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Super-tailoring: Using self-persuasion to reduce drivers' car use

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ABSTRACT

Car use is a common travel mode in many societies but it has negative impacts on the environment and public health. There have been various interventions to reduce car use but self-persuasion has not been tested as a potential intervention. Self-persuasion involves asking people to generate arguments in favour of a specific issue. Our goal was to investigate the effectiveness of self-persuasion in changing drivers' car use attitudes and behaviours. A sample of New Zealand drivers (n = 183) completed two online questionnaires; one immediately after and one at least 2 weeks after the intervention. We randomly assigned the drivers to one of three conditions: self-persuasion (generating arguments on the benefits of reducing car use), direct-persuasion (reading arguments on the benefits of reducing car use), and control (completing a different travel-related task). There were no significant differences between the three groups of drivers on car use intentions for commuting trips, weekly car use for commuting and non-commuting trips, or attitudes towards reducing car use. We attributed the ineffectiveness of self-persuasion to the average quality of arguments generated, the effortful nature of reducing car use, and the COVID-19 situation in New Zealand. Although self-persuasion may not be an appropriate intervention in the travel behaviour domain, future research needs to continue identifying new ways to reduce car use to reduce its detrimental effects.

1. Introduction

In the last 30 years, up to 74% of New Zealanders' journeys to work have involved driving, and in the last 18 years, ownership of light passenger vehicles has increased from 0.65 to 0.80 per head of population (Ministry of Transport, 2018, 2019). Frequent car use is associated with high levels of emissions of poisonous gases such as carbon dioxide (CO_2) and nitrogen oxides (NO_x). On a global scale, road vehicles account for nearly 75% of transport-related CO_2 emissions (IEA, 2019) and, in New Zealand, road vehicles are the biggest contributor of NO_x, which is one of the leading causes of air pollution in New Zealand (Statistics New Zealand, 2018). There are also health consequences, as people can die from exposure to road-vehicle emissions (Fisher et al., 2002). To address this situation, there need to be effective and long-lasting interventions to promote the use of sustainable modes and to reduce commuters' reliance on single-occupant cars and trucks.

There have been many attempts to encourage people to use their cars less and switch to more sustainable modes of transport. One such approach has involved education-based interventions, where commuters receive personalised information regarding the use of sustainable modes (e.g., Bamberg, 2006; Mutrie et al., 2002; Thøgersen, 2009). Providing personalised travel-related information is also part of Travel Feedback Programs (TFPs; Fujii and Taniguchi, 2005). Some of the most common TFPs include individualised marketing where only participants who are keen to change their travel behaviours are provided personalised travel information (see Cairns et al., 2004) and travel blending, where participants receive booklets describing why an individual's travel behaviour is important (see Taniguchi, Hara, Takano, Kagaya, and Fujii, 2003). Other researchers used financial incentives to promote the use of sustainable modes (e.g., Ben-Elia and Ettema, 2011; Jakobsson et al., 2002; Kristal and Whillans, 2020). Other than education- and financial-based interventions, Travel Demand Management (TDM) has also been used. TDM refers to the application of strategies, policies, or initiatives to reduce travel demand or redistribute the demand across multiple travel modes (Carran-Fletcher et al., 2020). Some examples include increasing parking prices (e.g., Litman, 2018), implementing congestion charges (e.g., Croci, 2016), promoting bike-share schemes and improving bicycle lanes, footpaths, rail networks, and public transport systems (e.g., Handy et al., 2013; Midgley, 2011; Parker et al., 2013; Rodriguez et al., 2009; TfL, 2019).

Another way of encouraging commuters to reduce their car use is to change their attitudes towards car use. Using the Elaboration Likelihood Model (ELM), Petty and Cacioppo (1986) suggested that a

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person's likelihood of changing their attitude depends on their tendency to elaborate upon an issue or an argument. According to the ELM, there are two routes to attitude change. The central route involves the person carefully and thoughtfully considering the argument content and quality, whereas the peripheral route involves the person relying on factors or cues unrelated to the argument content, such as the attractiveness of the communicator (Friedrich, 1990). When a person is highly motivated and receives compelling arguments, they are more likely to respond via a central route of persuasion (Chaiken et al., 1989; Chaiken and Maheswaran, 1994; Petty and Cacioppo, 1986). Whereas when a person is not motivated or receives weak arguments, they are more likely to respond to a peripheral route of persuasion (Petty and Cacioppo, 1986). Petty and Cacioppo (1986) claimed that the central route of persuasion is more likely to lead to enduring attitude and behaviour changes because it involves the processing of arguments under high elaboration conditions (i.e., high motivation, strong arguments). Thus, to effectively persuade attitude change, psychological interventions should target individuals' central routes by encouraging them to elaborate arguments.

One way to increase elaboration is tailoring arguments or messages to the individuals (i.e., message tailoring; Petty et al., 2009). Message tailoring involves developing a specific intervention based on the assessment of an individual's characteristics and needs (Kreuter et al., 2000, 1999; Lustria et al., 2009). Message tailoring promotes greater engagement with the message (i.e., reading, attending to, and recalling the message content) and deeper and elaborative processing of the message (Cortese and Lustria, 2012). As individuals become more motivated to process the information and perceive it to be compelling (i.e., high elaboration), they are more likely to change their attitudes and behaviours (Cesario et al., 2004; Noar et al., 2007; Petty and Cacioppo, 1979). An effective way to tailor messages or arguments to the individual is to explicitly instruct individuals to generate their own arguments about an issue or a decision option (Baldwin et al., 2013; Lemmen et al., 2020; Loman et al., 2018). This is known as self-persuasion. Aronson (1999) defined self-persuasion as placing people in situations where they are motivated to persuade themselves to change their own attitudes and behaviours.

Direct persuasion methods involve providing individuals with messages or arguments to persuade them to change their attitudes and behaviours. However, self-persuasion can be more effective than direct persuasion methods. Firstly, individuals tend to be more responsive to information that is generated internally than information that is provided externally (Mussweiler and Neumann, 2000; Wilson and Brekke, 1994) because they believe that their opinions are better than the opinions of others (see Dunning et al., 2004; Kahneman et al., 1991). Secondly, there is no psychological reactance when individuals generate their own arguments because their freedom of choice is not restricted (cf., direct persuasion, see Wakefield et al., 2010). Thirdly, individuals tend to generate compelling arguments as they match their arguments to their unique needs, characteristics, and situations (Baldwin et al., 2013; Briñol et al., 2012; Greenwald and Albert, 1968; Slamecka and Graf, 1978). Asking people to generate arguments can be thought of as 'super-tailoring', as people will tend to generate idiosyncratic reasons that are relevant to their own lives. Self-persuasion methods have been found to be more effective than direct persuasion methods, for example, in encouraging smoking cessation (e.g., Baldwin et al., 2013; Müller et al., 2009), healthy dietary behaviours (e.g., Pierce and Stoltenberg, 1990; Stice et al., 2008), safer sex practices (e.g., Stone et al., 1994), and pro-environmental behaviours (e.g., Damen et al., 2015; Lemmen et al., 2020).

To our knowledge, self-persuasion has not been used as an intervention in the domain of travel behaviour. This is presumably due to the dominating influence of direct methods of persuasion, such as providing commuters travel-related information or arguments to encourage them to make more sustainable mode choices (e.g., TFPs; see Cairns et al., 2004; Fujii and Taniguchi, 2005; Taniguchi et al., 2003). While using TFPs can be useful in the short run, especially under ambiguous travel conditions where commuters require more information for their commutes, it is not very useful in the long run because when commuters' travel conditions are no longer ambiguous, their sensitivity to travel information decreases and they rely on habitual travel behaviours (Ben-Elia and Avineri, 2015). Additionally, a tailored direct persuasion intervention requires segmentation – that is, messages must target specific sectors of the population. However, research on which types of persuasive car-reduction messages are effective for different segments is still ongoing (e.g., Andersson et al., 2020). In their study, Andersson et al. (2020) found that the car-reduction messages did not motivate devoted car users but had some positive effects on car contemplators (i.e., travellers with a low-car accessibility), image improvers (i.e., travellers who use the car as a way of self-expression), and malcontent motorists (i.e., travellers who do not like to drive). A self-persuasion intervention could circumvent the need for segmentation and segmented messaging by disseminating the same message to all segments of travellers, and relying on individuals to tailor their own arguments to their specific situations. Thus, there are two main shortcomings that we intended to address in our study: (1) the role of self-persuasion in encouraging behaviour change has yet to be studied closely in the domain of travel behaviour and (2) the long-term effectiveness of current interventions to encourage sustainable travel behaviour is not very promising or consistent across various studies. Testing the effectiveness of self-persuasion could introduce a new intervention technique in the context of travel behaviour that encourages longer-term travel behaviour changes.

In the current study, we tested whether self-persuasion can reduce drivers' car use in favour of sustainable travel behaviour. The self-persuasion intervention in our study involved asking drivers to generate arguments on the benefits of reducing car use (i.e., super-tailoring). We hypothesised that asking drivers to generate their own arguments would be more effective than providing them with arguments as previous researchers have done (e.g., Bamberg, 2006; Kristal and Whillans, 2020; Mutrie et al., 2002; Thøgersen, 2009). Using two online questionnaires, we compared self-persuasion (generating arguments) and direct persuasion (reading arguments) to a control task in their effectiveness to reduce the strength of the participants' intentions to use private cars for their commuting and other regular trips. We hypothesised that drivers in the generate-argument condition would have a larger decrease in intentions to use the car (i.e., weaker intentions) compared to drivers in the read-argument and control conditions (H1). We administered the second questionnaire 2 weeks after the first to assess longer-term effects of the interventions. We hypothesised that drivers in the generate-argument condition would have the largest reduction in car use (H2) and that these drivers would have a more positive attitude towards reducing car use (i.e., more favourable attitude) compared to drivers in the read-argument and control conditions (H3). We hoped that the findings of the study would reveal whether self-persuasion is an appropriate tool to encourage sustainable travel behaviour amongst drivers and whether it can lead to long-term behaviour changes.

2. Method

2.1. Design

We adopted a between-subjects design to compare the three groups of drivers (generate-argument, read-argument, and control) on four main dependent variables associated with car use (intentions to use the car for commuting trips, attitudes towards reducing car use, weekly car use for commuting trips, and weekly car use for non-commuting trips). We carried out the intervention via Qualtrics (www.qualtrics.com/). The participants were randomly assigned to

these three groups just prior to beginning the first questionnaire, which contained the manipulation. We assessed the participants' intentions and attitudes again in a second questionnaire administered at least 2 weeks later.

2.2. Participants

We recruited regular commuters between July and August 2020 (winter in New Zealand) who were 16 years and older through notices placed on the intranets of various organisations as well as on social media and through word-of-mouth. The study was conducted immediately after the New Zealand government lifted the nationwide lockdown due to COVID-19. We received ethical approval from the Human Research Ethics Committee of the Division of Arts, Law, Psychology, and Social Sciences at the University of Waikato.

Of the 390 respondents who completed the first online questionnaire, 251 (64.36%) were regular car drivers (i.e., driving for more than 50% of commuting trips in a week). We excluded 68 car drivers from the analyses because they either did not complete the intervention that they were assigned to, did not provide the main dependent measure of the first questionnaire (intention to use the car for commuting trips), or did not provide their demographic details. Our final sample was 120 women, 62 men, and one respondent of undisclosed gender. Of the 183 respondents, 58 were assigned to the generate-argument condition, 66 to the read-argument condition, and 59 to the control condition. The final sample had a mean age of 43.20 years (SD = 14.80). Table 1 shows the demographic characteristics of the sample. On average, the drivers took 23.19 min (SD = 17.83) and travelled 19.86 km (SD = 20.39) to work and spent NZ$215.71 ($SD$ = 159.39) per month on transportation. We invited the respondents to complete a second questionnaire any time 2 weeks after completing the first questionnaire. The final sample for the second questionnaire was 70 women and 35 men with a mean age of 45.54 years (SD = 14.45). Of the 105 respondents, 36 were in the generate-argument condition, 34 in the read-argument condition, and 35 in the control condition.

2.3. Materials and procedure

2.3.1. First questionnaire

The first questionnaire had six sections (Refer to Appendix A for additional details on the items and their respective response scales). The first question of the first section was a filter question where respondents indicated their usual mode for commuting before the nationwide lockdown (i.e., any travel mode used for more than 50% of commuting trips in a week) and only respondents who selected 'drive' continued. The remaining two questions of the first section asked respondents for their average travel time (in minutes) and distance (in kilometres) when commuting to work during a regular week before the lockdown.

In the second section, we asked respondents for the percentage of commuting trips made in a regular week using the car and if they had made any effort to reduce their car use during a regular commuting week. We asked respondents who indicated 'yes' to select their methods of reducing car use from a given list. We then asked them how likely were they to reduce their car use once the travel restrictions due to COVID-19 have been completely removed on a 7-point Likert scale (1 = *extremely unlikely*, 7 = *extremely likely*). We also asked respondents to indicate any other travel purposes for which they used their car before the lockdown by selecting from a list of travel purposes (i.e., shopping, personal appointment/services, social visit/entertainment, sport & exercise, education, and accompanying someone). Then, respondents indicated, on a scale of 0 to 100%, how often they used their cars in a week for each of the travel purposes selected in the previous question.

The third section measured respondents' attitudes towards reducing car use. We adapted three items, each answered on a 7-point scale, from Loukopoulos et al.'s (2005) scale. High scores indicated positive attitudes towards reducing car use while low scores indicated negative attitudes.

The fourth section asked respondents to complete one of three intervention tasks. After completing Sections 2 and 3, we randomly assigned respondents to one of three experimental conditions: generate-argument, read-argument, and control. The respondents in the generate-argument condition were asked to provide as many arguments as they could think of as to why reducing car use can be beneficial, and read-argument respondents received a list of 10 benefits of reducing car use (adapted from NZTA, 2019) and then both groups rated how convincing they found the arguments on a 7-point scale (1 = *extremely unconvincing*, 7 = *extremely convincing*). Respondents in the control condition described their daily car use experience before the nationwide lockdown due to COVID-19.

In Section 5, respondents indicated their intentions to use their cars for commuting trips and any other trips selected in Section 2 once the travel restrictions had been completely removed. Respondents' answers to the questions in Section 5 served as their post-intervention car use intention scores. Finally, in Section 6, we asked respondents for their gender, age, employment status, education status, education level, household type, annual income for the last 12 months, and residential relocation status in the last 12 months.

Table 1
Demographic Characteristics of the Drivers in the Sample (N = 183).

Demographic characteristics	Percentage of drivers (%)
Employment status	
Full-time work (30 h or more per week)	71.6
Part-time (less than 30 h per week)	15.3
Casual/sporadic work	5.5
Unemployed/looking for work	1.1
Looking after home and family	1.1
Retired	2.7
Other	2.7
Education status	
Not attending, studying or enrolled anywhere	73.2
Secondary school	0.5
Full-time University/Polytech/other	8.2
Part-time University/Polytech/other	13.1
Other	4.9
Highest level of education completed	
No secondary school qualification	0.5
High school qualification or equivalent	18.6
Tertiary diplomas or certificate	29.5
Bachelor degree or Bachelor with Honours degree	37.7
Master degree or higher	13.7
Household type	
Person living alone	10.4
Married/de facto couple only	30.6
Other adults only (e.g., flatmates)	13.7
Family (including extended) with children	30.6
Family with adults only	9.8
Single adults living with children	2.2
Other	2.7
Annual income	
Zero	0.5
$1 - $25,000	7.7
$25,001 - $50,000	20.8
$50,001 - $75,000	23.0
$75,001 - $100,000	20.2
$100,001 - $125,000	8.7
$125,001 - $150,000	6.0
More than $150,000	2.7
Prefer not to say	10.4
Recently moved status in the last 12 months	
Yes	20.2
No	79.8

2.3.2. Second questionnaire

The second questionnaire had three sections and respondents' answers to the questions in these sections served as their post-intervention car use behaviour and attitude scores (Refer to Appendix B for additional details on the items and their respective response scales). For the first question in the first section, respondents indicated how often they used their car for commuting trips in a regular commuting week on a scale of 0 to 100%. Then, we asked respondents if they had reduced their car use in the last 2 weeks and respondents who indicated 'yes' were asked to select their methods of reducing car use from a given list. In the next section, respondents indicated any other travel purposes they had used their car for in the last 2 weeks by selecting them from a list of travel purposes similar to Section 2 of the first questionnaire. Then, respondents indicated on a scale of 0 to 100%, how often they used their cars in a regular commuting week for each of the travel purposes selected in the previous question. In the final section, we again measured respondents' attitudes towards reducing car use using the adapted three items from Loukopoulos et al.'s (2005) study. Respondents answered on a 7-point Likert scale for each of the three items.

2.4. Analysis

We carried out a one-way, between-subjects ANOVA to compare the three groups of drivers on each of the four dependent variables. The independent variables in each ANOVA were intervention type with three levels (i.e., generate-argument, read-argument, and control). With an a priori estimation of statistical power of 0.8 and an estimated medium effect size Cohen's *d* of 0.25 (see Cohen, 1988), a minimum of 159 respondents was required for this study.

For the first dependent variable, we measured drivers' car use intentions for commuting trips before and after the intervention using a single-item measure twice in the first questionnaire. We then calculated drivers' differences in intentions by subtracting their intentions before the intervention from their intentions after the intervention. A positive difference score indicated an increase in drivers' intentions to use the car for commuting trips after the intervention whereas a negative difference score indicated a decrease.

We measured drivers' attitudes towards reducing car use before the intervention, and at least 2 weeks later, using a 3-item measure. We calculated drivers' differences in attitudes towards reducing car use by subtracting their attitudes before the intervention from their attitudes after. A positive difference score indicated a more favourable attitude after the intervention and a negative difference score indicated a less favourable attitude.

We measured drivers' weekly car use percentages for commuting trips before and after the intervention using a single-item measure. We then calculated drivers' differences in weekly car use for commuting trips by subtracting their weekly car use percentages before the intervention from their weekly car use percentages after. A positive difference score indicated an increase in drivers' weekly car use for commuting trips after the intervention whereas a negative difference score indicated a decrease.

For the fourth dependent variable, we obtained drivers' weekly car-use percentages for non-commuting trips before and after the intervention by averaging their percentages of weekly car trips for six travel purposes (i.e., shopping, personal appointment/services, social visit/entertainment, sport & exercise, education, and accompanying someone). We then subtracted drivers' average weekly car use percentages for non-commuting trips before the intervention from their average weekly car use percentages after. A positive difference score indicated an increase in drivers' weekly car use for non-commuting trips after the intervention and a negative difference score indicated a decrease.

We calculated the percentages of drivers who responded 'yes' and 'no' before and after the intervention for the item asking whether they have made any effort to reduce their car use in the last 1 week of their regular commute (see Section 2 of the first questionnaire and Section 1 of the second questionnaire). According to Field (2018), a McNemar's test is appropriate when looking for changes in individual's scores by comparing the proportion of individuals who responded in one direction (i.e., increase in scores) to the number of individuals who responded in the other direction (i.e., decrease in scores) and when there are two related dichotomous variables. Thus, we carried out a McNemar's test for each group of drivers (i.e., generate-argument, read-argument, and control) to determine whether the proportion of drivers who reduced their car use (as opposed to not reducing their car use) before the intervention increased after the intervention.

3. Results

3.1. Effect of self-persuasion on drivers' car use intentions, behaviours, and attitudes

Our first hypothesis was that drivers in the generate-argument condition would have a larger reduction in car use intentions (i.e., weaker intentions) compared to drivers in the read-argument and control conditions. Fig. 1a shows that drivers in all three groups reported reductions in their intentions to use the car for commuting trips regardless of the type of intervention that they completed. There was no significant effect of type of intervention on differences in intentions to use

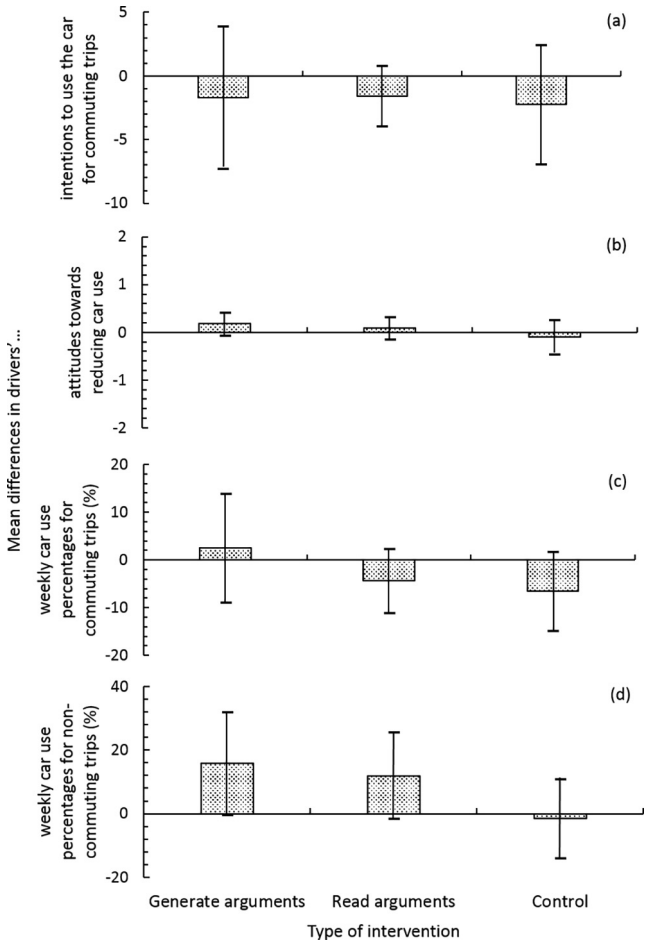

Fig. 1. Mean differences in scores of drivers who either generated arguments, read arguments, or completed a control task for four dependent measures: (a) intentions to use the car for commuting trips, (b) attitudes towards reducing car use, (c) weekly car use percentages for commuting trips, and (d) weekly car use percentages for non-commuting trips. Error bars represent 95% confidence intervals.

the car after controlling for attitudes and intentions, $F(2, 178) = 0.02$, $p = .98$, $n^2 = 0.00$. Thus, the results did not support our first hypothesis. To check whether our results were non-significant due to a lack of statistical power, we conducted a post-hoc power analysis using GPower 3.1 (Faul and Erdfelder, 1992; for a full description, see Erdfelder et al., 1996) with the current sample size ($n = 183$) and found that the ANOVA had a statistical power of 0.94. An a priori estimation of statistical power of 0.8 and an estimated medium effect size Cohen's d of 0.25 (see Cohen, 1988) indicated that a minimum of 159 respondents was required for this study. Thus, a lack of statistical power was not the reason for our failure to find differences between the groups, so we evaluated the variability of the intentions to use the car for drivers in all three conditions. As shown in Fig. 1a, drivers in the generate-argument condition had the highest variation in their ratings of intentions to use the car ($SD = 21.28$) followed by drivers in the control condition ($SD = 17.96$). Drivers in the read-argument condition had the lowest variation in their scores of mean differences ($SD = 9.65$).

Our second hypothesis was that drivers in the generate-argument condition would have the strongest positive attitude change towards reducing car use. Fig. 1b shows very little change in attitudes towards reducing car use for any group, $F(2, 101) = 0.94$, $p = .40$, $n^2 = 0.02$. Thus, the results did not support our second hypothesis.

Our third hypothesis was that drivers in the generate-argument condition would have a larger reduction in car use for commuting trips compared to drivers in the read-argument and control conditions. Fig. 1c shows that drivers in the generate-argument condition had a positive mean difference in their weekly car-use percentages (i.e., increased car use) for commuting trips while drivers in the read-argument and control conditions had a negative mean difference (i.e., decreased car use). Nevertheless, there was no significant effect of the type of intervention on drivers' differences in weekly car use percentages for commuting trips after controlling for intentions towards reducing car use, $F(2, 101) = 1.09$, $p = .34$, $n^2 = 0.02$. Thus, our third hypothesis was also not supported.

Fig. 1d shows that drivers in the generate- and read-argument conditions had positive mean differences in their weekly car-use percentages for non-commuting trips (i.e., increased car use) compared to drivers in the control condition. The one-way ANOVA, however, failed to reveal any significant effect of the type of intervention on drivers' differences in weekly car use percentages for non-commuting trips after controlling for their intentions towards reducing car use, $F(2, 101) = 1.63$, $p = .20$, $n^2 = 0.03$.

3.2. Effect of self-persuasion on drivers' car-use reduction behaviour

Fig. 2a and 2c show no changes in the percentage of drivers who reduced their car use after the intervention. Fig. 2b shows a slight increase in the percentage of drivers in the read-argument condition who reduced their car use after the intervention. Nonetheless, the McNemar's tests failed to reveal any significant differences in the proportion of drivers who reduced car use before and after the intervention for drivers in the generate-argument ($n = 35$, $p = 1.00$), read-argument ($n = 34$, $p = 0.22$), or control conditions ($n = 35$, $p = 1.00$).

3.3. Methods used by drivers to reduce their car use

By a plurality of 36.84%, working and/or studying from home was the most common method used by drivers to reduce their car use before the intervention, while using public transport was the least common method (Table 2). By a plurality of 31.82%, walking was the most common method used by drivers after the intervention, while using other methods such as electric bicycles or scooters was the least common method.

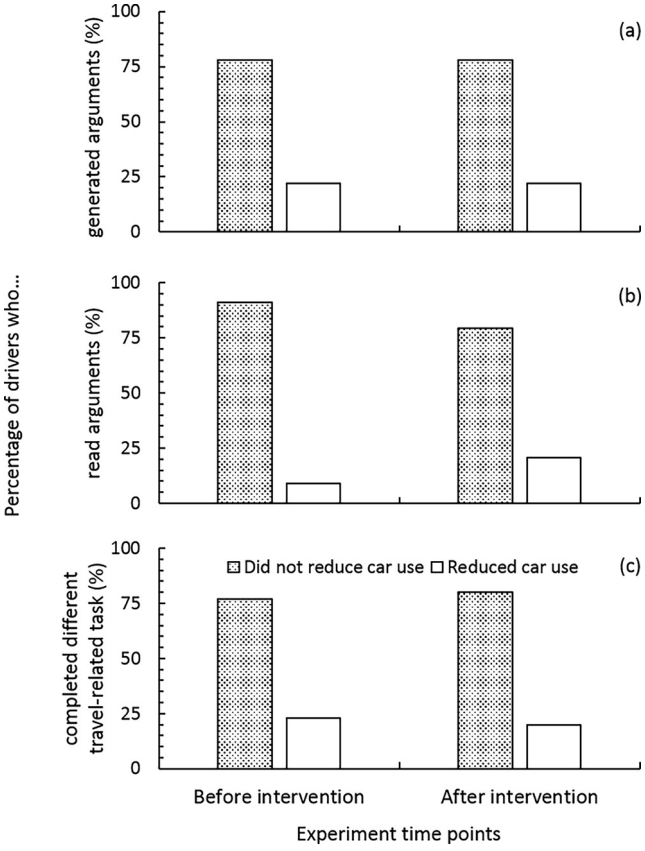

Fig. 2. Percentage of drivers who did and did not reduce their car use before and after completing one of three interventions: (a) generating arguments on the benefits of reducing car use, (b) reading arguments on the benefits of reducing car use, and (c) completing a different travel-related task.

Table 2
Percentages of Drivers Who Used Various Methods to Reduce Their Car Use for Commuting Trips before (n = 19) and after the Intervention (n = 22).

Method of reducing car use for commuting trips	Percentage of drivers who used this method before the intervention (%)	Percentage of drivers who used this method after the intervention (%)
1. I walk whenever I can	10.53	31.82
2. I ride my bicycle whenever I can	21.05	6.90
3. I take public transport when possible	5.26	9.68
4. I share a ride with family/friends instead of driving alone	21.05	8.82
5. I use ride-sharing services like Uber	–	2.70
6. I work or study from home whenever I can	36.84	31.58
7. I plan my trips ahead so that I visit different places all at once instead of making several trips	26.32	22.0
8. I use a shorter route so that I travel less with my car	–	3.28
9. Other (e.g., use e-bike, electric scooter)	15.79	1.59

Note. Respondents selected any method that applied to them.

3.4. Comparing ratings of argument convincingness

An independent t test revealed no significant difference between the ratings of convincingness of drivers who generated arguments (M = 4.97, 95% CI [4.54, 5.39]) and drivers who read arguments (M = 4.85, 95% CI [4.31, 5.39]), $t(118.18) = 0.34$, $p = .73$, $d = 0.06$.

3.5. Arguments generated by drivers in self-persuasion condition

Finally, we examined the arguments that the drivers in the generate-argument condition generated. One of the most common arguments was the reduced costs associated with reduced car use. Some drivers mentioned a reduction in fuel costs, while others mentioned a reduction in maintenance and parking costs. Consider the following examples from different drivers:

> "Save money on petrol, car maintenance and parking"
> "Don't have to repair or replace car parts, e.g., tyres as often, less money spent on petrol, have to clean the car less"
> "…reduces tax/road user charges, registration, insurance, WOF, maintenance costs"

Another common benefit of reducing car use provided by drivers in the generate-argument condition was the positive impacts on the environment. Specifically, the drivers were concerned with the reduction in poisonous gas emissions and noise pollution resulting from extensive car use. Some drivers mentioned improvement in the quality of air and stormwater. Consider the following examples from different drivers:

> "Reduce harmful pollution, reduce greenhouse gases…"
> "Less fossil fuels released into the environment"
> "Cleaner air and urban stormwater…"

Other drivers mentioned the health benefits of reducing car use. According to these drivers, reducing car use can be seen as an opportunity to improve one's fitness by getting more exercise. Some even mentioned the improvement of one's mental health as a benefit of reducing car use.

> "Health benefits [as a result of] walking to destinations more, rather than using a car for walkable distances"
> "…more physical movement for better health. We should never use cars for short distance if we can really get to our destination on foot, such as going to church on Sunday"
> "Improved health [through the] reduction in emissions, potential increase in walking/cycling [and] mental health improvements [through] socialising/human contact, sense of belonging to a community, getting outdoors/in touch with nature if walking/cycling"

Some drivers mentioned the safety-related advantages of reducing car use. For these drivers, reducing car use can result in safer roads, fewer road accidents, and safer active commutes such as cycling and walking to work.

> "Reduce the number of deaths and injuries"
> "Less crashes [and] more confidence in riding on the road without fear"
> "…safer roads for active modes of transport"

Other than the typical or generic benefits provided by drivers in the generate-argument condition, a few of the drivers in the generate-argument condition provided more idiosyncratic benefits. According to some drivers, reducing car use can make them more efficient and make their day more productive:

> "Get more time to prepare in the morning on public transport. Makes me more time efficient and transporting with a purpose."
> "Don't have to find a carpark [and] better time management"

For another driver, reducing car use made them feel that their tax money is being put to good use as there is an opportunity to improve road conditions when there are fewer cars on the road. The same driver also mentioned that reducing car use provides employment opportunities:

> "Less traffic on the roads therefore the roads are sustainable for longer - I'm not sure if that is a real fact but I would like to think my tax dollar would go further in that respect. [By reducing car use] we keep people in employment i.e., bus drivers and other driving services"

Another driver mentioned the opportunity for local governments to improve the public transport infrastructure when people reduce their car use:

> "Encourage local/central government to invest in improved public transport"

Based on the arguments provided by drivers in the generate-argument condition, it is evident that drivers provided a mix of typical and idiosyncratic benefits of reducing car use. It is also worth noting that there were more typical benefits than idiosyncratic ones and the typical benefits provided by drivers closely resembled the benefits that we provided to drivers in the read-argument condition (Appendix A).

4. Discussion

We tested self-persuasion as an intervention to encourage commuters to reduce their car use by asking a group of New Zealand car drivers to either generate or read arguments on the benefits of reducing car use, or complete a different travel-related task. We hypothesised that drivers who generated arguments would have (1) a larger decrease in their car use intentions (i.e., weaker intentions), (2) a larger reduction in their car use for commuting trips, and (3) a larger positive difference in attitudes towards reducing car use (i.e., more favourable attitudes) after the intervention, compared to drivers in the read-argument and control conditions. Statistical analyses failed to detect significant differences between drivers in the three conditions on any of these hypotheses. Moreover, the proportion of drivers in each group who reduced their car use before the intervention did not increase after the intervention, which also implies that the intervention did not affect drivers' car-use reduction behaviour. Overall, our results revealed no evidence that self-persuasion influenced drivers' car use intentions, behaviours, and attitudes.

There are several potential reasons why self-persuasion was not effective in the current study. Firstly, the arguments generated by drivers in the self-persuasion condition were not very different from the arguments that we provided to the drivers to the direct-persuasion condition. Both sets of arguments included benefits such as improved environmental conditions, lower transportation costs, better quality of life, and enhanced transportation infrastructure. Furthermore, drivers in the self-persuasion condition were no more likely to rate their arguments as being convincing than drivers in the direct-persuasion condition, which implies that the generated arguments were similar to the provided arguments in persuasiveness. However, both groups of drivers had relatively high ratings of argument convincingness. Drivers who generated arguments may have had high ratings because they were biased towards their arguments (ownership effect; Beggan, 1992), while drivers who read provided arguments may have believed that the source of the arguments (i.e., NZTA) had high expertise (see Chaiken and Maheswaran, 1994). While drivers in both conditions may have had different reasons to rate the arguments favourably, the similarities in the types of arguments and ratings of argument convincingness in both persuasion conditions could explain why neither self-persuasion nor direct persuasion was able to influence car users' intentions, behaviours, and attitudes.

Furthermore, neither providing nor reading arguments on why one should reduce their car use was more effective than simply describing one's daily commute experience. It can be said that the arguments in both persuasion conditions were not very good presumably because they were not specific or tailored to the drivers' personal needs and circumstances to change their attitudes and/or behaviours. Research has shown that arguments that are specific to one's circumstances or needs are compelling enough to promote greater engagement and elaborative processing (i.e., high elaboration; Cortese and Lustria, 2012) which tends to lead to attitudes and/or behaviours changes (Cesario et al., 2004; Noar et al., 2007; Petty & Cacioppo, 1979; see e.g., Evans and Petty, 2003). However, generating or reading non-tailored benefits did not encourage message elaboration, presumably similar to describing one's daily commute experience. Thus, the lack of message elaboration in all three conditions may be a reason why there were no significant differences in car use intentions, behaviours, and attitudes between drivers in all three conditions.

It is unclear why drivers in the self-persuasion condition generated typical benefits instead of idiosyncratic or personalised ones inasmuch as we randomly assigned them to complete the self-persuasion intervention. We believe this could be due to the ambiguous target of persuasion, such that we asked drivers to provide benefits of reducing car use without specifying whether they had to convince themselves or others. As a result, most drivers generated general or typical benefits of reducing car use instead of unique ones. Focusing on the self as targets of persuasion is more effective because individuals tend to view themselves are being more important, valuable, and worthy targets of persuasion and believe that their opinions are better than the opinions for others (e.g., Dunning et al., 2004). By prioritising the way they feel and think, they will invest more effort to generate and process the arguments that are relevant to themselves (Briñol and Petty, 2006; Petty and Cacioppo, 1979; Petty et al., 2000). For example, Lemmen et al. (2020) found that participants who were asked to provide arguments as to why they should follow the no-luring rule at a zoo were more likely to comply with the rule compared to the participants in the control group. Asking participants why they should change their behaviour provided them the opportunity to generate idiosyncratic reasons which were effective. In the current study, we assumed that the arguments generated by drivers in the self-persuasion condition were not self-relevant because the arguments generated in the self-persuasion condition were very similar to the arguments provided in the direct-persuasion condition. Thus, the ambiguous target of persuasion in the self-persuasion condition could explain the ineffectiveness of the self-persuasion intervention.

Another reason why self-persuasion was not effective in the current study could be because reducing one's car use requires high effort and comes at the expense of drivers' sense of convenience. Self-persuasion has been shown to be ineffective at changing high-effort behaviours (e.g., physical exercise) but effective at changing low-effort behaviours (i.e., increasing one's fruit and vegetable consumption; Stavrositu and Kim, 2018). According to Diekmann and Preisendörfer's (2003) low-cost hypothesis, psychological variables such as environmental attitudes, concerns, and norms are more likely to influence behaviours that are easy to perform or that cause little inconvenience to the individuals (i.e., low-cost behaviours). Therefore, attitude and/or behaviour interventions may be more effective for low-cost or easy behaviours compared to high-cost or effortful behaviours. Reducing one's car use is a high-effort or high-cost behaviour because using the car itself is a low-effort behaviour for many drivers (Jensen, 1999; Maxwell, 2001; Sivasubramaniyam et al., 2020; Steg, 2005) and reducing car use involves giving up the convenience and pleasure of car use (Ünal et al., 2019). Furthermore, for some drivers, reducing car use is effortful because of the physical effort required to use alternative modes such as active commuting (e.g., Loukopoulos and Gärling, 2005) and public transport (e.g., Gardner and Abraham, 2007).

One way to encourage high-effort behaviour change (e.g., reducing car use) is to break the behaviours down into small, low-effort behaviours and encourage individuals to perform these low-effort behaviours instead. Much health-related research refers to this as the small-changes approach (e.g., Foster et al., 2005; Lutes et al., 2008). Encouraging small behavioural changes can be more effective than encouraging large behaviour changes because small, low-effort behaviour changes are more realistic and feasible to achieve and maintain (Hills et al., 2013). Furthermore, attitude and/or behaviour interventions are more likely to predict whether individuals engage in low-effort behaviours compared to high-effort behaviours (see low-cost hypothesis; Diekmann and Preisendörfer, 2003). With regards to car use, interventions should focus on encouraging low-effort behaviours that contribute to the overall reduction of car use. If low-effort, easy behaviours are performed consistently, they could result in large overall effects at population levels. In the current study, some of the drivers' popular methods of reducing their car use were working and/or studying from home and sharing rides with family or friends, which imply that these behaviours could be low-effort or low-cost behaviours. Therefore, instead of generally asking drivers to reduce their car use, it might be more effective to ask them to work from home once a week or even carpool once a week.

There are also several issues related to the execution of the study that may have obscured any underlying effects of self-persuasion. Firstly, we started collecting data soon after the New Zealand government lifted domestic travel restrictions due to COVID-19 (i.e., early July; Cheng, 2020), which is a limitation because drivers' lack of commuting or their reluctance to commute due to concerns regarding COVID-19 may have influenced their car use. Furthermore, as we stopped collecting data after the New Zealand government re-implemented localised travel restrictions (i.e., mid-August; Wade and Cheng, 2020), there is a possibility that drivers may have reduced their car use due to the travel restrictions instead of the intervention. Another limitation was that we did not impose a duration for drivers to complete the interventions and did not measure how long they took to complete their respective interventions. As the drivers in our study may have spent different periods of time completing the interventions, time is a potential confounding variable. To detect the effectiveness of self-persuasion, it is imperative to ensure that time spent on the intervention task is equal across all experimental conditions (Stavrositu and Kim, 2018). Another time-related issue to consider is the time period to measure the effects of self-persuasion. In the current study, we examined drivers' car use intentions immediately after they completed the self-persuasion intervention and examined their car use attitudes and behaviours at least 2 weeks after the intervention. Stavrositu and Kim (2018) suggested that in the case of high-effort behaviours (e.g., reducing car use), it is best to examine the effects of self-persuasion over a longer period (e.g., 1 month or longer). So, we suggest future research examine the effects of self-persuasion on drivers' attitudes and behaviours at least 1 month after the intervention. Additionally, our study suffered from participant mortality, which poses a threat to the internal validity of our study. Of the 185 drivers who completed the first questionnaire, only 105 completed the second questionnaire. The low number of drivers in the second questionnaire reduced the statistical power of the analyses.

Overall, as self-persuasion was not an effective intervention in our study, we conclude that encouraging drivers to motivate themselves to reduce their car use by generating arguments on the benefits of reducing car use may not be an appropriate intervention in the domain of travel behaviour. We have outlined potential reasons why self-persuasion was not effective in our study. As car use is becoming increasingly popular (Chowdhury et al., 2018) and has negative consequences on the environment and public health (Fisher et al., 2002; IEA, 2019), there is an imminent need to try as many interventions as possible to reduce car use, especially in car-dependent societies. We tested self-persuasion as a potential intervention to encourage sus-

tainable travel behaviour and promote long-term behaviour changes. While self–persuasion is a rapidly growing technique, the main limitation of our research remains that self-persuasion was not effective at encouraging sustainable travel behaviour. However, we believe that our research has highlighted the importance of developing and testing new interventions in the domain of travel behaviour. Researchers have been testing new types of interventions to promote sustainable travel behaviour, such as gamification (e.g., Yen et al., 2019), motivational-stage based approaches (e.g., Friman et al., 2019), and low-cost physical changes to the environment (e.g., Benton et al., 2021). Regardless of whether the interventions were effective or not, the testing of new and innovative interventions can provide insights into how susceptible people are to change and the factors that need to be considered to promote successful behaviour changes. In our study, although our intervention did not significantly affect behaviour, future researchers could build on our study by improving the methodology, and investigating factors that may influence individuals' susceptibility to persuasion interventions (e.g., personality types; see Wall et al., 2019). Our study has emphasised the importance of a well-thought-out self-persuasion intervention and the execution of the intervention itself.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A:. Questions used in the first online questionnaire

Questionnaire Items
Section 1
1. Prior to the level 4 lockdown due to COVID-19, what was your usual mode of getting to work? (Note: Usual mode refers to the mode that you use for more than 50% of your regular commuting trips in a week).
a. I drive a car
b. I share a car ride with someone else
c. I take the bus
d. I cycle
e. I walk
f. I use another mode (Please specify)[1]
2. Prior to the level 4 lockdown due to COVID-19, how long did it take you (in minutes), on average, to reach your workplace in a regular commuting week using your usual mode? (0 – 120 min[2])
3. Prior to the level 4 lockdown due to COVID-19, how far did you travel (in kilometres), on average, to get to your workplace in a regular commuting week, using your usual mode? (0 – 120 km[3])
Section 2
1. Prior to the level 4 lockdown due to COVID-19, in a regular commuting week, what percent of your commuting trips (i.e., travel to work or school) involved using the car? (0 – 100%)
2. Prior to the level 4 lockdown due to COVID-19, in a regular commuting week, have you reduced your car use? (Some common ways of reducing your car use include using another travel mode, working or studying from home, using a shorter route, or sharing a ride with someone else).
a. Yes, I have
b. No, I have not
3. If yes, which of the following means have you used to reduce your car use for commuting trips? Please select all that apply.
a. I walk whenever I can
b. I ride my bicycle whenever I can
c. I use the bike-share program that is available in my city
d. I take public transport when possible
e. I share a ride with friends instead of driving alone
f. I use ride-sharing services like Uber
g. I work or study from home whenever I can
h. I plan my trips ahead so that I visit different places all at once instead of making several trips
i. I use a shorter route so that I travel less with my car
j. Other: Please specify
4. After the travel restrictions due to COVID-19 have been removed completely, on a scale of 0 to 100%, what are the chances you would use your car for your regular commute?
5. After the travel restrictions due to COVID-19 have been removed completely, how likely are you to reduce your car use for your regular commute? (1 = *extremely unlikely*, 7 = *extremely likely*)
6. Prior to the level 4 lockdown due to COVID-19, other than commuting trips, which of the following trip purposes have you used your car for? Please select all that apply.
a. Shopping (i.e., travelling with the intention to purchase goods, includes window shopping)
b. Personal appointment/services (i.e., travelling with the intention to purchase services instead of goods, such as visiting a doctor, dentist, hairdresser, or bank)
c. Social visit/entertainment (i.e., travelling to visit friends, going to the movies, going out for a meal)
d. Sport, recreation, and exercise (i.e., travelling with the intention to perform physical activity in a designated location, such as going to the gym, attending yoga classes, going to the lake for a run, etc.)
e. Education (i.e., travelling with the intention to pursue education in various education institutions, such as universities, colleges, and schools)
f. Accompany someone (i.e., travelling with the intention to drop off or pick up someone)
7. Prior to the level 4 lockdown due to COVID-19, on a scale of 0 to 100%, how often did you use the car for the following trips in a week?[4]
Section 3
1. My opinion of reducing the rate of car use in New Zealand is… (1 = *extremely negative*, 7 = *extremely positive*)
2. I think that reducing the rate of car use in New Zealand is… (1 = *extremely bad*, 7 = *extremely good*)
3. The very idea of reducing the rate of car use in New Zealand is… (1 = *extremely unappealing*, 7 = *extremely appealing*)
Section 4[5]*Generate-arguments condition*According to the New Zealand Transport Agency (NZTA), over the last 70 years, New Zealanders have become dependent on their private cars to meet their travel needs. While using private cars can provide some level of flexibility and convenience, it is not sustainable. As result, the NZTA has come up with a plan to improve New Zealanders' travel choices and reduce their car dependency.
1. Could you provide some benefits of reducing car use? You may provide as many benefits as you wish.

Appendix A: (*continued*)

Appendix A: (*continued*)

Questionnaire Items

2. Looking back at the answers that you provided above, how convincing, did you find the benefits of reducing car use? (1 = *extremely unconvincing*, 7 = *extremely convincing*)*Read-arguments condition*According to the New Zealand Transport Agency (NZTA), over the last 70 years, New Zealanders have become dependent on their private cars to meet their travel needs. While using private cars can provide some level of flexibility and convenience, it is not sustainable. As result, the NZTA has come up with a plan to improve New Zealanders' travel choices and reduce their car dependency. In preparing this plan, the NZTA has listed from benefits of using private cars less frequently.Here are some benefits of reducing car use.
   - It can ease the financial burdens of buying and owning a car.
   - It is economically efficient, such that public transport, walking, and cycling can move people with less fuel and land resources.
   - It can improve the quality of life and strengthen community cohesion when people meet friends and acquaintances on the streets while commuting.
   - It saves time through a more efficient and attractive public transport system.
   - It can reduce vehicle emissions by increasing the share of travel by public transport, walking and cycling.
   - It can reduce traffic volumes and congestion as there will be less cars on the road.
   - It can promote better health as there will be an improvement in the air quality and an increase in physical activity.
   - It can improve road safety as there will be fewer cars on the road and better safety measures have been implemented for public transport and cycling facilities.
   - It is kinder to the planet by reducing the emissions of poisonous gases from cars.
   - It reduces car-parking problems, as there are fewer cars, which allow a more effective parking management to take place.

   1. Looking back at the list provided above, how convincing, did you find the benefits of reducing car use? (1 = *extremely unconvincing*, 7 = *extremely convincing*)*Control condition*Can you please describe your daily experience of using the car prior to the level 4 lockdown due to COVID-19? An example is provided below but you may describe your experience in your own words.*On an average day, I leave home around 7 pm and drive to work. It takes me about 12 min to get to my office. There is not much traffic at that time. I leave work around 4.30 pm and I usually stop by the supermarket to get a few groceries and household items before heading home. Once at home, I get ready to go to the gym around 6 pm. My drive to the gym takes about 15 min. After my workout around 8 pm, I go home.*

Section 5

1. After the travel restrictions due to COVID-19 have been removed completely, on a scale of 0 to 100%, what are the chances you would use the car for the trip purpose(s) listed below?[6]
   a. Shopping (i.e., travelling with the intention to purchase goods, includes window shopping)
   b. Personal appointment/services (i.e., travelling with the intention to purchase services instead of goods, such as visiting a doctor, dentist, hairdresser, or bank)
   c. Social visit/entertainment (i.e., travelling to visit friends, going to the movies, going out for a meal)
   d. Commuting (i.e., travelling to get to work)
   e. Sport, recreation, and exercise (i.e., travelling with the intention to perform physical activity in a designated location, such as going to the gym, attending yoga classes, going to the lake for a run, etc.)
   f. Education (i.e., travelling with the intention to pursue education in various education institutions, such as universities, colleges, and schools)
   g. Accompany someone (i.e., travelling with the intention to drop off or pick up someone)

Section 6

1. Please indicate your gender.
   a. Male
   b. Female
   c. Prefer to self-describe
   d. Prefer not to say
2. Please indicate your age (in years). (0 – 110 years)[7]
3. What is your current employment status?
   a. Full-time work (30 h or more per week)
   b. Part-time work (less than 30 h per week)
   c. Casual/sporadic work
   d. Unemployed/looking for work
   e. Looking after home and family
   f. Retired
   g. Other
4. Are you attending, studying or enrolled at school or anywhere else?
   a. No
   b. Secondary school
   c. Full-time University/Polytech/other
   d. Part-time University/Polytech/other
   e. Other
5. Please indicate the highest level of education you have completed.
   a. No secondary school qualification
   b. High school qualification or equivalent
   c. Tertiary diplomas or certificate
   d. Bachelor degree or Bachelor with Honours degree
   e. Master degree or higher
6. Please indicate your household type.
   a. Person living alone
   b. Married/de facto couple only
   c. Family (including extended) with children
   d. Family with adults only
   e. Single adult living with children
   f. Other
7. Prior to the level 4 lockdown due to COVID-19, what was your total personal income in a year, before tax or anything else was taken out? (Please note: you may provide an estimate if you are not sure)
   a. Zero income
   b. $1 - $25,000
   c. $25,001 - $50,000
   d. $50,001 - $75,000
   e. $75,001 - $100,000
   f. $100,001 - $125,000
   g. $125,001 - $150,000
   h. More than $150,000
   i. Prefer not to say

(*continued on next page*)

Appendix A: (*continued*)

Questionnaire Items
8. Prior to the level 4 lockdown due to COVID-19, how much (in New Zealand dollars) did you spend, on average, on transportation over a typical month? (Please note: you may provide an estimate if you are not sure). (0 - $1000)[8]
9. Prior to the level 4 lockdown due to COVID-19, have you moved to another residence in the last 12 months? a. Yes b. No
Notes
1. Respondents who selected any other option than option 'a' reached the end of the questionnaire and were told that we were only interested in car drivers who commute on a regular basis
2. An option of 'longer than 120 min' is provided
3. An option of 'more than 120 km' is provided
4. Respondents only responded to the trip purposes selected from the list in Q6 of Section 2
5. Respondents were randomly assigned to one of the three conditions using the Qualtrics randomiser tool
6. Respondents received the commuting trip purpose and only the trip purposes that they selected in Q6 from Section 2
7. There is a 'prefer not to say' option
8. There is a 'more than $1000 per month' option

Appendix B:. Questions used in the second online questionnaire

Questionnaire Items
Section 1
1. In a regular commuting week in the last 2 weeks, what percent of your commuting trips (i.e., travel to work or school) involved using the car? (0 – 100%)
2. In a regular commuting week in the last 2 weeks, have you reduced your car use? (Some common ways of reducing your car use include using another travel mode, working or studying from home, using a shorter route, or sharing a ride with someone else). a.Yes, I have b.No, I have not
3. If yes, which of the following means have you used to reduce your car use for commuting trips? Please select all that apply. a. I walk whenever I can b. I ride my bicycle whenever I can c. I use the bike-share program that is available in my city d. I take public transport when possible e. I share a ride with friends instead of driving alone f. I use ride-sharing services like Uber g. I work or study from home whenever I can h. I plan my trips ahead so that I visit different places all at once instead of making several trips i. I use a shorter route so that I travel less with my car j. Other: Please specify
Section 2
1. In the last 2 weeks, which of the following trip purposes have you used your car for? Please select all that apply. a. Shopping (i.e., travelling with the intention to purchase goods, includes window shopping)

Appendix B: (*continued*)

Questionnaire Items
b. Personal appointment/services (i.e., travelling with the intention to purchase services instead of goods, such as visiting a doctor, dentist, hairdresser, or bank) c. Social visit/entertainment (i.e., travelling to visit friends, going to the movies, going out for a meal) d. Sport, recreation, and exercise (i.e., travelling with the intention to perform physical activity in a designated location, such as going to the gym, attending yoga classes, going to the lake for a run, etc.) e. Education (i.e., travelling with the intention to pursue education in various education institutions, such as universities, colleges, and schools) f. Accompany someone (i.e., travelling with the intention to drop off or pick up someone)
2. In a regular week in the last 2 weeks, on a scale of 0 to 100%, how often have you used your car for the following trip purposes?[1]
Section 3Please answer the following attitude questions while considering your regular commute in the last 2 weeks.
1. My opinion of reducing the rate of car use in New Zealand is… (1 = *extremely negative*, 7 = *extremely positive*)
2. I think that reducing the rate of car use in New Zealand is… (1 = *extremely bad*, 7 = *extremely good*)
3. The very idea of reducing the rate of car use in New Zealand is… (1 = *extremely unappealing*, 7 = *extremely appealing*)
Notes
1. Respondents only responded to the trip purposes selected from the list in Q1 of Section 1

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