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Can public transport compete with the private car?

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Abstract

Public transport is often perceived to be a poor alternative for car use. This paper describes who may be open to use public transport more often, and how people might be persuaded to use it. A computerised questionnaire study was conducted among 1803 Dutch respondents in May 2001. Results revealed that especially fervent car users dislike public transport. For them, the car outperforms public transport not only because of its instrumental function, but also because the car represents cultural and psychological values, e.g. the car is a symbol of freedom and independence, a status symbol and driving is pleasurable. So, for fervent car users, car use is connected with various important values in modern society. Infrequent car users judge less positively about the car and less negatively about public transport. Consequently, they may be open to use public transport more regularly. In contrast, many efforts are needed to stimulate fervent car use to travel by public transport, because in their view, public transport cannot compete with their private car. In this case, policies should be aimed at reducing the functional, psychological and cultural values of private cars, as well as at increasing the performances of public transport and other (more) environmentally sound modes of transport on these aspects. An overview of possible policy strategies is given.

Key words: public transport; car; attractiveness; psychological factors; policies

1. Background

Private car use has grown rapidly during the last decades. The number of motorised vehicles in the world grew from about 75 million to about 675 million between 1950 and 1990. Around 80% of these vehicles were primarily used for personal transportation, i.e., cars and motorcycles¹. The amount of passengers-kilometres by private car per capita increased by 90% (from 4,620 to 8,710 kms) in Western Europe between 1970 and 1990¹.

The increasing car use has generated various environmental, social and economic problems. Environmental problems concern the emissions of toxic and harmful substances, which, among other things, contribute to global warming, smog and acid precipitation. Next, scarce raw materials and energy are needed to produce and use cars. The extension of road infrastructure causes distortion and fragmentation of natural areas, which might disrupt natural habitats.

On the social level, car use threatens the urban quality of life because it is noisy, causes odour annoyance, local air pollution and yields traffic accidents. Transport has been identified as the main cause of environmental noise in OECD countries: about 16% of the population is exposed to noise levels from transport that might severely disturb sleep and communication¹. In 1998, 42.000 people were killed in traffic accidents in the European Union². Moreover, less space is available for walking, cycling and playing, especially in urban areas. And whereas more and more people own a car, those without access to cars become more disadvantaged and socially isolated as workplaces, shops and leisure facilities relocate to suit car users³.

Economic problems of car use are related to the decreased accessibility of economically important destinations. Congestion in European cities is estimated to cost 100 billion Euro's per year, and projected to double in the next decade³. Motorists are allowed to shift of external costs such as accident costs, costs for managing environmental nuisance and noise, and maintenance of traffic safety to society as a whole.

The problems of car use might be reduced in different ways⁴. First, the negative impact per car and per kilometre driven may be reduced via technological innovations that, e.g., increase the energy efficiency of cars, reduce emissions per car kilometre or reduce the level of traffic noise. Technological solutions appear not to be sufficient to manage the problems listed above, because the effects tend to be overtaken by the continuing growth of motorised traffic in the world. Second, new road infrastructure may be constructed. This may reduce congestion, but environmental and social problems are likely to increase if this strategy is followed. Third, we may stimulate people to drive at other times or places. This will also especially be effective to reduce congestion problems, but less to reduce the environmental and social problems of car use. Fourth, governments may aim at reducing the level of car use, i.e., stimulate people to use other modes of transport, to combine trips or to travel less. Fifth, policies may be aimed at making people drive more safely or more environmentally friendly. All five types of solutions may be called for to effectively address the problems caused by car traffic.

This paper focuses on how people might be motivated to more often travel by public transport instead of by car. Paragraph 3.1 describes which people travel by car, and which people more often use other modes of transport, such as public transport. Paragraph 3.2 focuses on why people are more likely to travel by car or by public transport. First, judgements on the (dis)advantages of cars and public transport are described as well as group differences in these judgements. It is hypothesised that especially frequent car users judge more favourably about the car compared to public transport. In contrast, people who hardly travel by car will judge relatively less favourably about the car and relatively more favourably about public transport. Second, the societal and personal significance of travelling, car use and the use of public transport is discussed. We hypothesised that the car is evaluated as being more important than public transport, because Western societies are geared to the regular use of cars⁵. Moreover, this will be especially true for regular car users, since they may have organised their lives in such a way that they became dependent of their car⁵. Third, we examined

whether frequency of car use is related to people's awareness of the problems of car use and to their perceptions of the need for policy measures aimed at reducing these problems. It is hypothesised that frequent car users are less concerned by the problems caused by car use and evaluate transport policies aimed at reducing car use as less legitimate than infrequent car users do.

2. Method

2.1. Respondents and procedure

A computerised questionnaire study was conducted in May 2001 among 1803 Dutch respondents of 18 years and older. These respondents were part of an internet-based telepanel who fill out a questionnaire on various topics each week via the Internetⁱ. In total 73% of the panel filled out the questionnaire; 9% could not respond because they were ill or on a holiday. The sample was representative for the Dutch population^{6, 7}. Fifty-six percent of the respondents was male. The mean age was 46 years (SD = 14.8). Forty-six percent had completed primary school, technical or vocational education (lower education), 33% had completed the highest level of secondary education (middle education), and 21% had attained a university degree or equivalent (higher education). Respondents were classified into four income quartiles: monthly net household income of less than Dfl. 3,172, a monthly net household income between Dfl. 3,173 and 4,500, a monthly net household income of Dfl. 4,501 to 6,183 and more than Dfl. 6,184 a month. Nearly 23% of the respondents was single, 38% had a partner but no children, 37% had a partner and children and 2% lived in another type of household.

2.2. Measures

Attractiveness of car and public transport

Respondents evaluated the attractiveness of the car and public transport by comparing both modes on the following 17 aspects.

- Arousal, comfort, convenience, freedom, not stressful, control, status, sexy, pleasure, various experiences and flexibility. Scores could range from 1 'little' to 7 'a lot'.
- Independence and security. Scores could range from 1 'low' to 7 'high'.
- Traffic safety. Scores could range from 1 'not safe' to 7 'very safe'.
- Cosy. Scores could range from 1 'not cosy' to 7 'very cosy'.
- Travel speed. Scores could range from 1 'slow' to 7 'fast'.
- Price. Scores could range from 1 'expensive' to 7 'inexpensive'.

Importance of transport, car use and the use of public transport

Respondent indicated to what extent they agreed with the following 6 statements on the importance of travel, car use and the use of public transport for society and their lives. Respondents were divided at random in three groups. Thirty five percent of the respondents were asked about the importance of travelling in general, 31% about the importance of car use and 34% about the importance of travelling by public transport. All three groups rated the same statements, only the mode of transport varied (indicated as X):

1. X is of key importance in our modern society.
2. X is far less important for our daily life than often claimed*.
3. X symbolises social progress.
4. Reducing X would make my life much more troublesome.

ⁱ To ensure the representativeness of the sample, respondents who do not have a computer and Internet access are provided with a so-called Net.Box that allows them to fill out the questionnaire via their television set. If necessary, a television set is provided too.

5. I can not imagine that I can have a pleasant life without X.
 6. I can not reduce my X, because it takes too many sacrifices.

Scores could vary from 1 'totally disagree' to 5 'totally agree'. The internal consistency of the three scales was sufficient: Cronbach's $\alpha_{\text{mobility}} = .71$; $\alpha_{\text{car}} = .81$; $\alpha_{\text{public transport}} = .75^{\text{ii}}$. Therefore, for each scale, the mean scores on the six items were computed, after recoding the scores on the second item. The scores on the variables 'importance of travelling / car use / use of public transport' could vary from 1 'not important' to 5 'very important'.

Problem awareness

Respondents indicated to what extent they are concerned about the following problems caused by car use: (1) air pollution, (2) exhaustion of scarce resources like oil, (2) space occupation resulting in less space for cyclists, pedestrians and children, (4) traffic unsafety, and (5) reduced quality of life in cities due to traffic noise and odour annoyance. Scores could vary from 1 'not at all concerned' to 5 'very concerned'. The mean score on the 5 items was computed (Cronbach's $\alpha = .77$). The resulting scores on the variable 'problem awareness' could vary from 1 'low' to 5 'high'.

Legitimacy of transport policies

Respondents indicated to what extent they agreed with the following two items 'Everyone should be free to use their car whenever they want' and 'The government has the right to reduce car use to safeguard environmental qualities and the urban quality of life'. In both cases, scores could vary from 1 'totally disagree' to 5 'totally agree'.

Car use

Respondents were asked how many kilometres they travel by car in comparison to other modes of transport, like public transport, bicycle or walking. Subjective judgements were given on a 7 points Likert scale, ranging from 1 'almost always by car and almost never by public transport' to 7 'almost always by other transport modes and almost never by car' (see Table 1). To examine differences in perceptions and preferences between frequent and infrequent car users, the following three groups were distinguished: respondents who often or always travel by car (38%), respondents who use their car as well as other modes of transport (37%) and respondents who often or always use other modes of transport (24%).

 Insert Table 1 about here

3. Results

3.1. Who are likely to travel by car?

Several differences in travel behaviour were found between socio-demographic groups. Higher income groups relatively more often travel by car than lower income groups do (lowest income quartile: $\underline{M} = 4.1$; income quartile 2: $\underline{M} = 3.6$; income quartile 3: $\underline{M} = 3.4$; highest income quartile: $\underline{M} = 3.1$): $\underline{F}(3, 1750) = 19.59$, $p < .001$. Women relatively more often use other modes of transport ($\underline{M} = 3.9$) than do men ($\underline{M} = 3.3$): $\underline{F}(1, 1801) = 41.42$, $p < .001$. Further, younger respondents more often use other modes of transport next to their car ($\underline{M} = 3.8$) than do the other age groups ($\underline{M} = 3.5$, 3.5, and 3.3, respectively). Finally, couples and families with children more often travel by car ($\underline{M} = 3.4$ for both groups) than singles do ($\underline{M} = 4.1$): $\underline{F}(2, 1757) = 20.60$, $p < .001$. These findings are in line with earlier studies on car use in the Netherlands^{8,9}.

ⁱⁱ Cronbach's α reflects the internal consistency of a scale and indicates to what extent the items included in a scale measure the same construct. Values of Cronbach's α can vary between 0 (no relationship between items) and 1 (perfect relationship between items); a Cronbach's α above .65 is generally considered to be acceptable.

3.2. Why do people drive a car?

3.2.1 Advantages of car use and use of public transport

Figure 1 clearly reveals that the car is evaluated more positively than public transport in nearly every respect. The car is especially more attractive than public transport because of its convenience, independence, flexibility, comfort, speed, reliability and because driving is perceived to be more pleasurable. The car also offers more status than public transport does. However, travelling by public transport is perceived to be safer than driving a car.

Insert Figure 1 about here

Car use is not only perceived to be more attractive than public transport to regular car users. Figure 2 reveals that even respondents who hardly drive evaluate cars as more attractive than public transport in nearly every respect. Respondents who usually not drive only think the car is less safe, less cosy and it delivers not as many varied experiences than travelling by public transport does.

Insert Figure 2 about here

A principal components analysis with varimax rotation was conducted to examine which dimensions could summarise the judgements about (un)attractive aspects of car use. Five factors had factor loadings higher than 1. These five factors accounted for 58% of the variance of the judgements on (un)attractiveness of car-use aspects and could be clearly interpreted (see Table 2). Below, only aspects having factor loading $|\gt .45|$ will be discussed to interpret the factors.

Insert Table 2 about here

Factor 1 accounted for 16% of the variance in the judgements. This factor reflects the independence and convenience of car use. Aspects loading $\gt .45$ on this factor were convenience, comfort, independence and flexibility. Factor 2 accounted for 12% of the variance in the judgements and reflects the 'fun' of car use, i.e., the aspects cosy, various experiences and pleasure had high loadings on this factor. Factor 3 also accounted for 12% of the variance. The aspect having high loadings on this factor, i.e., security, control, freedom and travel speed, refer to control and freedom. Factor 4 accounted for 10% of the variance. The aspects sexy, status and arousal loaded high on this factor, which refer to kick and status. The fifth factor accounted for 8% of the variance, and refers to the negative aspects of car use, i.e., travel costs, traffic safety and stress. Interestingly, respondents who think car use is safe and not expensive also think driving is stressful.

Based on the results of the factor analysis, five new variables were composed, by computing the factor scores on each factor. Next, it was examined whether group differences could be found in scores on these five factors. Only differences at $p < .05$ are reported. Figure 3 reveals that frequent car drivers evaluate all factors more positively than respondents who hardly drive do. Frequent car users especially evaluate the disadvantages of car use less negatively ($F(2, 1800) = 45.29, p < .001$) than infrequent car users do. Further, they think car use is more 'fun' ($F(2, 1800) = 16.97, p < .001$), and they judge more favourably about the independence ($F(2, 1800) = 7.98, p < .001$), feelings of control ($F(2, 1800) = 10.85, p < .001$) and status ($F(2, 1800) = 4.20, p < .05$) associated with car use than do infrequent car users.

 Insert Figure 3 about here

We also conducted a principal components analysis with varimax rotation to examine which dimensions could summarise the judgements about aspects related to travelling by public transport. Four factors had factor loadings higher than 1. These four factors accounted for 49% of the variance of the judgements on (un)attractiveness of aspects related to the use of public transport. Again, only aspects having factor loading $| > .45 |$ are discussed to interpret the factors (see Table 3).

 Insert Table 3 about here

The first factor reflects the independence and convenience of public transport and accounted for 17% of the variance in the judgements. Aspects loading $> .45$ on this factor were convenience, comfort, independence and freedom. Factor 2 reflects the 'fun' of public transport use, i.e., the aspects various experiences, cosy, pleasure and travel speed had high loadings on this factor. This factor accounted for 12% of the variance in the judgements. The third factor accounted for 11% of the variance and refers to freedom and control, i.e., the aspects security, freedom and control loaded high on this factor. The aspects sexy, status and traffic safety loaded high on the fourth factor, which indicates that respondents who think travelling by public transport is sexy and that public transport enhances one's status also indicate that public transport is not safe. This factor accounted for 10% of the variance and refers to status and traffic safety. The aspects arousal, stress and travel costs did not have factor loadings higher than $| > .45 |$ on any of the factors. The factor solution is to a large extent comparable to the one reported in Table 2. However, some differences were found too, indicating that factors underlying the attractiveness judgements of cars and public transport differ to some extent.

To examine group differences in the judgements on the (un)attractiveness of public transport, four new variables were composed by computing the factor scores on each factor. Figure 4 reveals that frequent car drivers judge less favourably about the independence ($F(2, 1800) = 42.53, p < .001$), fun ($F(2, 1800) = 26.23, p < .001$) and feelings of control ($F(2, 1800) = 6.53, p < .001$) of public transport than infrequent car users do. No significant differences were found between frequent and infrequent car users in their judgements about the status and safety of public transport.

 Insert Figure 4 about here

3.2.2 Importance of transport, car use and the use of public transport

Figure 5 shows the mean scores on the 6 items of the scale that assessed the importance of transport, the car and public transport to society and to respondents' personal life. As expected, respondents

indicated that the car is more important to society and their personal life than public transport is. However, Figure 6 reveals that this is only true for people that regularly drive a car (in this case, the mean scores on the six items are shown). Respondents who hardly drive think public transport is more important to their lives and to society than the car is. More specifically, transport in general and travelling by car are more important to frequent car drivers, especially compared to infrequent car drivers ($F(2, 634) = 22.31, p < .001$ and $F(2, 551) = 146.38, p < .001$, respectively), while travelling by public transport is more important to infrequent car users than to frequent car users ($F(2, 609) = 59.70, p < .001$). So, the more often a particular transport mode is used, the more important this mode of transport is to the respondents.

 Insert Figure 5 and 6 about here

3.3. Who support car reduction policies?

Figure 7 reveals that frequent car users are less concerned about the problems of car use than infrequent car users are: $F(2, 1800) = 106.63, p < .001$. Moreover, frequent car users evaluate transport policies aimed at reducing car use as less legitimate ($F(2, 1800) = 104.05, p < .001$), while they more strongly believe everyone should be free to use a car whenever they want ($F(2, 1800) = 132.92, p < .001$) compared to infrequent car users.

 Insert Figure 7 about here

Problem awareness is related to the perceived legitimacy of car use restriction policies. The higher people's problem awareness, the more strongly respondents believe that the government has the right to reduce car use to safeguard environmental qualities and the urban quality of life ($r = .43$) and the less strongly they believe that everyone should be free to use their car whenever they want ($r = -.37$).

4. Conclusion

This paper described who drive frequently and why they do so. Further, we explored who may be open to travel by public transport more frequently, and how the use of public transport may be facilitate and stimulated.

Women, younger people, low-income groups and singles use their car relatively less often than men, older age groups, higher income groups and couples and families. Car use was evaluated much more positively than public transport (except for traffic safety), even in the densely populated Netherlands, where public transport is widely available. Notably, respondents evaluated almost all car use aspects positively, although the car use is perceived to be expensive and not sexy. In contrast, the judgements of the public transport aspects are generally negative or neutral, aside from traffic safety. Strikingly, even respondents who hardly drive evaluated car use more positively than travelling by public transport in nearly every respect.

So car use indeed has many individual advantages compared to public transport. Considering only individual interests, it appears that public transport can hardly compete with the car. However, this does not imply that people cannot be persuaded to travel by public transport more often instead of driving. People may choose to do so out of collective interests, e.g., to safeguard environmental qualities and urban quality of life. Results of this study indicate indeed that respondents who are concerned about the problems caused by car use evaluate policies aimed at reducing car use as more legitimate, while respondents who are less concerned about these problems more strongly think that

the individual freedom to move should not be restricted. Problem awareness was also higher among people who use their car selectively compared to frequent car users. Furthermore, this study focused on the attractiveness of cars and public transport in general. It may well be that in specific situations travelling by public transport is more attractive compared to driving, e.g., the train might be preferred above the car for long distance travel between cities. This suggests that policy makers should not aim at banning people from cars completely, but only at stimulating people to use their car more selectively and to travel by public transport whenever possible and reasonable. Further, a distinction should be made between various types of public transport. For example, in the Netherlands, people generally especially dislike travelling by bus, while travelling by train is evaluated far more positively⁹. So it might be easier to persuade people to travel by train more often than stimulating them to travel by bus.

It appeared that five dimensions underlie the attractiveness judgements of car use: independence and convenience, the 'fun' of car use, control and freedom, kick and status, and negative aspects of car use (i.e., travel costs, traffic unsafety and stress). Frequent car drivers judge more favourably about all these factors than those who hardly drive. Comparable dimensions underlie the judgements on the attractiveness of public transport, i.e., independence and convenience, the 'fun' of public transport, freedom and control, and status and traffic safety. Infrequent car users evaluated these factors most favourably. A Danish study also revealed that frequent car users evaluate car use positively on many different aspects, while only a minority of the respondents had strong positive feelings towards travelling by public transport or cycling¹⁰. Interestingly, especially the car appeared to be much more than a means of transport (for more than half of these Danish respondents), while cultural and psychological values are hardly connected with travelling by public transport.

These results suggest that car users do not only travel by car because they *need* to do so, but also because they *love* driving. People also prefer to drive car because of its psychological and cultural meanings^{11, 12, 13, 14, 15, 16, 17, 18}. Motorists can express themselves in the choice of their car and the way they use it and driving a car may cause feelings of control or feelings of superiority over others. Moreover, many people like to drive because they think driving is pleasurable, adventurous, and arousing. So, people also drive because they like to, and not (only) because they have a real utilitarian need for a car or a practical reason to drive¹⁹. Based on the correlational data presented here, we can not draw conclusions about the causal relationship between the attractiveness of travel modes and actual mode choices. People may drive much because they judge favourably about cars, but they may also have adjusted their opinions to their travel behaviour.

As hypothesised, car use was evaluated as being more important to respondents' personal life and to society than public transport was. However, this was only true for frequent car drivers. Respondents who hardly drive think public transport is more important to their personal life and to society than the car is. A study by Sandqvist and Kriström¹⁹ also revealed that especially frequent car users report that the car significantly contributes to their quality of life. Many policy makers think car use can not easily be reduced because car use enhances people's quality of life and fulfil important societal values. Based on the results of this study, we may conclude that this assumption is only true for frequent car users. People who hardly drive may be better off when the quality of public transport is improved and when car use is reduced. This will very likely improve their quality of life, not only because the personal and societal significance of public transport for them, but also because environmental and urban qualities will probably significantly improve in this case. Further research should address this point in more detail.

As expected, frequent car users are less concerned about the problems caused by car use than are infrequent car users. They also less strongly believe that the government has the right to reduce car use, and they more strongly value the individual freedom to drive than do infrequent car drivers. These results are in line with studies by Stradling *et al.*¹⁶ and Nilsson and Küller¹². Stradling *et al.*¹⁶ found that the more people value the freedom connected to car use, and the more strongly the car contributes to their identity, the less they are willing to reduce their car use. Nilsson and Küller¹²

reported that people who are emotionally attached to their car drive their car more often and evaluate transport policies aimed at reducing car use as less acceptable.

Stimulating public transport use appears not to be an easy task, because public transport seems to be perceived as a poor alternative for car use. Especially fervent car users dislike public transport. For them, the car outperforms public transport on various aspects. They think the car is much more than just a means of transport. It also represents cultural and psychological values, e.g. the car is a symbol of freedom and independence, a status symbol and driving is pleasurable. So, for fervent car users, car use is connected with various important values in modern society. This may be one of the main reasons why they (more) strongly oppose policies aimed at reducing car use.

Infrequent car users judge somewhat less positively about the car and less negatively about public transport. Consequently, they may be open to use public transport more regularly, especially if they also consider the many problems caused by massive car use. However, since they already use their car selectively, they may not be able to reduce their car use (even) more. Many efforts are needed to stimulate fervent car use to travel by public transport, because in their view, public transport can surely not compete with their private car. In this case, policies should be aimed at reducing the functional, psychological and cultural values of private cars, as well as at increasing the performances of public transport (and other alternative modes of transport) on these aspects. Next, they should consider the problems of car use when making travel mode choices.

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Table 1. Degree of car use

	% respondents
Almost always by car and almost never by other transport modes	17
Most frequently by car, but sometimes by other transport modes	21
Mostly by car, but regularly by other transport modes	21
As much by car as by other transport modes	5
Mostly by other transport modes, but regularly by car	11
Most frequently by other transport modes, but sometimes by car	12
Almost never by car and almost always by other transport modes	12

Table 2. Rotated factor loadings of judgements on (un)attractiveness of car use

	Convenience, independence	Affect, pleasure	Control, freedom	Kick, status	No disadvantages
Convenience	.88				
Comfort	.84				
Independence	.78				
Flexibility	.69				
Various experiences		.79			
Cosy		.79			
Pleasure		.67			
Security			.75		
Control			.66		
Freedom			.63		
Travel speed			.54		
Sexy				.78	
Status				.78	
Arousal				.63	
Price					.69
Traffic safety					.65
Stress					-.59

Note: only factor loadings $> .45$ are printed.

Table 3. Rotated factor loadings of judgements on (un)attractiveness of public transport

	Convenience, independence	Affect, pleasure	Control, freedom	Status, traffic safety
Convenience	.83			
Comfort	.79			
Independence	.69			
Freedom	.60			
Various experiences		.80		
Cosy		.78		
Pleasure		.65		
Travel speed		.45		
Security			.63	
Freedom			.63	
Control			.61	
Sexy				.74
Status				.63
Traffic safety				-.58

Note: Note: only factor loadings $|\gt .45|$ are printed. The aspects arousal, stress en price are not included in the Table since they did not have high factor loadings $|\gt .45|$ on any of the factors.

Figure 1

Attractiveness of car use and the use of public transport

Figure 2

Evaluation of attractiveness of car use and the use of public transport by infrequent car users

Figure 3

Differences in evaluation of car use between frequent and infrequent car users

Figure 4

Differences in evaluation of public transport use between frequent and infrequent car users

Figure 5

Importance of transport, the car and public transport to society and respondents' life

Figure 6

Differences in importance of transport, the car and public transport between frequent and infrequent car users

Figure 7

Differences in problem awareness and legitimacy of car use reduction policies between frequent and infrequent car users

Figure 1

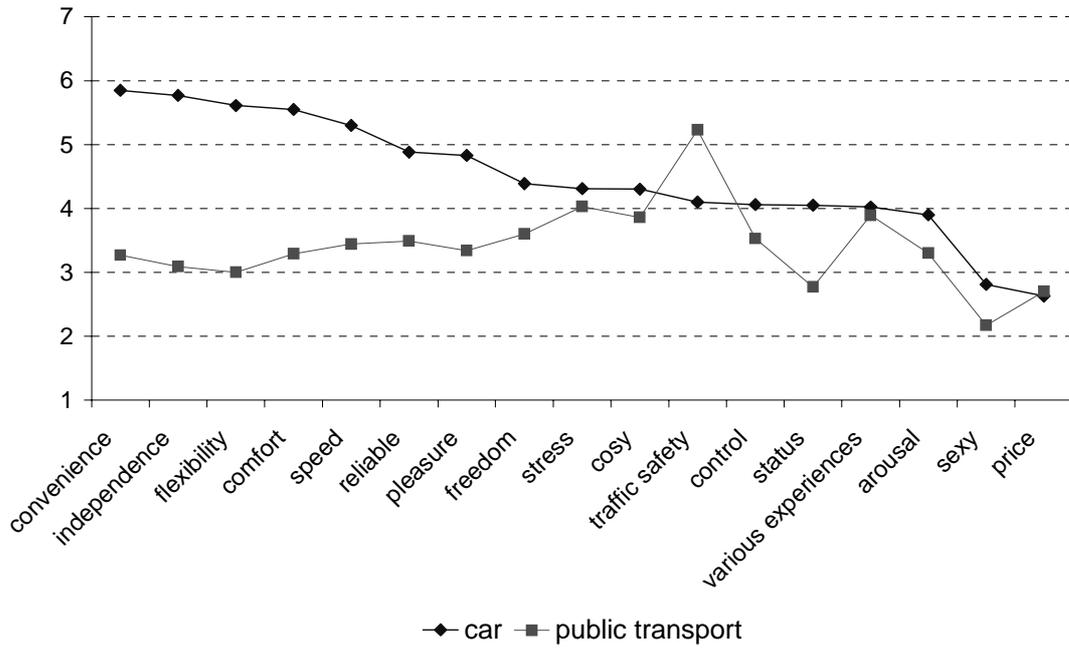


Figure 2

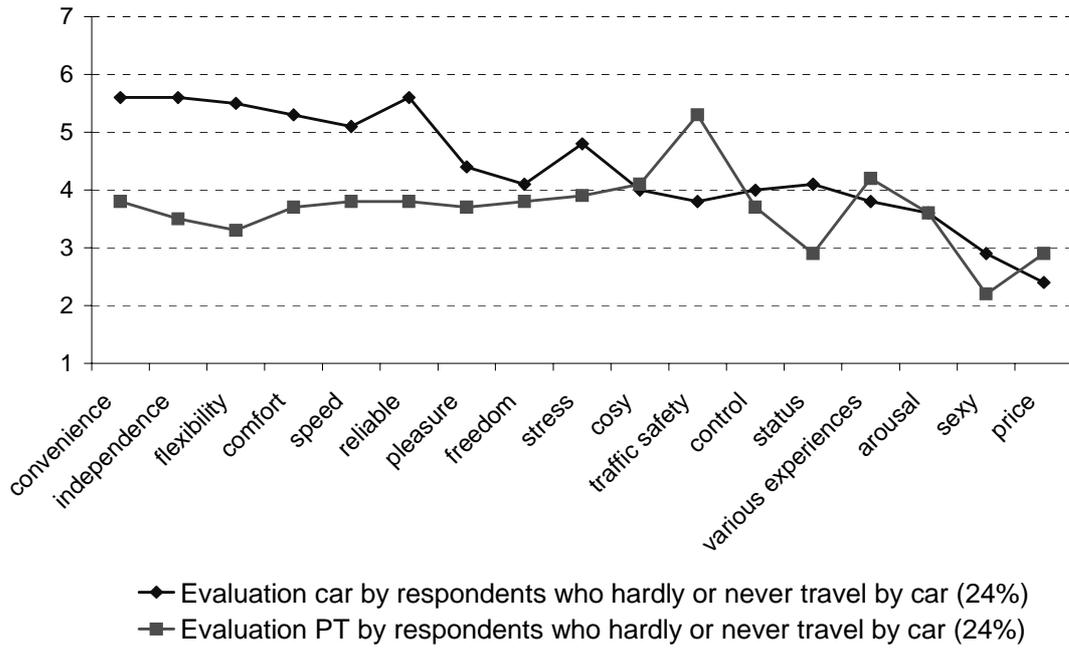


Figure 3

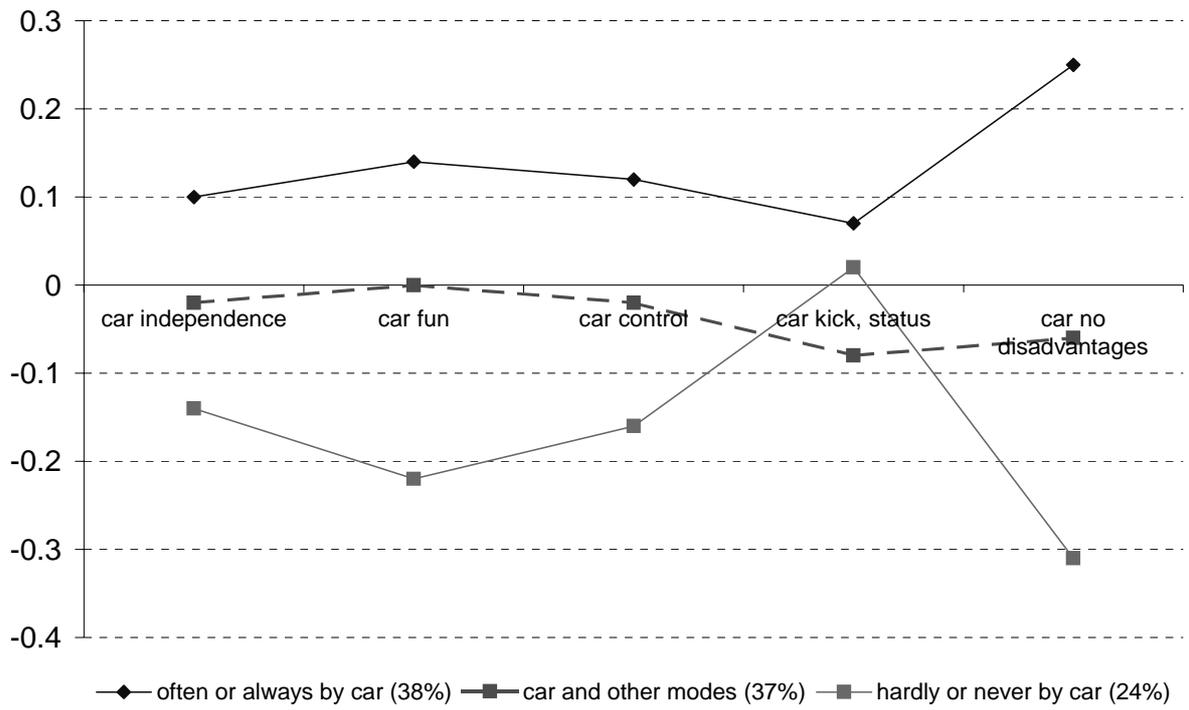


Figure 4

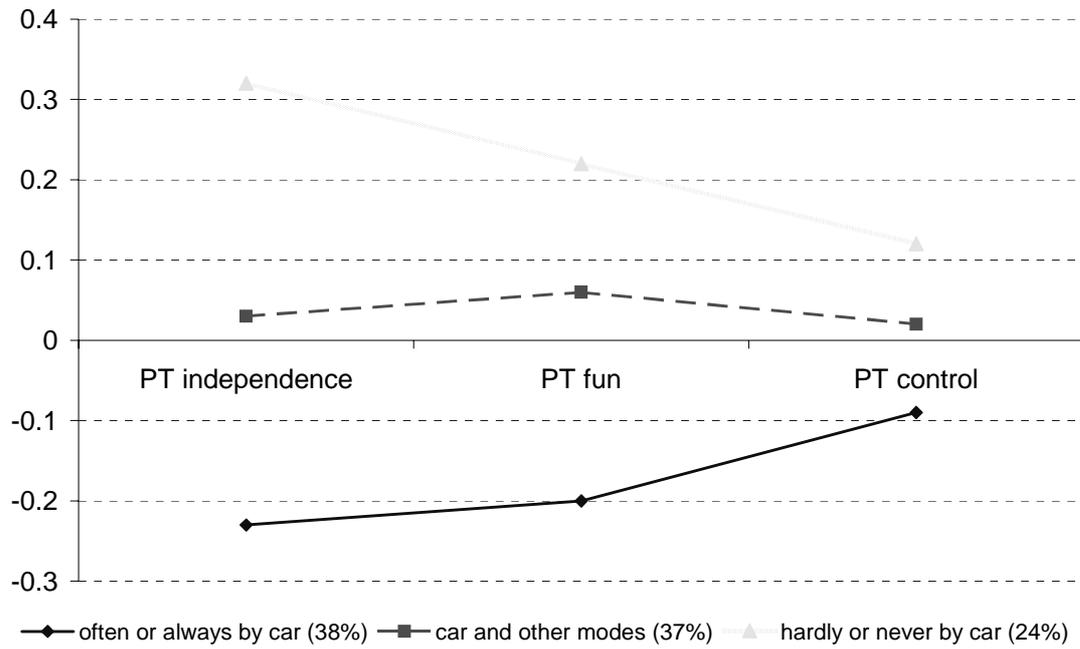


Figure 5

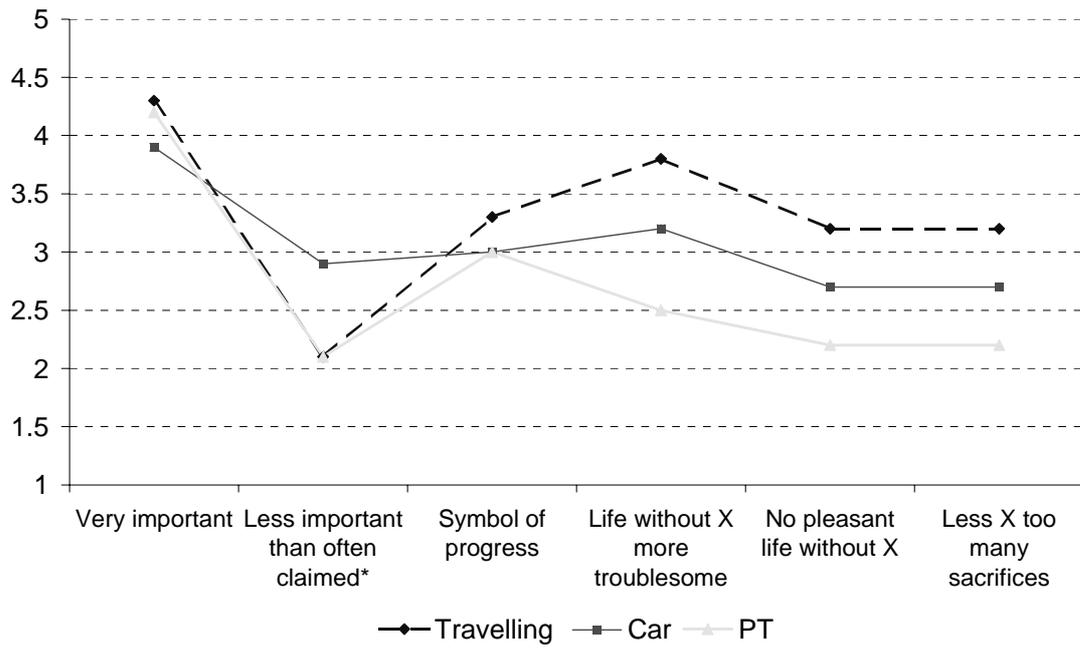


Figure 6

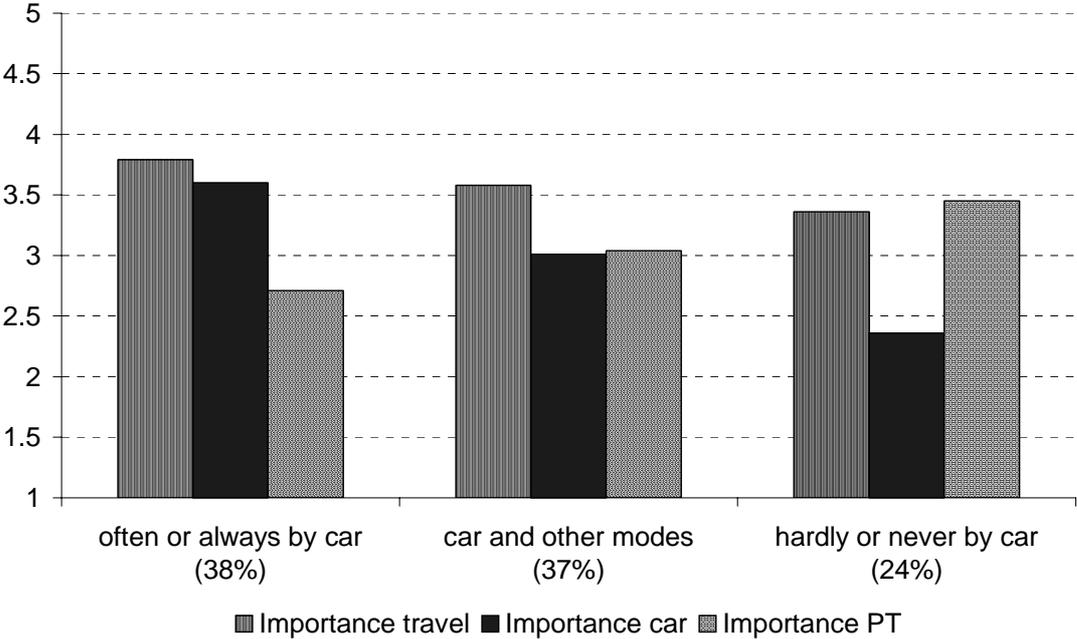


Figure 7

