De invloed van tele-/thuiswerk op het activiteitenpatroon en het verplaatsingsgedrag. Van synchronisatie naar flexibilisatie.
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Summary

In this study an attempt is made to answer the question whether and to what degree tele-/homework can contribute to reducing traffic congestion and the problems associated with it. In our present-day society, the problems that arise from growing mobility are increasing steadily. Problems such as traffic congestion have become a daily reality and this applies equally to the consequence for human, society and environment.

In Chapter 1 spatial mobility, i.e. travel needs, travel possibilities and travel behaviour is discussed. The causes and consequence of travel and the possibilities of influencing travel mode choice with push and pull measures are discussed in detail. Traffic congestion, defined as a too high concentration of vehicles on specific times and specific road sections, is considered to be due to the fact that many of our daily activities are fixed in time and space. The activity work determines to a large extent our activity patterns and as a consequence our travel behaviour. Mobility is normally not a goal in itself but an activity that is by necessity the consequence of the fact that another activity cannot, or can only partly, be realised at every location. That the car in commuter traffic is usually preferred above other transport modes has to be attributed to the fact that the car is fast, comfortable, private and relatively cheap. Moreover, the advantages and disadvantages of the different travel modes are hardly considered in travel mode choice. This is in part due to the lack of information about the different alternatives and in part due to the impossibility to weighing all (known) advantages and disadvantages of car usage. Travel behaviour is, as a result, mostly habitual and repetitive.

Commuter travel is more than business and social-recreation travel determined in space and time. Of all travel categories, this makes it easiest to change and, as a consequence, tele-/homework may be more successful than other measures used by the government to reduce car usage during hours of congestion, in particular because this measure attacks the problem at its core.

Chapter 2 focuses on tele-/homework as a possible measure to reduce congestion. Amongst others, the reasons of tele-/homework are discussed, as well as the effects of this form of work for government, employers and employees. Tele-/homework is increasingly considered as an effective measure to solve numerous individual, company and societal problems, which are in part the result of work activities and the resulting mobility. This includes travel time and costs, overhead costs, employment and air-pollution. Present-day tele-/homework can be described as a form of work in which work is carried out at a distance from the employer for one or more half-day periods per week and in which the tele-/homeworker is or is not continuously on-line connected to the traditional office. Tele-/homeworking involves a total or partial substitution of the traditional working place by a working place situated closer to home or in the own home. Tele-/homeworking can reduce the limitations posed by time and space on human action. For example, the necessity to perform a certain activity, the time at which the activity is performed or the place of action can be changed. This may result in activity patterns that
can be realised more easily and flexibly, which can affect the nature, amount and intensity of travel behaviour. As a consequence of tele-/homeworking, a number of trips, in particular the work-related trips, will be shifted in time or will even be abolished altogether. However, it is possible that others replace these trips.

In chapter 3, the social acceptance of tele-/homeworking is discussed. The main question in this chapter is whether car commuters who regularly face congestion are more favourable towards tele-/homeworking than those who are never or seldomly facing congestion. The model of reasoned action by Fishbein and Ajzen (1975) was used to study the attitudes towards tele-/homeworking and the factors that affect these. It was investigated whether and to what degree tele-/homeworking is accepted as form of labour, to what degree the intention to start with tele-/homeworking is related to attitude and subjective norm and which external factors play a role in this.

In the study, questionnaires were distributed amongst 936 car drivers: 436 found travelling on the A10 (Amsterdam) and 500 on the A28 (Groningen).

**Question 1**

*How and to what extent do car commuters consider tele-/homeworking as a solution for the present congestion problem?*

Measures of a positive, stimulating nature and measures that do not involve increases in taxation generally appear to be more acceptable than measures such as increases in petrol prices, car taxes, road pricing and tolling. Tele-/homeworking appears to be mentioned after improved and cheaper public transport, flexible working times and carpooling on the list of possible positive measures.

**Question 2**

*The acceptance of tele-/homeworking as congestion measure and the intention to engage in this form of labour.*

Even though tele-/homeworking is considered as one of the measures to reduce traffic congestion, this form of labour appears to be used only very seldomly. In particular, those who are highly educated and who can determine their own working times and location appear to regularly work at home during one or more days. However, the reasons why they work at home do not so much concern mobility aspects such as avoiding congestion or reducing travel costs or time but rather peace and concentration, flexibility and the possibility to carry out working activities for employer or customer at home.

Those who normally spend normally their working time at the office would in general prefer to work at home for one or more days. However, a positive attitude towards tele-/homeworking is not indicative for the intention to engage in tele-/homeworking in the foreseeable future. The reasons for this negative intention are
not related to working space or social circumstances at home, but the character of the function, the circumstances at work, and the opinions of colleagues and superiors.

**Question 3**

*Which personal and societal advantages and disadvantages are related to tele-/homeworking?*

Although the negative consequences of commuting are hardly an argument for tele-/homeworkers to work at home, they do appear to be less often caught in congestion than those who do not engage in tele-/homeworking. Regular tele-/homeworkers mention as personal advantages that they are able to work undisturbed. Those who do not engage in tele-/homeworking but are positively inclined mention a peaceful working environment, reducing mobility and travel time savings as arguments. Remarkably, non-tele-/homeworkers appear to overestimate the effects of tele-/homeworking on travel time.

**Question 4**

*Are car commuters with a relatively long home-work travel distance more inclined to engage in tele-/homeworking than those who live relatively close to their work?*

Those who have to travel long distances to work are more prepared to start tele-/homeworking than those who live close to their work. This is particularly the case for those who are presently (very) discontent about their present commuter travel. The inclination to start tele-/homeworking is somewhat greater in the Amsterdam region than in the Groningen region. This is probably due to the fact that those living in the Amsterdam region are more likely to be faced with congestion. Commuters in the Amsterdam also expect larger effects of tele-/homeworking as congestion measure than those in the Groningen region.

**Question 5**

*Is tele-/homeworking expected to result in changes in working times and thus, in changes in the activity pattern?*

The usual working times of tele-/homeworkers when working at home hardly differ from the desired working times of non-tele-/homeworkers. However, the travel time saved thanks to reduced commuter travel provides an opportunity to spent time on other activities. Even so, the respondents do not consider it likely that having more free time will result in these activities more flexibly being fulfilled in terms of time and space.
The central question whether car drivers who are regularly faced with congestion are more likely to accept tele-/homeworking than those who are not or hardly ever faced with congestion, cannot be answered positively on the basis of the results obtained. Commuting-related aspects hardly appear to be relevant for the intention to engage in tele-/homeworking. That work-related aspects are more important can be attributed to the conditions at work on the one hand, and to the satisfaction with respect to commuter travel, on the other.

With regard to the model of reasoned action it can be concluded that personal control plays a more important role in the prediction of the intention than the components attitude and subjective norm.

In chapter 4, the time use and travel study, the most important theories and models that are used in traffic sciences to explain or predict travel behaviour are discussed. The detailed activity models are given a central place.

In contrast to the aggregated and disaggregated models in which a trip-based approach is followed and a trip is considered as an unrelated, independent activity, in the activity-based approach a trip is considered as a side activity derived from another main activity. Individual travel behaviour is in the activity-based approach placed in a broad context which is characterised by numerous limitations: capability, coupling and authority constraints.

Mapping the travel behaviour with the use of diaries - as research has indicated - appears to produce an acceptable approximation of the reality as respondents are better capable to reproduce trips if these are related to activities. Reliability and validity are important arguments to use this research method for travel behaviour studies.

The problem, design and operationalisation of the second large-scale study investigating the effect of tele-/homeworking on the activity patterns and thus on travel behaviour is described in chapter 5.

The central research question in this study was: 'In which way and to what degree does tele-/homeworking influence the activity pattern and as a consequence, travel behaviour; does tele-/homeworking result in changes in activity patterns and travel behaviour in time and space?' In short, does a change in the participation in the labour process resulting from tele-/homeworking lead to a change in the temporal-spatial behaviour and if so what are these in term of time, duration and location of the activities.

This central problem is translated into three research questions, i.e.: 'What is the effect of tele-/homeworking on the activity pattern?', 'What is the effect of tele-/homeworking on travel behaviour?' and 'Is the reduction in commuter travel as a consequence of tele-/homeworking compensated by other mobility-generating activities, and if so, in which way and to what degree?'

Since these questions require data of superior quality, both a time-use study and a questionnaire survey was carried out amongst tele-/homeworkers and non-tele-/home-workers and a travel behaviour study amongst the partners of the participants of the survey. In both studies a repeated measurements design was used. The participants in the
time-use study and the participants in the travel behaviour study had to record their activities or trips in an activity or trip diary during three non-consecutive weeks ranging from Monday 0.00 hours till Sunday 24.00 hours.

The study was not limited to the physical trips or actual behaviour, it also considered the personal characteristics and the social context in which the participants operated.

In total, 90 non-tele-/homeworkers and 119 tele-/homeworkers, working with two different employers (Digital and the University of Groningen [RUG]) participated in the study. The number of partners that collaborated in the study was 141.

In chapter 6 the results of the questionnaire survey are presented. It can be concluded that, independent of the employer, tele-/homeworkers generally have a higher level of education than their non-tele-/homeworking colleagues. Age differences are dependent on the sample. The tele-/homeworkers at Digital are older than their non-tele-/homeworking colleagues, while the opposite is true for the RUG employees.

The results further show that non-tele-/homeworkers consider the increase in car mobility to be more of a problem than do tele-/homeworkers. This is possibly due to the fact that tele-/homeworking allows the possibility to work and travel at other than the usual times. Non-tele-/homeworkers are more appreciative of government measures that would reduce car usage. If the different possible measures are considered, negative sanctions such as increasing petrol prices and road taxes are again the least popular.

Tele-/homeworking is mentioned as the most effective measure, followed by improved public transport, carpooling and increasing petrol taxes. That tele-/homeworking is considered to be the most effective measure is particularly due to the respondents employed at Digital and can be explained by the fact that in this company tele-/homeworking is part of the secondary labour conditions with clear advantages for both employer and employees. The fact that tele-/homeworkers have higher expectations of tele-/homeworking as a measure to reduce congestion can be attributed to the fact that these respondents already have experience in tele-/homeworking for one or more days per week and thus are better able to estimate the effects of this measure.

Remarkably, peace/concentration appears a more important reason to start tele-/homeworking than saving in commuting time or costs. That peace and concentration are most often mentioned by both tele-/homeworkers and non-tele-/homeworkers is related to the conditions at the office. Respondents report often being disturbed at work which leads to reduced concentration and productivity.

The fact that commuter related aspects are less important is also apparent from the maximum acceptable travel distance and the related travel time. The results concerning commuter travel indicate that non-tele-/homeworkers not only accept a considerably larger travel distance but also are willing to spend much more time on commuter travel. This is due to the fact that tele-/homeworkers live at a relatively longer distance from their regular working place and the maximum acceptable travel time and distance already has been reached for this group.

Although comparison between non-tele-/homeworkers and tele-/homeworkers both at Digital and RUG do not reveal significant differences in terms of business trips, tele-/homeworkers undertake more business travel than their non-tele-/homeworking colleagues.
If we consider the business trips of the Digital employees who have a company car at their disposal, tele-/homeworking appears associated with a lower number of commuter travel kilometres and a higher number of kilometres for business purposes. If we compare non-tele-/homeworkers and tele-/homeworking in terms of the third category of trips, social-recreational trips, tele-/homeworkers appear to travel 23% more kilometres by car for holiday-related travel than do non-tele-/homeworkers.

The differences found between non-tele-/homeworkers and tele-/homeworkers can be mainly attributed to car possession and usage. On the whole, this also applies for the differences between the Digital and RUG employees. If only those employees are considered who regularly travel to work by car, the differences in opinions between non-tele-/homeworkers and tele-/homeworkers and those between Digital and RUG employees are next to negligible.

That for participants at both employers there mostly are no significant differences between tele- and non-tele-/homeworkers is partly due to the company cultures which are dominated by norms and values which in their turn can be explained in terms of car possession, car usage and social context. Travel mode choice is not only determined by the function, the company culture and the commuter distance, but also by habitual behaviour. The daily delay in one or more traffic jams mostly does not play a role in the decision in travel mode choice for commuter travel. Habit formation can be regarded as one of the most important, if not the most important cause for repeated, in time fixed participation in commuter travel with the same transport mode, the car.

Chapter 7 contains the results of the time-use study and the travel survey. In relation to the main question concerning the possible effects of tele-/homeworking on the activity patterns and the travel behaviour, a number of hypotheses were formulated. The analyses of the diary data are limited to those respondents who participated in all three measurement periods and spent 36 or more hours per week on the activity 'paid labour'. This implies that the total sample contained 167 persons, 80 non-tele-/homeworkers and 87 tele-/homeworkers. The travel survey analyses were limited to those cases in which the respondents and their partners participated in all three measurement periods. This resulted in a total number of 114 persons, 52 of these belong to the category 'partner non-tele-/homeworker' and 62 to 'partner tele-/homeworker'.

Question 1
What is the effect of tele-/homeworking on the activity pattern?

Analysis of the diary data reveals that non-tele-/homeworkers and tele-/homeworkers differ substantially in terms of their activity pattern, in particular during office hours. Tele-/homeworking not only affects the order of the activity sequences, it also affects the location of the activities and the time spent at these locations. With tele-/homeworkers, activities are less often preceded by a work-related trip. There is also a clear difference in the time spent at the home location and the work location during
office hours. Considering these results we can postulate that the temporal and spatial constraints posed on the activities are reduced by tele-/homeworking. The **first hypothesis** namely that non-tele-/homeworkers and tele-/homeworkers differ in terms of order, time and location of activities is therefore not rejected. 

The **second hypothesis**, which assumes that as a result of tele-/homework the average amount of time spent on a single socio-recreactive activity is reduced, has to be rejected. This is not only because there are no significant differences between tele-/homeworkers and non-tele-/homeworkers but also because at Digital the differences are in the opposite directions. Apparently, the duration of the activity is not so much determined by tele-/homeworking as by the type of employer. The **third hypothesis**, postulating that tele-/homeworking results in more outdoor social activities, has to be rejected as no significant differences were found in this respect.

**Question 2**

*What is the effect of tele-/homeworking on travel behaviour?*

The **fourth hypothesis** postulates that as a consequence of tele-/homeworking commuter travel changes in that the number of commuter trips and the amount travelled is reduced. If we interpret the hypothesis such that as a consequence of tele-/homeworking the total number of commuter trips is reduced, the hypothesis is not rejected. However, if we consider the total number of work-related trips, the hypothesis is rejected, as there are no significant differences found between tele-/homeworkers and non-tele-/homeworkers. The fact that tele-/homeworkers and non-tele-/homeworkers do not differ in terms of time and distance travelled is attributable to the differences in work-home distance between the two groups. However, since the distance and time travelled is related to the number of times that respondents have to travel for work-related purposes, the two hypotheses can be accepted. In general we can postulate that as a consequence of tele-/homeworking the number of direct commuter trips and the related time and distance is reduced. The **fifth hypothesis** has to be rejected. The expectation that as a consequence of tele-/homeworking the non-work-related trips change in terms of an increase in number of trips, and the total amount and time travelled, is not supported. However, this is dependent on the measurement period. Tele-/homeworking has an effect on the total amount of time spent, in particular if the week is considered in total. With improving weather conditions, non-tele-/homeworkers spent more time on social-recreactive travel, while this is not the case for tele-/homeworkers. The conclusion we can draw is that the total amount of time a tele-/homeworker spends on social-recreactive activities is more or less characterised by a fixed pattern in which distance and time is constant over the different measurement periods. If tele-/homeworkers realise a consistent pattern of social-recreactive trips, with non-tele-/homeworkers the maximum level in terms of time and distance is not yet reached. This applied in particular to employees at the RUG.
The sixth hypothesis postulates that as a consequence of tele-/homeworking travel mode choice is changed. Interpreting the results with regard to the travel mode car and the number of direct commuter trips, we conclude that tele-/homeworkers make less car trips than non-tele-/homeworkers. However, there are no significant differences between the groups if all work-related trips are considered. If we limit the analysis to Digital employees, there is a clear effect of tele-/homeworking in terms of a decrease in the number of car trips. That a similar effect is not found amongst the RUG employees is due to the fact that the tele-/homeworkers do not always use the car.

Considering the results, we can conclude that tele-/homework has an effect on car usage. This is not surprising considering the fact that tele-/homework reduces the number of commuter trips. It is remarkable though that this reduction is not accompanied by an increase in the number of car trips related to or arising from social-recreational activities. A substitution effect in which a decrease in the number of commuter trips is compensated by an increase in other work-related trip is also not apparent.

The hypothesis that tele-/homework affects modal split has to be rejected as, with the exception of work-related trips, no effects were found. A possible explanation is that habit and experience play an important role in mode choice.

The seventh hypothesis which postulates that tele-/homework has a negative effect on travel behaviour of the partner present, in the sense of an increase in the number of non-commuter trips, is accepted as it is found that partners of tele-/homeworkers spend considerably more time on social-recreational trips than partners of non-tele-/homeworkers. We therefore can conclude that tele-/homeworking may negatively affect the partner’s travel behaviour.

**Question 3**

*Is the partial or total reduction of commuter travel as a consequence of tele-/homeworking cancelled out by mobility generating effects and if so, in which way and to what degree?*

The eighth hypothesis, which postulates that the total number of kilometres travelled per (working) week and the related amount of travel time will not change as a consequence of tele-/homeworking cannot be rejected. Reductions in travel time as a consequence of tele-/homeworking do not lead to a reduction in mobility in term of the total distance travelled and the time spent travelling. However, if each measurement period is considered separately, there are some differences between tele- and non-tele-/homeworkers. This indicates that with improved weather conditions non-tele-/homeworkers travel longer distances and reserve more time in their daily activities for travel. With tele-/homeworkers this trend is not found but a more or less consistent pattern in terms of distance and time.

The ninth hypothesis, which states that as a consequence of tele-/homeworking the number of short-distance trips is increased, has to be rejected. Tele-/homeworkers and
non-tele-/homeworkers do not differ in terms of trips with a distance of 5 kilometres or less.
The tenth hypothesis, stating that as a consequence of tele-/homework the number of combined trips that are part of commuter travel is reduced, has to be rejected. In fact, the number of combined trips is greater for tele-/homeworkers than for non-tele-/homeworkers.
Although no specific hypothesis was formulated with respect to differences in forms of communication, it was investigated whether tele-/homeworkers more often use telephone, fax or E-mail. Even though this may seem plausible, the results show no significant differences in this respect.

In summary, we can consider tele-/homework as a measure that has positive effects and above all can contribute significantly to the reduction of car mobility and its distribution in time. It is only the degree to which this measure is realised that raises concerns about its feasibility. In this case, it is not the individual car commuter who has to adapt his behaviour but those in a leading position in the companies where tele-/homeworking is a real possibility. They have to be convinced of the fact that tele-/homeworking not only has societal advantages but can also contribute to solving company problems.
If tele-/homeworking is to be successful as congestion measure and as form of labour, both government and employer need to adopt a more flexible stance. The government has to stimulate through structured measures such as tax advantages or public information, whereas the middle management has to regulate more on the basis of output than on physical presence.
Whether tele-/homeworking will be introduced on a large scale as a form of labour is questionable in view of the gap between intention and behaviour and people still daily respond negatively to the call of the Ministry of Transport: "congestion, do something about it".