



Psychological Effects of Travel Time Use

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Abstract: There is an increasing interest in understanding travel behaviour to predict the effect of a policy into the shape of transportation system. However, less attention has been given to the psychological aspect of the system that leads to travel behaviour changing. This paper overview a comprehensive research that combined psychological related research area into transportation especially travel behaviour. Specifically, this paper overview several studies on the psychological aspect of travel time with respect to the positive utility of travel time in data collection and analysis. There are three aspects of the effects discussed in this paper such as perception of time, attitudes, and value of time. The integration of the psychological research methods into transportation offers a deep understanding of travel behaviour at individual as well as aggregate level.

Keywords: *psychological influence, positive utility of travel time, travel behaviour*

1. Introduction

In psychology, there is a quotation saying that time is perceived to be shorter when having fun or time is crawling when you have fun. This has been proven by several studies such as Danckert and Allman [1], Gray and Gray [2], and O'Brien *et al.* [3]. They examined participants in two groups, one group conducting a fun task and another group conducting a boring task. The study found that those who conducted boring task perceived the elapsed time longer than those who engaged in a fun task. However, the study was conducted in a laboratory where researcher can minimise unexpected factors to influence the results. Will the results be the same if the study conducted in a real life activities such as travelling on a train?

In traditional transportation studies, travel time was considered, as a wasted time because it was perceived to have a negative or no utility therefore should be minimised. However, in some transportation modes such as train, passengers have an opportunity to conduct a more productive or enjoyable activities. Travel time was no longer a wasted time but has a positive utility or at least the negative utility is reduced. There was an expectation that the use of technologies whilst travelling would increase the potential to use of travel time for more productive and enjoyable activities such as preparing presentation file, reading and writing e-mail, browsing internet either for job or just for fun. In this case, travel time is not only perceived as a mean to reach a destination, but also a "gift time" to carry out activities that might not be able to do at a normal time [4].

The objective of this study is to explore the effect of positive utility of travel time in the psychological point of view.

This paper contributes significantly in incorporating the psychological influence of positive utility of travel time from several studies in terms of time perception,

attitude and behaviour in one paper. This contribution is important in order to obtain deep understanding of the potential impact of the improvement of on-board facilities of train encouraging travellers to engage in productive and enjoyable activities. Such impact has not been discussed in the reviewed literatures.

The state of the art of the travel time use is described in section 2 followed by methodology in section 3. The result of the study is presented in section 4 and discussion surround the findings and its potential impact to current train operation policy is presented in section 5. Finally, a conclusion and direction for future research is presented in section 6.

2. State of the Art of Travel Time Use Study

The positive utility of travel time has been recognised by researcher since the concept of value of travel time was introduced by Johnson [5] as one of application of the Becker's [6] theory of time. According to Johnson [5] similar to time spent on work, time spent on a work trip also has a utility to allow the possibility that the travelling is desirable. Oort [7] supported Johnson's theory that work trip does have a utility value especially when the time can be used productively or is relatively pleasant, however, in general, people prefer to reduce the time spent in travelling.

The discussion about positive utility of travel time is increasing as invention in information and communication technologies giving more opportunity for travellers to use travel time more productively. Introduction of smartphone, tablet PC, and laptop as well as Internet services allow travellers to communicate with other people in the office or doing office work whilst travelling. Mokhtarian and Salomon [8] put the idea that 'travel time is a derived demand' in a question mark, because utility of travel time also is not only activities conducted at the destination which made possible by travelling but also

activities conducted during the journey and the travelling itself.

Previously, Mokhtarian and Salomon [9] differentiated travel into utilitarian and undirected. Utilitarian travel is when people choose the shortest or the fastest route. In this case, travel is completely ancillary given the primary goal is to arrive at the required destination. On the other hand, undirected travel is when people prefer to choose a longer or faster route because they enjoy the beauty of the scenery or there are other attractions along the route. Here travel was primary and the destination was ancillary. Furthermore it is possible that these two components are of equal or with a different balance of utility.

Mokhtarian and Salomon [8] hypothesised the unobserved “desired level of mobility” exists as a subset of the “desired travel time budget” (TTB). By using the terminology “desired”, implicitly, Mokhtarian and Salomon (2001) suggested that people have a tendency to travel within their time budget, however, in reality, the travel may or may not be actually implemented. Both of these vary across individuals, and within the same individual across time. The study demonstrated that people seek to decrease their travel, only if the desired optimum was exceeded, conversely people seek to increase travel to reach their ideal. Therefore, instead of considering travel time as a cost, it is suggested that people tend to reach the amount of travel that is considered “ideal” [8].

Lyons and Urry [10] criticised the value of time (VOT) theory that assumed travel time is unproductive time, because in this information age, several activities can be conducted whilst travelling including doing office work on computer, online shopping or enjoying online movies. Lyons and Urry [10] suggested that the use of value of travel time savings (VTTS) in assessing an investment in transportation might over estimate of its benefit. Similarly, Metz [11] regards travel time saving as a myth because individuals have travel time budget and the time saved from a travel time would be used for other travel or to travel longer.

Based on data collected in 2004, Lyons *et al.* [12] presented a new evidence of travel time use in the UK which showing that most of travellers used their travel time for more productive and enjoyable activities. Similar study was conducted in 2010 and revealed that the proportion of people in term of activities conducted whilst travelling were consistent between the 2004 and 2010 data (Lyons *et al.*, 2013). In Netherland, Ettema and Verschuren [13] conducting a study about the effect of multitasking ability to the value of travel time savings revealed some activities that often performed by travellers on public transport are reading for leisure (80%), reading for work (67%) and window gazing (60%).

Lyons *et al.* [14] found that the numbers of passengers equipped with electronic devices in 2010 was higher than in 2004, whilst on the contrary, those who were equipped with a newspaper in 2010 was lower than in 2004. However, those who were equipped with electronic devices may not been used them whilst travelling. For example, a laptop; despite the proportion of those who use one whilst travelling increasing by 70% in 2010, only one third of those who were equipped with one, reported using it. It is arguable that the situation on the train such as enough space or time to use it, determined whether the equipment could be used or not.

Those studies ([12]; [13] and [14]) were based on a self-completion questionnaire data which potentially to bias as respondents might not remember their activities during their last journey.

Yosritzal *et al.* [15] carried out a study by interviewing rail passengers during their journey on East Coast Mainline train travelling between Newcastle and London. In the study, the activities were differentiated into 3 groups i.e. electronic based (EB), non-electronic based (NEB) and personal engagement (PE). Electronic based activities are activities that are conducted using one or more electronic devices such as a laptop, a mobile phone, and/or a multimedia player. Non-electronic based activities are the activities that require an interaction with other passengers or a non-electronic device such as using a pen and paper, reading a book/magazine/newspaper, chatting with other passengers, and eating or drinking. Personal engagement activities are those that can be conducted without involving other passengers or any devices. Such activities include enjoying the view, sleeping and thinking. Being bored or anxious is included in personal engagements activities as well.

Similar to Lyons *et al.* [14], the study found that most of travellers reported that their main activities whilst travelling were reading a printed book/newspaper/magazine (41.7%) followed by enjoying the view outside the window (8.6). In terms of main activity, it is interesting to find that more than a half of respondents were confessed that they were engaged in non-electronic based activities, about one third in electronic based activities and one five in personal engagement activities as shown in Table 1.

Table 1 Activities of Rail Passengers whilst travelling

No	Activity	Do (%)	Main Activity (%)
Electronic based activities (EB)			
1	Working on computer	17.7	6.0
2	Reading/Writing e-mails	43.2	6.8
3	Logging onto the internet for work related purposes	18.0	0.0
4	Browsing internet for leisure	21.4	0.8

5	Accessing social network website	16.9	0.4
6	Text messaging/making phone calls	66.5	6.0
7	Listening to Radio/Music	18.8	5.3
8	Watching a film/Video	5.6	1.5
9	Playing digital games	5.3	0.3
10	Reading e-book	4.1	1.9
Non-electronic based activities (NEB)			
11	Pen and paper work	24.4	1.9
12	Studying	5.3	0.8
13	Reading printed book/magazine/newspaper for leisure	69.2	41.7
14	Playing non-digital games	3.0	0.8
15	Chatting with other passengers	21.8	5.3
16	Eating and/or drinking	63.9	0.8
17	Entertaining children	3.4	0.3
Personal engagement activities (PE)			
18	Enjoying the view	59.0	8.6
19	Thinking	62.8	6.0
20	Sleeping	24.8	1.9
21	Being bored or anxious	7.1	0.3
22	Other ^y	2.6	2.6
Total Respondent		100.0	

Source: Yosritzal *et al.* [15]

3. Methodology

Critical review was used in order to obtain a deeper understanding on how the activities conducted whilst travelling, psychologically influence the time perception, attitude, and behaviour of travellers. First of all, the effect of positive utility divided into three areas such as time perception, attitude and behaviour. For each area, available studies were evaluated in terms of methodology used and findings. A comparison between studies was conducted to clarify their advantages and the disadvantages. Finally, comprehensive conclusions were made and the consequences of the findings were predicted.

4. Results

During this study, it was difficult to find travel time use studies in literatures. Travel time use study became popular when Lyons and Urry [10] challenged UK government transport investment policy. However, this study managed to explore the three effect of positive utility of travel time psychologically which are presented in sub-section 4.1 to 4.3.

4.1. The Effect of Positive Utility of Travel Time to the Perception of Time

As mention earlier in section 1, psychology revealed that time is felt shorter than the actual when having fun and longer when being bored. Will this theory applicable in transportation? Evidence has proven that

travel time has been used productively by most of rail passengers ([12], [13], [14], [15]). The productive use of travel time was expected to make travel time more enjoyable, will the travel time be perceived shorter than actual?

Before the widespread ownership of personal electronic devices, possible activities that can be conducted whilst travelling were limited to a non-electronic based activities such as reading a printed material (such as book, magazine or newspaper), chatting with other passengers and enjoying the view. Wilson [16] revealed that at the time, travel time was perceived to be higher than actual by rail passengers.

The study was conducted by adopting psychological research method by asking travellers to estimate the elapsed time spent on train from their origin station until they were interviewed. However, the study was conducted in a local train that might have a different characteristic from an intercity journey.

Taking sample from both long and short journey rail passengers, Lyons *et al.* [13] found that travel time seems to pass more quickly when engaging in electronic based activities. This result seems to support the expectation that the use of such technologies makes travel time more enjoyable and more productive therefore the elapsed time felt shorter than it actually was. However, a direct comparison between those studies cannot be conducted because the methods used were different. While Wilson [16] asked respondents to estimate the elapsed time during a face-to-face interview on train travelling between Newcastle and Hexham, Lyons *et al.* [13] collected their data qualitatively by distributing a self-completion questionnaire at several major railway stations in the UK.

In contrast, Yosritzal *et al.* [15] found that travel time is perceived to be higher than actual when engaging in electronic based (EB) activity. Those who engaged in non-electronic based (NEB) activity perceived travel time shorter than actual whilst those who engaged in personal engagement (PE) activities perceived travel time equal to the actual [15].

This finding is different from previous study by Lyons *et al.* [12]. Travel time passes more quickly than the actual time when respondents interacted with other passengers or read magazines, newspapers and books. Travellers who were working on the computer or other electronic devices perceived travel time higher than the actual, and those who were enjoying the view whilst travelling, perceived travel time as equal to the actual. However due to disaggregation of data into three groups, it was evident that the statistics of significance was much lower and the density of points about regression was much less. Outliers (outside three standard deviations of the mean) suggested that there was a possible structure in the clustering of the data which required further investigation.

4.2. The Effect of Positive Utility of Travel Time to Attitude

One of the advantages of travelling by rail is that the passengers have an opportunity to carry out productive and enjoyable activities. It was proven by evidence that only very little less than 5% of passengers getting bored during rail journey as found in [12]; [14] and [15].

Regarding attitude to travel (of those that enjoy travelling), Mokhtarian and Solomon [8] found that more than 80% of respondents agree with the statement: “*It is nice to be able to do errands on the way to or from work.*” Only about 15% agreed with the statement: “*The only good thing about travelling is arriving at your destination.*” Surprisingly, the study found that nearly equal proportion between those who agree, neutral and disagree with the statement: “*I use my commute time productively.*” It is arguable that the finding is bias as the study did not consider the advantages of one mode over another such as the convenience to conduct a productive activity whilst travelling on a train compared to on a bus. However, the study provided evidence that the intrinsic utility for travel was existed and was recognised by a large portion of travellers.

Lyons *et al.* [12] found that those business travellers were more likely to bring equipment that helps them to do productive work during the journey. Those who prepared their journey with the equipment were more likely to perceive their travel time “worthwhile” than those who were not prepared. However, being prepared with equipment does not guarantee the equipment will be used. Lyons *et al.* [12] found that about 65% of individuals taking laptop with them do not use it on train and 62% of commuters do not spend their time on paper work they have. Lyons *et al.* [12] suggested that the decision of the time use is flexible despite they prepared their journey with the equipment.

Yosritzal *et al.* [17] examine whether the perception of time represented by the ratio between perceived and actual time (RPA) correlated factor solutions extracted from factor analysis of variables such as socio-economic, main activities and attitudinal data. The correlation analyses of the factors solutions revealed that most of the factors were not correlated with the perception of time. Yosritzal *et al.* [17] reveals that there was one factor only in each model that was statistically significantly correlated with RPA namely factor 3 (technology effect) in EB, factor 4 (train comfort potential) in NEB and factor 5 (productivity) in PE model as pointed in bold number with a star symbol explaining its significance level. It is worth noting that the coefficients’ correlations are not strong enough (lower than absolute 0.50) suggesting that the correlation existed but other factors may have a stronger influence on the relationship.

The perception of time of those who engaged in EB whilst travelling is positively correlated with the agreement to the statements related to the effect of the use of technology such as acceptance for a small increase of travel time and cost as long as free Wi-Fi available on-board. It was arguable that the perception of time of those who engaged in EB was influenced by the productivity they achieved whilst travelling as discussed in Yosritzal *et al.* [15]. On the other hand, the perception of time of those who engaged in NEB is negatively correlated with the agreement to train comfort potential suggested that travel time felt shorter than actual when the train is comfortable. In contrast, the perception of time for those who engaged in PE was positively correlated with the agreement to the statements related to productivity whilst travelling suggested that they wish to engaged in a more productive work rather than just enjoying the view or thinking.

4.3. The Effect of Positive Utility of Travel Time to Value of Time

The value of time is considered as a representation of a psychological process in decision making of respondents because usually the study of value of time is based on a stated preference survey (See Hensher, [18] and Hensher *et al.*, [19]). In the survey, respondents were asked to consider the attributes values of several alternatives and choose one alternative giving the most benefit to them. The perception of each alternative and attributes are expected to influence the decision being made. As discussed earlier, the productive use of travel time challenges the assumption that travel time is unproductive and should be minimised. However, Lyons *et al.* [12] suggested that the productive use of travel time might not necessary challenge the value of time theory but it might reduce it depend on the productivity of passengers during the journey.

Fickling *et al.* [20] conducted a special study which commissioned by Department for Transport, UK, to estimate the VOT with regards to the positive utility of travel time. The study found that the VOT is reduced up to 50% of the previously calculated benefit of time saving from the business sector. Fickling *et al.* [20] noted that marginal reduction in travel time less than 20 minutes are not worth for more productive time at work. One of importance result from Fickling *et al.* [20] is that in calculation of monetary benefit of time saving should also consider welfare benefits beside its financial consequence. This was supported by Russell [21] who found that travel time use is one of welfare benefit of travelling.

Back to the effect of the productive use of travel time to VOT, Ettema and Verschuren [13] found that individuals who do not like multitasking and regard deadline as strict, have a higher VOT. Those who applied multitasking to make travel time more comfortable have a lower VOT. However, when

several tasks were conducted simultaneously in order to get it done, the VOT of the individuals was higher. With respect to travel time use, the variation of the VOT might also be influenced by other factors that were not included in this study.

In a more recent study, Yosritzal [22] examined the variation of the VOT based on passengers' main activity during the journey. Yosritzal [22] found that travel time was higher when individuals engaged mainly in EB activities followed by those who engaged in NEB and PE. As the samples were mainly business travellers who worked on a computer, the result reflected the higher VOT of them compared to those who travel for leisure rather than the influence of the use of electronic devices.

5. Discussion

The psychological effect of positive utility of travel time has been presented in this paper including its effect on perception of travel time, attitudes and value of time. There were some contradictions found in the reviewed studies such as whether the use of technology reduces the perception of time or not. Qualitative research by Lyons *et al.* [12] confirmed that the travel time seems to pass more quickly when engaging in electronic based activity whilst a quantitative study by Yosritzal *et al.* [15] found the opposite. The methods of the study may play a role in the difference where in the qualitative study respondents answered the question based on the experience not at the time when the survey was carried out and in the quantitative study, the answer was based on the actual experience of passengers at the time of the survey. In answering the quantitative study, passengers have an opportunity to compare their feeling when engaging in EB activities and other activities, whilst in the quantitative study, passengers made an estimation of the elapsed time without any comparison. It was the researcher who made a comparison between the estimated time and the recorded actual time. It was suggested that passengers made estimation based on the productivity achieved because they do not have any other clue on the elapsed time.

In terms of its effect on the attitudes and value of time, all studies found that even though travellers have an opportunity to work whilst travelling, reduction of travel time is still demanded. This is a strong indication that the activity whilst travelling is less priority compared to the activity that can be conducted at the destination. However, it was also indicated that the activities whilst travelling have a positive impact for wellbeing. Therefore, instead of accepting travel time saving and rejecting travel time use or vice versa, accepting travel time use and rejecting travel time saving, it is better to consider both as travel time benefit at a particular limit.

As both, shorter journey and possibility to use travel time more productively, demanded by passengers, it is

more convenient if policy makers put them together in considering an investment benefit in the future. Therefore, not only how to arrive at the destination is important, but also how the quality of time spent on-board is increased. This policy is expected to make public transport more attractive than private car, which in turn reduces the traffic congestion.

It should be noted that many people can do more than one activity in the same time or conduct one activity after another during the same journey. Instead of the main activity alone, supporting activities may also have influence on the psychological of the passengers. However, such data were not available in the reviewed literatures therefore cannot be explored further.

6. Conclusions and Future Research

The effects of travel time use in psychological terms have been explored in this study. Such effects were predicted to influence further on how people react to the implementation of particular policy in transport. Therefore, any policy maker should consider the psychological effects in their policy so that the objective of the policy will be achieved. For example, it is important to invest in equipment to support electronic based activities on a delay prone transportation system because research found that travel time is more enjoyable when engaging in electronic based activities so that people would be more able to accept any delay or longer journey than it should be. Moreover, given that providing facilities to support positive utility of travel time on train could reduce the wasted time, it is expected that people will be more encouraged to use train rather than other transport modes.

Further research would be to investigate quantitative and qualitative impacts of travel time use to the estimation of benefit of transport investment. The main question is which one is better, to provide a higher speed train to reduce travel time or to provide more equipment on-board to support positive utility. However, it is also possible to optimise the benefit by reducing travel time and providing more facilities on-board. There should be criteria for each policy and this will be the objective of the future research.

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