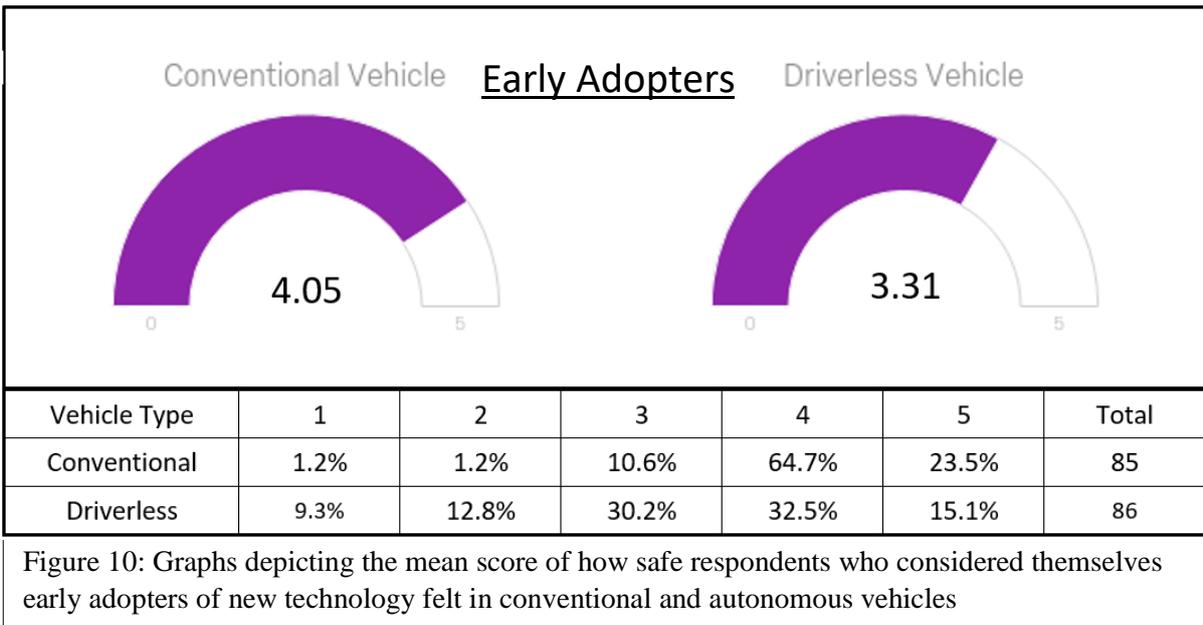## Safety and Stage of Adoption

Another trend observed in our research was respondents that perceived themselves as early adopters of new technology, were more comfortable with the idea of riding aboard autonomous vehicles; this links with the overrepresentation of younger respondents and their natural willingness to adopt new technologies. The trend could also be attributed to people that perceive themselves as early adopters of technology, as they are more aware of AV technologies; 88% of these respondents were already aware, compared with 80% for the respondents who considered themselves later adopters, and therefore felt safer as a result.
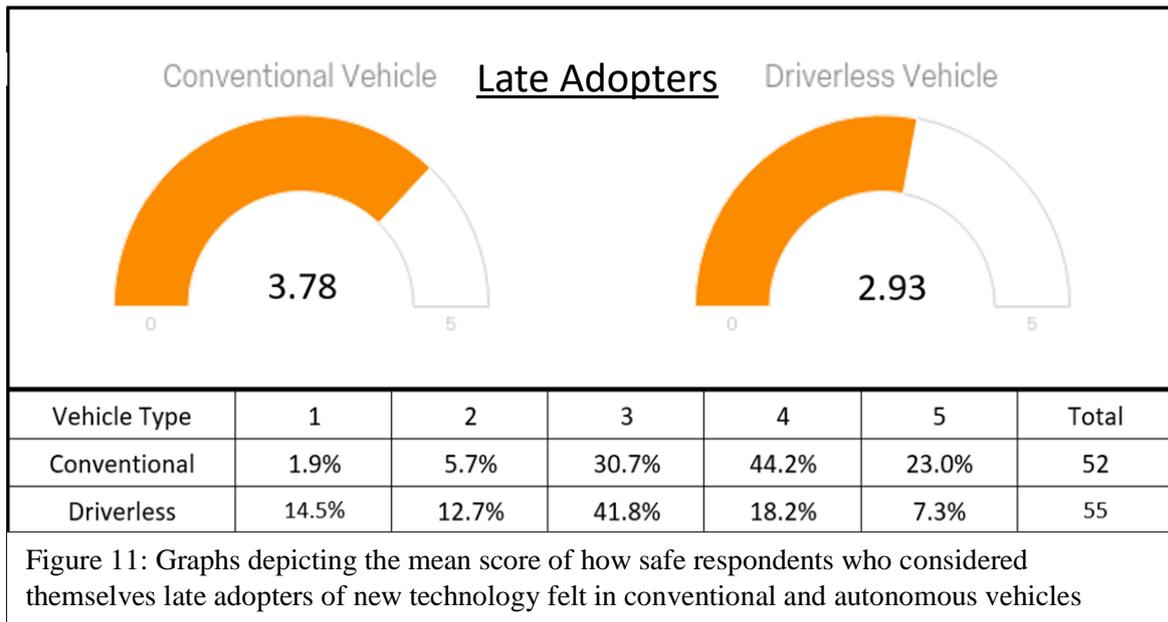

Vehicle Type	1	2	3	4	5	Total
Conventional	1.2%	1.2%	10.6%	64.7%	23.5%	85
Driverless	9.3%	12.8%	30.2%	32.5%	15.1%	86

Figure 10: Graphs depicting the mean score of how safe respondents who considered themselves early adopters of new technology felt in conventional and autonomous vehicles

Vehicle Type	1	2	3	4	5	Total
Conventional	1.9%	5.7%	30.7%	44.2%	23.0%	52
Driverless	14.5%	12.7%	41.8%	18.2%	7.3%	55

Figure 11: Graphs depicting the mean score of how safe respondents who considered themselves late adopters of new technology felt in conventional and autonomous vehicles

Mode of Transport: Use and Frequency

One of the survey questions asked respondents to rank the frequency of their use of modes of transport. The purpose of gathering this information was to gain an insight of how people currently use transport, whether it be public, private or shared. This information could be compared to other data, allowing relationships to be identified and discussed.
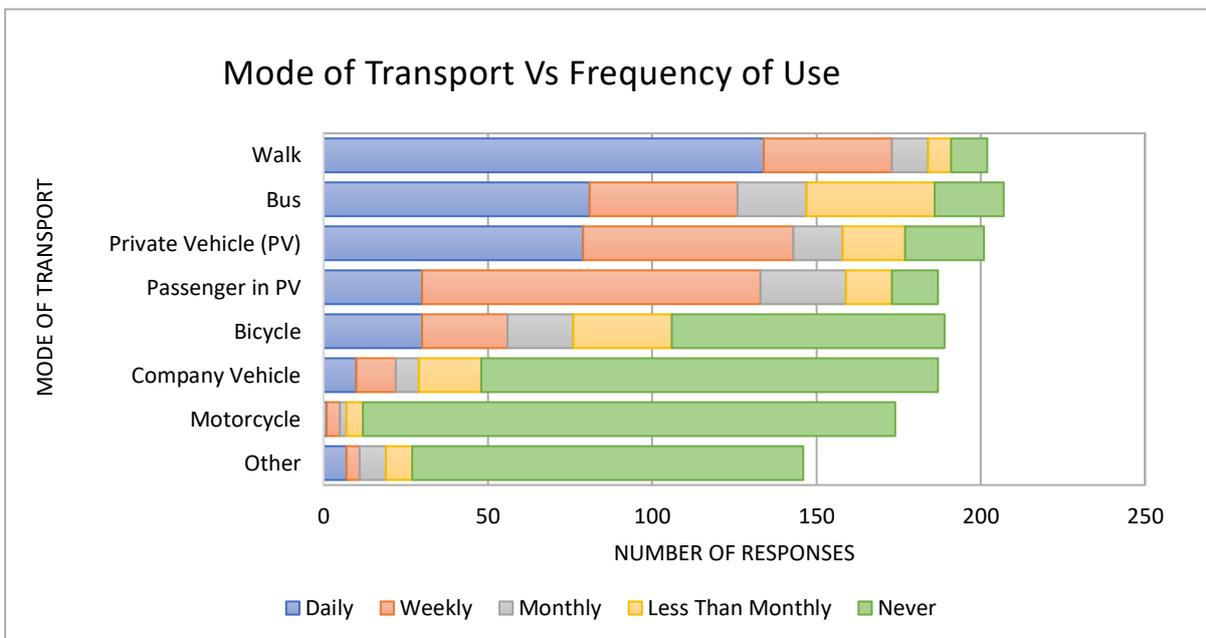

Figure 12: Graph showing a breakdown of the mode of transport and frequency of use of these forms of transport by the survey respondents

As shown by Figure 12, the most common modes of daily transport are walk, bus and private vehicle. This was expected, as walking accompanies many other modes of transport, especially for those who are moving to, from or within the CBD, as many shared modes of transport fail to directly reach the users destination. This can be supported by our data, which found that 55

of 78 daily bus users also walk daily as a mode of transport. This finding aligns well with our research, as it shows the need for first and last mile transport solutions. The first and last mile was referred to throughout the project by both the researchers and community partners; filling this gap is one of the primary objectives when introducing shared autonomous vehicles. It must be noted, however, that some respondents who selected 'walk' as a daily mode of transport may have had very different perceptions towards how much walking must be undertaken to define it as a mode of transport, which the survey failed to make clear; this is one of our limitations and should be defined.

Gaps in Transport Infrastructure

Despite only receiving 35 usable responses from the question 'Have you ever identified any public transport infrastructure gaps in Christchurch City?', they were simple to categorise and paired well with answering our research objectives; all other respondents indicated that they hadn't identified any gaps.

One of the most popular responses identified the lack of a CBD loop shuttle, shown on Figure 13. This response was a reason behind the creation of our second route, discussed previously; as well as supporting our first-last mile objective. Respondents also stated that a night service would be beneficial to the Christchurch public transport infrastructure; coincidentally, autonomous vehicles are not limited to daylight and do not require night staff; therefore, night services should be considered by those planning the introduction of autonomous vehicles. This idea was integrated into the CBD loop as well, by including areas popular with Christchurch's night life (e.g. Victoria Street).

Light rail had the same amount of responses as the shuttle (n = 10, Fig 13); services provided by light rail could those provided by AVs; however, AVs can be integrated into the already existing infrastructure, rather than requiring new infrastructure such as a railway or stations; which wouldn't be economically viable.
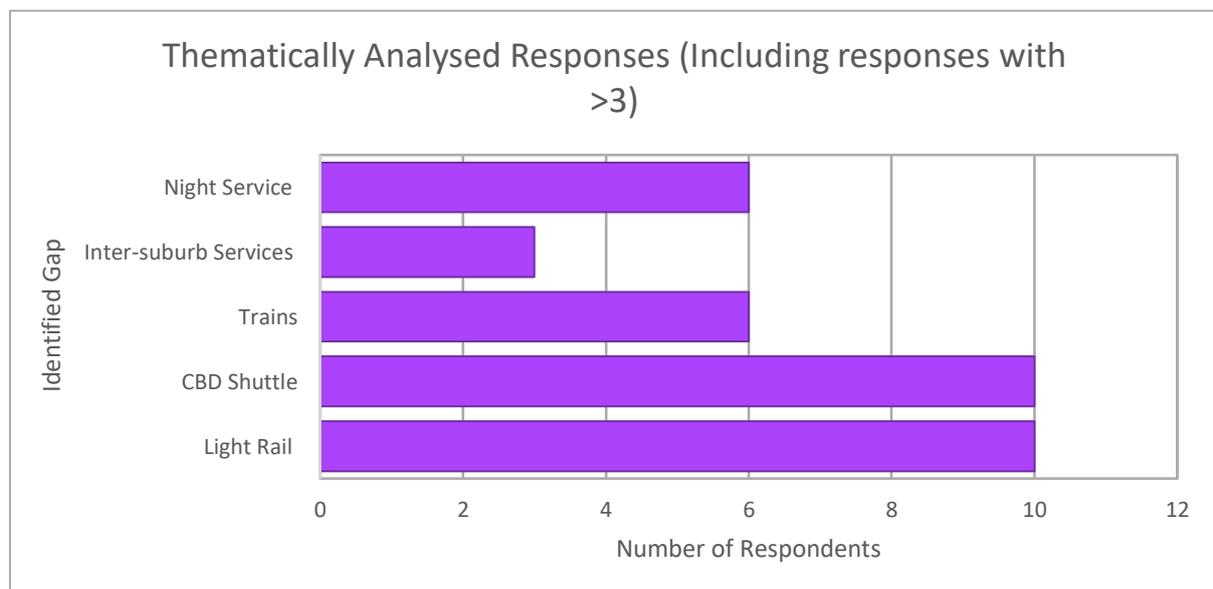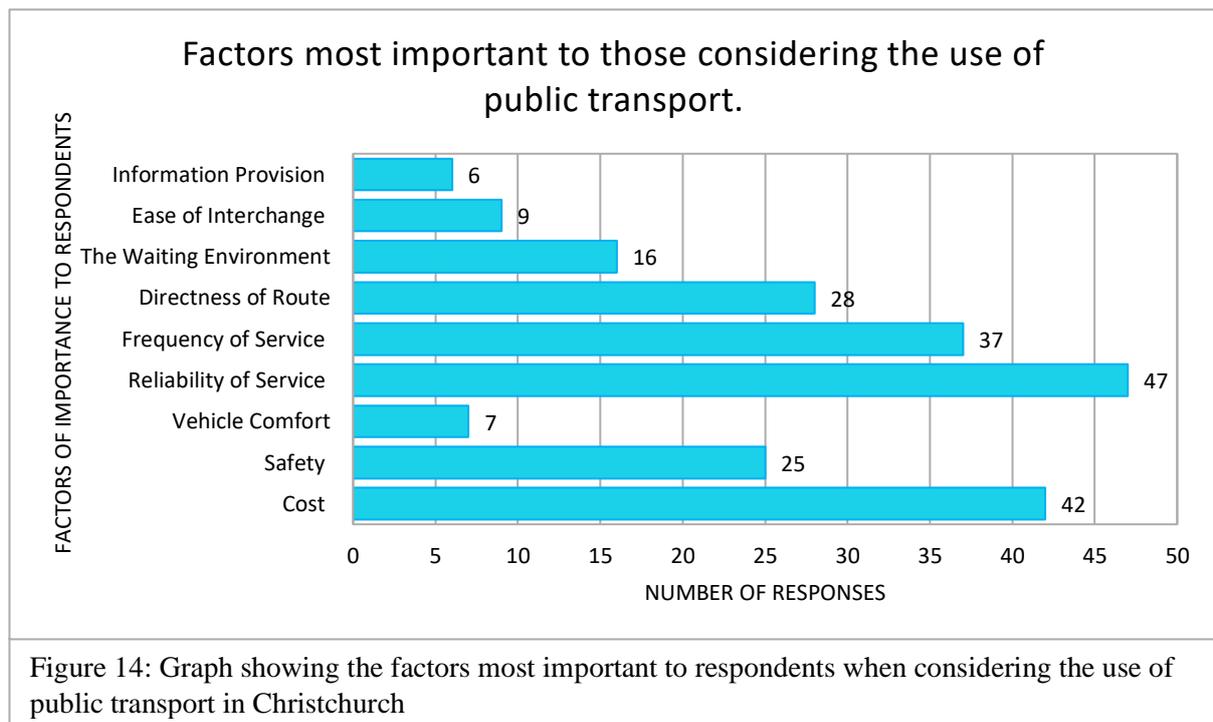

Figure 13: Graph showing identified gaps in the current public transport infrastructure in Christchurch

The results of the question "What are the factors that are most important to you when considering the use of public transport?", displayed on Figure 14; show that the leading three answers were frequency, reliability and cost. This information was a key factor when designing the routes, which resulted in the prioritisation of service frequency and reliability through short geographical distances, while allowing for as many desired stop-off locations as practical; this keeps running costs down.

The survey question that provided this data was inspired by the work of UK-based Doug Paulley et al (2006), who completed a report on the demand of public transport, and the key factors contributing to the service quality. When comparing the findings to Paulley's, we found that the respondents ranked service frequency and reliability relatively high; on the other hand, the primary finding in Paulley et al (2006) was that interchange between transport modes was prioritised by UK public transport users. This was our third least important factor selected; this is likely due to differences in public transport infrastructure between Christchurch and the UK.

Figure 14: Graph showing the factors most important to respondents when considering the use of public transport in Christchurch

Age and Destinations

Question 17 read 'Beginning at the bus interchange in the CBD, what locations or areas most appeal to you when considering the development of new public transport routes?'. This multi-choice question provided a choice of location themes to use when developing the routes. When this data was split into respective age groups it yields interesting results. In Figures 16, 17 and 18, one can see that individuals aged 30-50 rated hospitals lower than those under 30 and over 50 years old, and the 30-50 responses were relatively even across the categories. Another interesting finding is that younger people wanted to travel to residential areas, whereas older respondents didn't rank this option nearly as high.
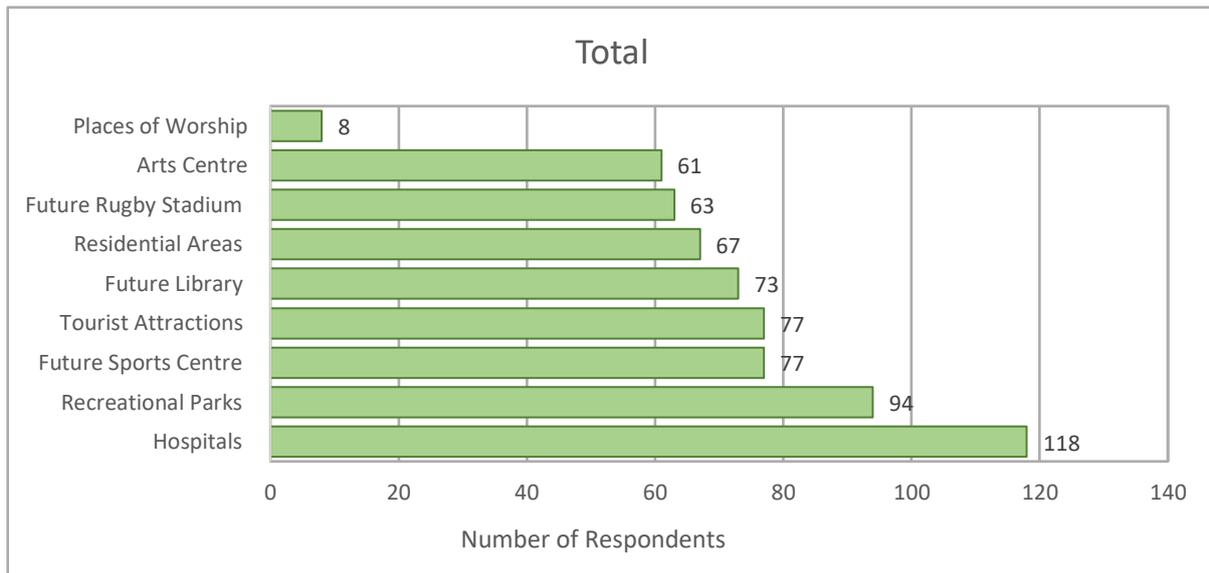

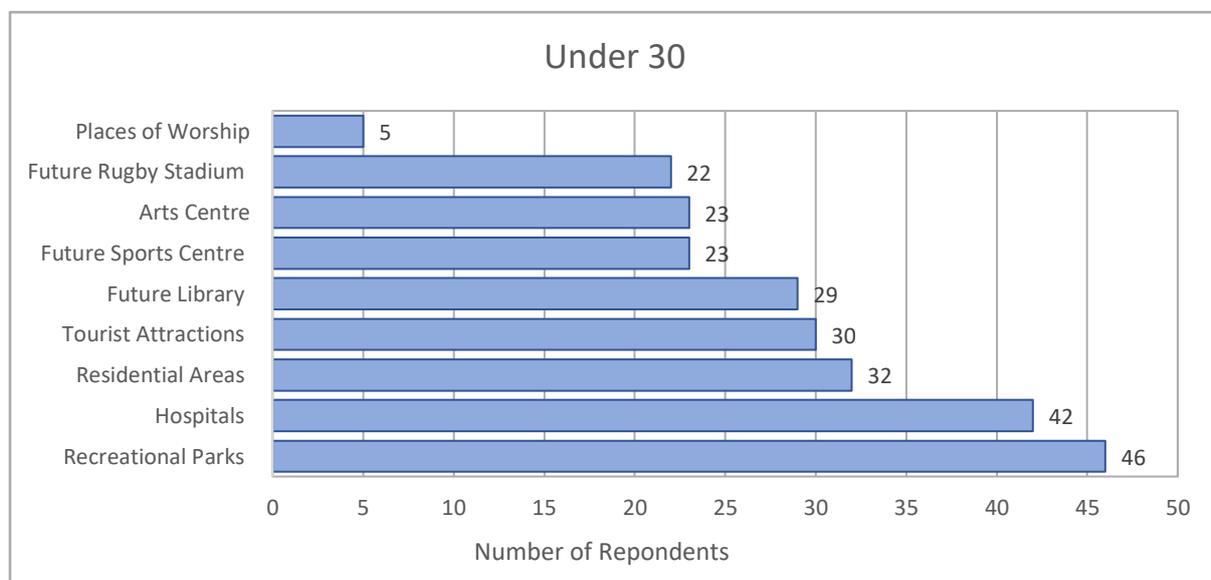Figure 15: Graph showing the most desired places all respondents wanted included in future public transport routes

Figure 16: Graph showing the most desired places respondent's aged under 30 wanted included in future public transport routes
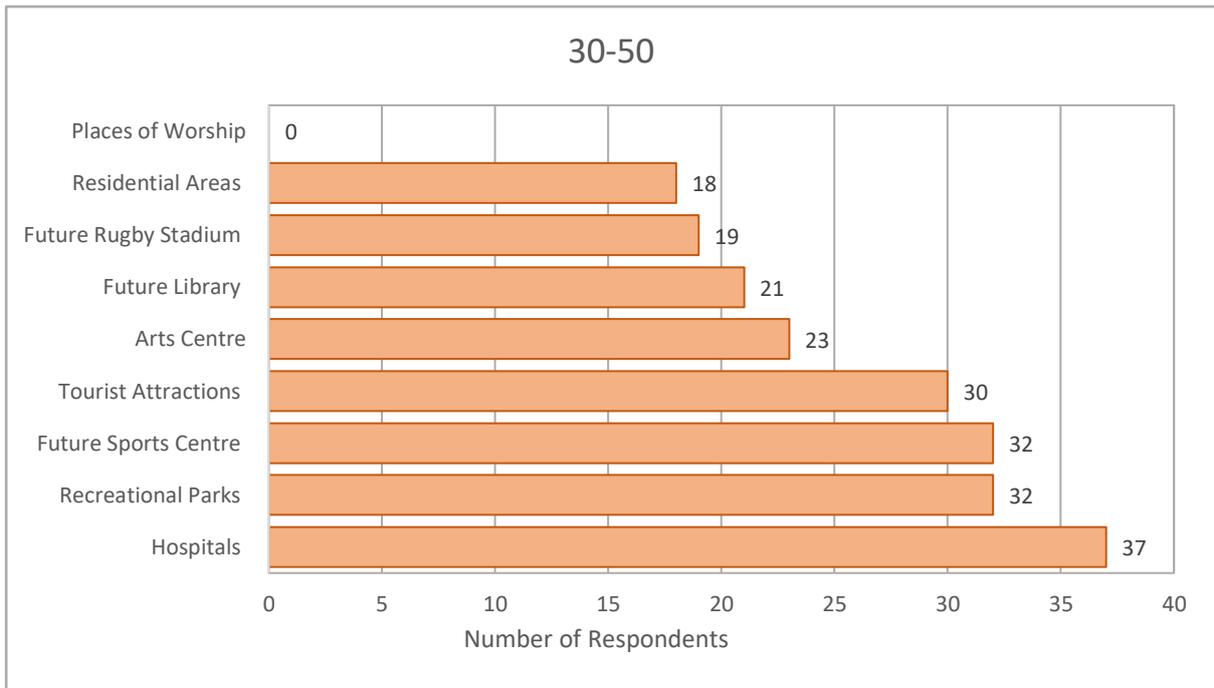
Figure 17: Graph showing the most desired places respondent's aged 30-50 wanted included in future public transport routes
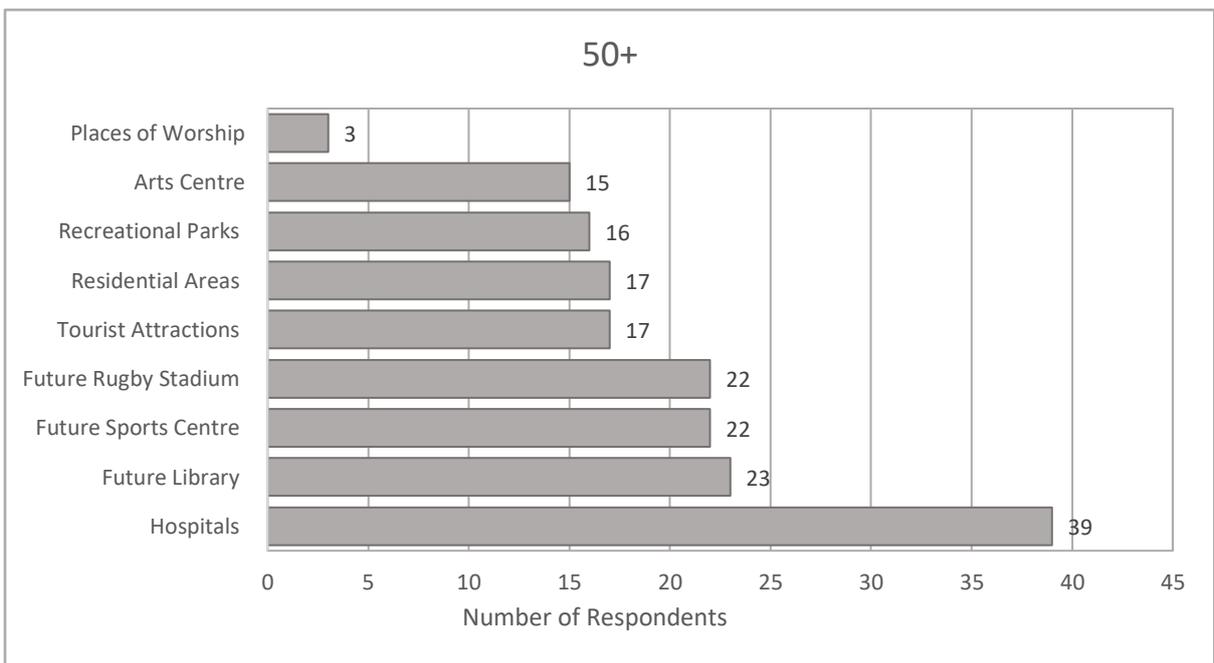

Figure 18: Graph showing the most desired places respondent's aged over 50 wanted included in future public transport routes

Limitations

Method Limitations

193 of the 211 total in-person surveys conducted were with members of the public at the Lichfield Street bus interchange between 4-6pm on weekdays. While the results are useful, we encountered numerous limitations, and observed increased bias for the research results and subsequent analysis within this report.

Primarily, conducting in-person surveys at the bus interchange resulted in a bias towards individuals that already use public transport. Consequently, the sample demographics are not truely representative of the Christchurch population when compared to the 2013 census data. It can be observed that the 18-25 age demographic is overrepresented; this skewed some of the results.
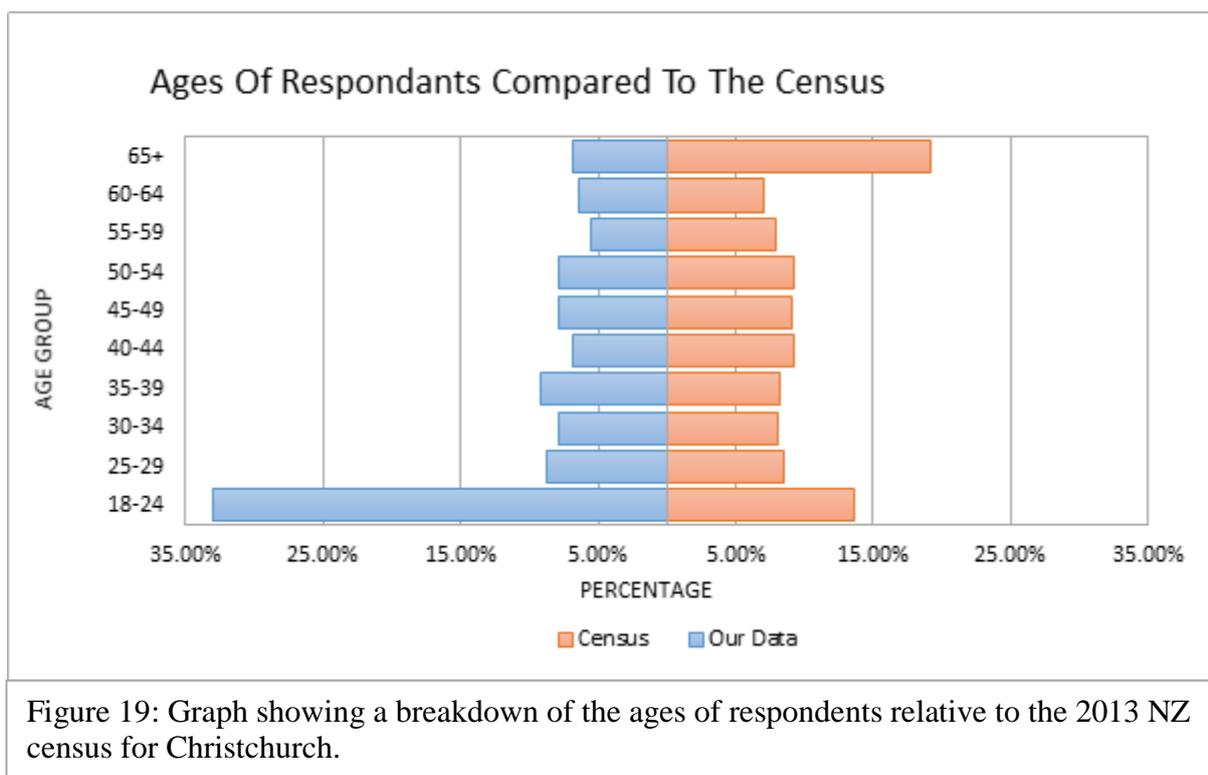

Figure 19: Graph showing a breakdown of the ages of respondents relative to the 2013 NZ census for Christchurch.

Figure 19 shows the bias that lies in the demographics of the age 18-24 respondents compared to the 2013 census; on the other hand, the 65+ age demographic is shown to be heavily underrepresented throughout our surveying. We attempted to minimise this bias by surveying people across multiple days and utilising a systematic sampling method where every *nth* person is selected, so that everyone has an equal chance of being selected (Oxford University Press, 2014). An attempt to survey every third individual was made. In future studies, we would recommend researchers attempt to target those that use other modes of transport in various hotspots around the city.

Surveying between 4-6pm on weekdays meant people surveyed were primarily those that commute to and from the CBD for work. This allowed us to improve the time efficiency of our surveying due to increased foot traffic; however, it may have biased the results towards the perceptions of workers, which are possibly different to other users. Any significant gaps in

current public transport infrastructure, however, are likely to have been recognised due to the large sample size of 277 and thematic saturation of their responses. In future studies, it would be recommended that researchers conduct their surveying during different times to minimise this bias.

By surveying in the CBD, the opinions of people who do not travel there due to accessibility may be missing from our results. This group are arguably the most important, as it could be those gaps in the infrastructure that are preventing travelling into town. Nava et al., (2017) also makes the point that while AVs could benefit many people, if their disability prevents them from accessing the stops or routes in the CBD, then nothing has been done to improve the groups' mobility. This could be a future research project; apart from our online survey, we were unable to consider the opinions of groups outside our surveying location.

The use of online surveying methods contributed to our limitations through increased selection bias, as certain demographics are more likely to complete online surveys (Nulty, 2008). It can be observed that 18-25s were greatly overrepresented in our online survey results and no individuals in their 50s completed the survey online. This can be attributed to the demographics and algorithms of the platforms we shared the survey to, however, we were able to recognise these patterns by using a separate online survey version, so results could be compared.

Researcher and Route Limitations

This research only considers the development of proposed routes for AV trialling within the CBD, to increase public engagement and to utilise desirable destinations in an effective and efficient manner. In the locations that are recommended on the potential AV routes, there are areas where current infrastructure may not be able to accommodate the use of these vehicles. An example is the shared bike and walkways within Hagley Park; they have already been subject to controversy, and our proposal to introduce AVs into this environment will likely increase this (Macbeth et al., 2018). This leads to portions of the proposed routes being unsuitable for use, new or enhanced infrastructure to be implemented, or legislation introduced that accommodates AVs. For the results and legitimacy of the routes generated, we assumed that new legislation or enhanced infrastructure will be implemented alongside AV introduction.

Long-term limitations

This project only considers the development of proposed routes for AV trialling within the CBD, aiming to increasing public engagement and utilising desirable destinations in an effective and efficient manner.

It has been acknowledged in surrounding literature that using AVs to cover 'first and last mile' journeys, people may become less active; and experience increased energy use and carbon footprint (Watkins, 2018). While some people may still choose to walk it is likely a large number will choose to take an AV in the future. It is important to consider this in the long-term development of routes and infrastructure.

Conclusions

When considering AV implementation, one may be expecting it in the distant future. However, this may not be the case; researchers and companies are already developing prototypes and production vehicles across the globe (Litman, 2017). An AV network is widely considered to be the transport of tomorrow, as we focus on a sustainable future. This advanced timeline supports the need for more research on the social, economic and environmental effects of autonomous vehicles. Our results show that there is still much work to be done to encourage the public to 'warm up' to the idea of a driverless vehicle in their town or city; even if the introduction is gradual. This is highlighted in the stark contrasts between the attitudes of the younger and older generations towards this new technology; able to be improved through public engagement efforts and the companies developing this technology proving the safety of the vehicles and system.

The findings of this research and surrounding literature supports our short and long-term needs; advancing technology in AI, GIS and electric vehicle engineering fields will allow for AVs to be introduced and operating within five years in major urban settings (Hayward & Hutching, 2017). With depleting fossil fuel resources, growing environmental impacts and energy needs, inflation and rising prices throughout our lives, it is key that electric autonomous vehicles are introduced as soon as possible to take some of the strain off our current transport systems. A future where, like Uber, one can order an AV to take them to any urban destination on the vehicle network is the direction technology is headed in and is beneficial to almost every member of society. Coupled with contributing to our sustainable future through decreasing carbon emissions, abolishing the need for owning a private vehicle, and increasing road safety through the elimination of human error and decision making (Danyrd, 2018), the future of transport and the stakeholders involved in its development have an exciting chapter ahead of them.

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