DRIVERS' EN ROUTE HANDLING OF TRAVEL PLANS

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Abstract: The paper describes a study on how drivers handle travel plans in the en route situation. The aim is to map out how factors related to the travel plan influences the decision to change plan. Behavioral data on the dynamic changes to the travel plan over the course of travel between several destinations is collected both in real world and simulated experiments. The travel plan change behavior is discussed in the light of changes in travel plan factors as parts of assumed cognitive processes that govern the evaluation of travel plans among drivers. Results point out that the evaluations that drivers do of travel plans in the en route situation are not likely to be controlled by single processes but probably several in parallel or interacting.

Keywords: Driver behavior, travel plan, en route, intelligent transportation systems

1. INTRODUCTION

This paper describes a study of drivers' handling of travel plans in the en route situation. The aim is to analyze how properties of travel plans, changing dynamically over the course of travel, influence the decision to divert from the current travel plan. It is considered that cognitive processes consider travel plan properties when evaluating the changes to the temporal feasibility of the current travel plan caused by changes in travel times and events. The primary response alternatives of change or no change are considered. Travel plan changes are important to study because they can potentially reveal what factors in real time travel planning and plan adjustment that drivers are most sensitive to. Results from the study should add to a knowledge base on which to develop ATIS borne services.

By suggesting a background of cognitive processes that govern the handling of travel plans, intuitively likely behaviors are examined in the light of data collected in two experiments covering a leisure travel scenario and a more strictly regulated "work"-like scenario. The data covers how drivers set and change their travel plans as travel progresses from fixed start and finish times.

The analysis consists of a discussion around 3 hypothetical ways that the driver handles the travel plan in the en route situation. These 3 "cognitive processes" are viewed with data from both a simulator and from a real world experiment representing leisure time and "work restricted" scenarios respectively.

The paper starts with a description of the travel plan related concepts used in the study. This is followed by descriptions of the suggested cognitive processes that form a background for analysis. Data considerations and collection work are then described in separate chapters before the concluding analysis.

2. FRAMEWORK AND CONCEPTS

2.1 A framework of typical car use

This study bases its analysis around hypothetical scenarios, which are supposed to depict normal car use. Scenarios are located on urban networks where drivers use cars for driving between 3 to 5 destinations within 1 to 5 hours. It is also assumed that a start time and a finish time make up a time frame that drivers often want all tasks to be completed within and therefore tries to respect.

2.2 Handling travel plans with several destinations

For this study a travel plan is described by a sequence of links and activities, called steps. The activities are located at certain points on a road network and the links are the roads that the drivers utilize in order to move between them. A simple hypothetical network and a linear description of the travel plan is shown in figure 1, below.

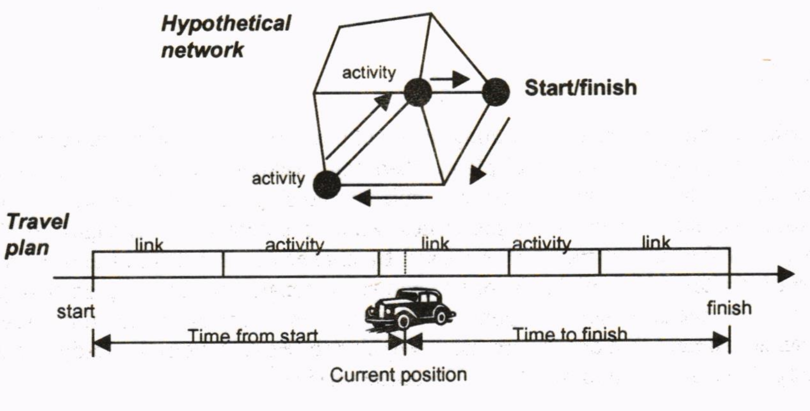

Figure 1: Network and travel plan

During travel, the original travel plan may become less attractive to the driver. For instance delays due to traffic conditions can make the travel plans too large to fit in between the current temporal position and the time limits that is set for the journey. If this occurs, the driver must at some point decide to abandon the original plan and change to a shorter one in order to be able to finish on time. This can be done by eliminating activities from the travel plan, change routes, speed up the travel or shorten activity time. (See figure 2)

When handling travel plans in this way the driver must be able to evaluate the feasibility of the travel plan in relation to the time limits set in a repeated fashion at every point of consideration. These points are here called "decision points" and are located at every connection between links and activities.

The evaluation of travel plans is not trivial since it contains calculation of several variables such as travel times on links and also activity participation times. All these variables have a uncertainty connected to them – travel times of links on a road network are likely to change after time-of-day and after traffic incidents connected to the traffic load. This work, that the driver must perform in order to understand the feasibility of a travel plan, and to form a sense of time pressure, is a cognitive process based on information from the travel plan contents and how the travel plan has developed regarding delays and other events that, in any way, change the temporal situation of the plan compared to how the driver originally intended it.

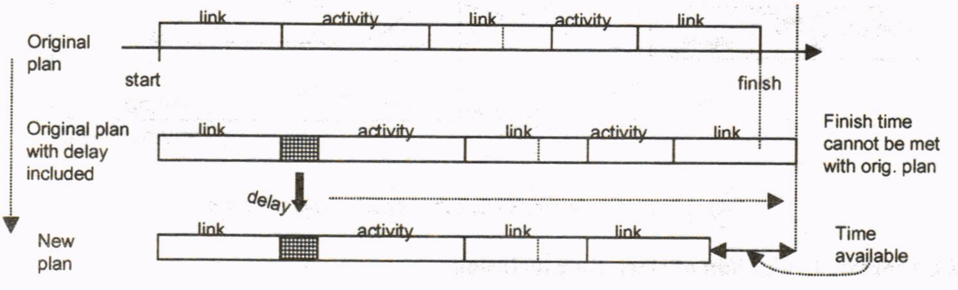

Figure 2: Elimination of activity in travel plan due to delay

Travel plan change is thought to be the result of outside stimuli influencing the constant process of updating the perception of plan feasibility "inside the head" of the driver. When travel plan change occurs, some outside stimuli has successfully influenced the process in such a way that the outcome of the evaluation changes from "good enough and possibly optimal" to "not good enough and hardly optimal". Drivers' sensitivity to different stimuli is likely to be of varying nature and this study aims to break into the field of studying the differences between them by applying simple statistic methods on behavioral data.

2.3 The cognitive processes from which time pressure is formed

It is assumed that drivers incorporate information for the outside driving environment as well as personal expectations in processes where travel plans are evaluated. These pieces of information can be described as elements in a cognitive environment, "inside the driver's head", where the driver forms a sense of to what extent a travel plan is feasible. The cognitive elements include the data that is used by the drivers and correspond to the material that needs to be collected in experiments. The cognitive processes cannot be observed directly so it is thought that by describing the input and output we can try to draw conclusions on whether the proposed configuration is likely or not. The input data can be said to be the driving environment and the output is the driver behavior (see figure 3). This study proposes three cognitive processes that relate to the feasibility of travel plans with a focus on the included step times individually or in combination. In three following sections, these cognitive processes are described and connected to behaviors that should be plausible representations of these processes in the real world that can be measured. Also, the way to measure and numerically set up analysis measures are described. So, the three cognitive processes:

1. Evaluation of the amount of slack time that the drivers think is included in the remaining travel plan in relation to the time to finish. It is here assumed that the driver holds an impression of anticipated remaining travel time formed as the sum of anticipated times for each remaining step.
2. Evaluation of the ratio between anticipated and actual times for the latest performed step in the travel.
3. Formation of a subjective measure of time pressure based on several pieces of information in the cognitive environment some of which are not possible to observe.

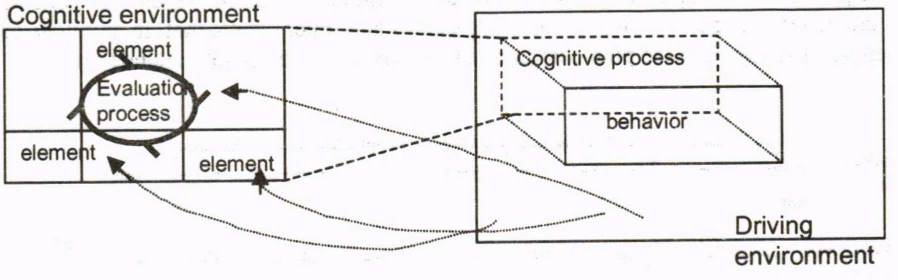

Figure 3. Cognitive processes, behavior and the environment

2.4 Process: Evaluation of slack time inclusion

The driver may look forward from the current position and compare the current travel plan and the available time window between the current position and the finish time, thereby evaluating the possibility to complete the remaining part of the travel plan before the finish time. The difficulties facing the driver here are the quick changes that the dynamics of traffic imposes on the situation which make it extremely difficult for a driver to evaluate the feasibility of the plan. The driver must consider several road links and personal opinions about activity participation – all under the uncertainties that are connected to the traffic situation. Evaluation of the plan includes calculating the amount of time that the drivers thinks is needed to complete the current plan. When comparing this to the time frame that is available, the difference is the slack time – additional or lacking time available. This process can be described as a "prospective" evaluation of the travel plan where drivers look forward and evaluate the situation. A hypothesized resulting behavior that should be checked for is thus that drivers will change plans to shorter ones when current plans are considered too long and vice versa. It should be investigated what role the limited abilities of the driver to correctly estimate the slack time plays in relation in the decision to change travel plan.

The calculation of slack time is straightforward: Anticipated times for all the remaining steps of a travel plan are added together and compared with the time distance between the current position and the finish time. The difference between the times is the amount of slack time that is included in the current travel plan. Negative slack time means that the current plan is too long to fit in before finish.

2.5 Process: Perceiving changes in the ratio between anticipated and actual times

The travel plan set by a driver is also likely to be evaluated in a "retrospective" manner where the driver compares expected times for completed steps with the actually experienced times.. When a link has been traversed or an activity has been finished, the originally expected time may not be the same as the actually passed. This comparison can lead the driver to feel that travel is going slower or faster than expected and thus press the time pressure level upwards or downwards. Changes in the ratio between anticipated and actual times are thought a possible trigger for the desire to change travel plans.

A Hypothesized resulting behavior is thus that after travel; plan steps where there has been a big difference between the anticipated and the actual time, the driver is more likely to make a travel plan change. This may also occur in a cumulative fashion where several steps have been had longer actual times than anticipated and push the driver into a travel plan change. The measure is calculated by comparing estimations for each step, road link travel or activity participation, and compare them with the actual corresponding outcome and study the immediately following decision point for travel plan changes over the entire course of travel.

2.6 Process: Changes in subjective stress

The subjective time pressure measure is seen as a composite of several variables that may be personal interpretations of the time frames in relation to the travel objectives that can also include personal opinions about the travel plan contents. The construction of such a measure may be too difficult to measure objectively in all its separate ingredients so it is here attempted to collect statements of drivers to reflect this. Drivers are thus asked to simply state on a scale of 1 to 5, where 5 represents the highest level, to what extent they perceive time pressure regarding the travel plan in relation to the time limits imposed on the travel.
The resulting hypothesized behavior that can be studied is that drivers should respond with travel plan changes to situations where they have just experienced rises or reductions in their sense of time pressure. A sharp rise in time pressure could in this manner "trigger" a travel plan change. The measure for time pressure is collected directly from driver respondent in experimental situation. Respondents are asked to state their sense of time pressure at every decision point over the course of the travel.

2.7 Note on measuring time pressure – stress – in travel plans

The general concept "stress" will here be included in the term "time pressure" since it is thought to be connected to the completion of a travel plan within set time limits. Time pressure is simply a subjectively based statement from drivers as an opinion on the temporal state that the travel plan is in. In the field of psychology, time pressure is commonly measured as a number of actual or cognitive tasks that have to be performed per time unit (Svenson et al.). Stress as "time pressure" has been studied as what decision rules apply under congested traffic conditions (Stern 1999) and also as the role of time pressure in activity scheduling (Gärling et al 1999) but has not yet been related to travel plan contents. The analysis at the end of this paper is not built on measures reminiscent of how it has been treated in the studies above, but will only use the statement of the drivers about time pressure to relate to other behavioral changes, such as changes done to the travel plan.

2.8 Plausibility of the selected processes

The proposed cognitive processes are considered interesting to test due to their relatively simple configurations. When drivers consider data in the en route situation - assuming little or no experience in this research - it is likely that the combinatory sets of data that the driver can handle "inside the head" are simple. This should follow the results of psychological studies where allocation of cognitive resources imposes limitations on the ability to perform other tasks. In the en route driving situation some cognitive resources are already used for the task of controlling the vehicle – leaving the resources available to calculate travel plans as previously described limited. The way that drivers utilize information when calculating the feasibility of travel plans in the en route situation s thus assumed to no more complicated than what is described in the processes above.

3. DATA REQUIREMENTS

3.1 Travel-following data and decision points

Data for studying travel plan handling en route needs to be collected by continuously following the driver throughout the course of the travel. This "travel-following" or time-line data should ideally give a complete picture of the travel. This is hardly possible because it would crave constant recording of the driver behavior. During a drive it is neither practically possible to have a driver constantly expressing intentions and feelings since this may interfere with the driving and travel-planning tasks, which are the very phenomena that we intend to study. Instead, the "decision points" are used which constitutes intervals on which data will be "hung up" and the analysis will be possible. The decision points are for this study set to be at the end and start of every step (link or activity) in the travel plan. The intervals are thus not temporally equally distributed over the course of travel but instead follow the rhythm of the travel plan. This makes it possible to associate the statements at the end of an activity with that particular activity which is possibly similar to how drivers see changes themselves. The use of decision points also provides for smooth data collection in the en route situation in that the driver does not have to be disturbed in the driving task at a point when this is particularly complicated or stressed. This is particularly important in the real world situation. Events that occur in the middle of a link or activity can be covered by the researcher taking notes and, if necessary, debriefing the respondent at the next decision point.

3.2 Selection of a practical scheme

To perform an experiment corresponding to the typical car use situation described in the beginning of the text, it is necessary to provide a scenario containing a road network with traffic condition that the driver interacts with. Also, the respondent should set a travel plan as guidance for the acting on the network while considering the time frames set. The multiple recording levels, incorporating both statements from the driver as well as from the surrounding environment points towards a high grade of automation necessary for systematic and reliable data to be produced. The driver must be kept in a dynamic scenario and be fed the conditions that the traffic system and also other events can add to the drivers impression of how the travel progresses.

Suitable methods for collecting the data are here chosen to either through a travel simulator device or as a "real world" experiment with the respondent using a car on a real urban network. The dynamics needed to provide the respondent with a developing travel situation does not lend itself very well to paper-based methods as the choice situations should be situated on time intervals that mimic the travel progress with constant time scale. Computer supported simulation can provide dynamic scenarios with much greater precision than use of papers controlled by a researcher.

The term "real world" will here be used to describe the experiment where actual driving of a car takes place but where the activities and time frames are controlled by the researcher. Data has been collected in two scenarios where one depicts a holiday's "leisure" scenario. Te driver can freely pick among a set of activities and can set a travel plan as long as desired. The other scenario resembles a "work" situation where the respondent is given three activities to perform within a limited time frame. The time frame was set deliberately tight in order to allow traffic conditions to make it difficult to keep the return time without deleting any activities from the travel plan.

3.3 Research using experimental data

Using experimental data is a compromise on recording real life phenomena; the "real life data" would need either complicated instructions for the respondent or for the researcher to follow respondents in daily life with increasing interviewing effects as a result. It is here concluded by the researcher that for exploratory research with limited means on an issue where the data is of complicated art – it is a sensible choice to start by setting up experiments for producing data on behavioral issues in transportation research.

4. ABOUT THE DATA COLLECTIONS

Two data collections have been carried out. One using a simulator and one as a real world experiment with respondents driving cars in central Tokyo.

4.1 Simulator experiment

4.1.1 Previous research on information provision using simulators

Generally the behavior of drivers under intelligent information systems have been studied from many aspects using simulators; Examples are the IGOR simulator (Bonsall and Parry 1990), which was used to study rates of acceptance as functions of advice quality. A Driving simulator developed at MIT (Koutsopoulus et al 1994) incorporated the driving task – the driver had to take actions in order to be able to change route. The DYNASMART simulator (Jayakrishnan et al 1994) combined the route choice functions with full simulations of network conditions and also provided for traffic control functions. A simulator, TRAVSIM (Firmin 1995) was developed at ITS Leeds for studying issues related to using simulator themselves in research.

The simulator developed for this study differs in that it collects statements on time pressure along the course of the travel in order to automatically record impressions from the driver during the drive and navigation tasks. The design of the simulator therefore had to balance the interviewing effect of the collection of impressions and the dynamic scenario that is necessary for having the respondents acting as if in an en route situation.

4.1.2 How the simulator works

The device works like an interactive computer interview where screens on a web browser (figure 4) take respondents through travel on links and participation in activities. Respondents are shown a map including average link travel times and distances. Respondents are first asked to set an initial travel plan, within a time limit, and start travel according to it. When traveling on a link in the network, the respondent is shown a screen indicating where he/she is driving together with some explaining image. When participating in an activity, the respondent is held on an activity screen for as long time as he/she has stated or, for some activities, for a set length of time.

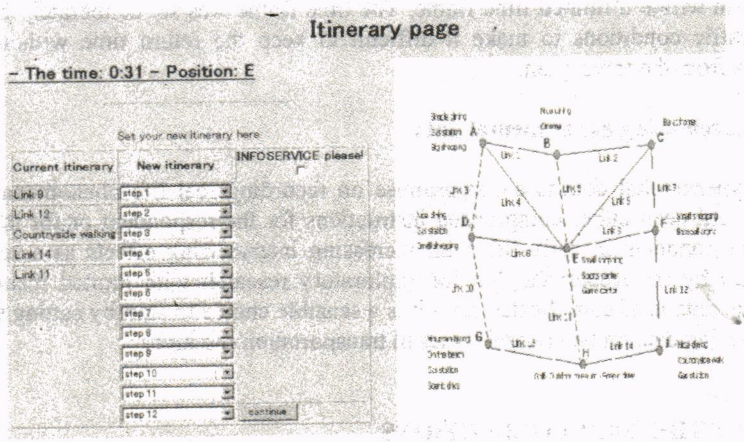

Figure 4: Example screen: Itinerary change screen.

A respondent travels the network simply by confirming the next step on the current itinerary. After completing the travel, respondents are asked to fill in a questionnaire for additional socio-economic and transport related data. During the travel, driver perceives traffic conditions either through checking the time or also by direct information given by the simulator.

4.1.3 Simulator data collection and scenario

15 respondents completed 2 travel sessions each on the simulator where the first was a training of how use the controls and input answers on the screens. The travel in the simulator was done on a simple hypothetical network (see the right hand side of the screen in figure 4). The idea was that drivers should use up as much as possible of the available time and thereby handle the travel plan after the changing conditions on the network. Delays were implemented, randomly and announced to the driver via messages on the screen, as traffic congestions and events in activity participation. In order to have drivers use up as much as possible of the available time, a point system was used where drivers were punished for finishing too early or too late. This in a way created an artificial utility function that supported the artificial time pressure that needs to work in a simulated scenario. The complete flexibility of the activity selection gives the scenario an impression of "leisure" travel.

4.2 Real world experiment

4.2.1 Real world data collection - basics

6 drivers participated in driving experiments in central Tokyo (figure 6, below). A car equipped with Global Positioning System (GPS) connected to a notebook computer with mapping software (ProAtlas), a video camera and a hand record were used to capture the data by a researcher who accompanied the driver in the car (figure 5). Unforeseen events,

statements of time pressure levels and factors behind itinerary changes were collected by the researcher on a handheld record.

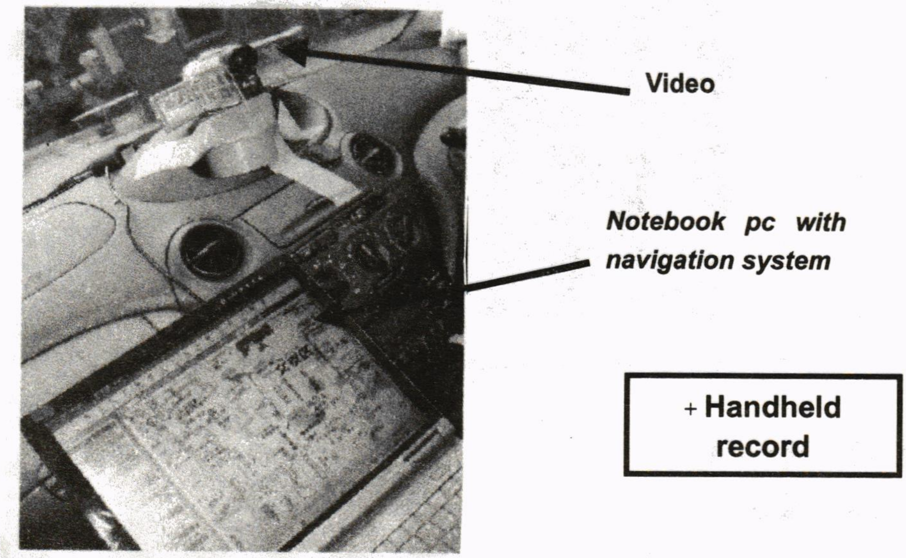

Figure 5: Car interior in the real world data collection.

The handheld record was used to keep a multitude of data; plans – time pressure levels – expected times – event details etc. The hand record was necessary as a complement since not all events were visible on video or GPS, such as a missed turn, a closed activity detected by the driver from the car etc. GPS and video worked satisfactorily. None of the two produced 100% perfect data. The GPS data suffered interruptions due to the urban canyon-related satellite loss of fix along some road segments and the video recordings were interrupted by human error. Together the two recordings could give a complete record of step times and positions.

4.2.2 Real world - network/scenario

On each driving "session", drivers were given 3 destinations on the network to drive to within 75 minutes. This strict dictation of activities and time frames resembles "work" related travel where there is little discreet control over the travel. The task of the driver is inflexible and is just to fit in al the activities between the start and the finish time. At destinations, drivers were asked to collect some simple information. All drivers performed 2 sessions each. All driving was done on weekdays; between 10am and 5:30 pm. The large circle in picture 8 has a diameter of 3.6 km. The small circles are the activity positions and the oval is the start and finish point of the travel.

Figure 6: The real world experiment network in Tokyo

5. ANALYSIS OF DATA

5.1 About the scenarios

For the analysis it should be remembered that the scenarios differ mainly three respects: Time frame; the work scenario was 75 minutes long, the leisure scenario 5 hours in simulated time. The activities were decide for the respondents in the work scenario in terms of position as well as content, for the leisure scenario activities were freely selected and participation time was fully controlled by the respondent. The travel times varied more in the work scenario, which was used in an area with extremely high traffic loads.

5.2 Analysis introduction

Data from two different scenarios are used side by side to illuminate the hypothetical behaviors described earlier. The data will here be displayed in sections corresponding to the sections in the Cognitive processes chapter. The research presented here is based on small samples so graphical methods for describing the behaviors will be used. Future expansion of the datasets will allow for meaningful applications of statistical methods.

5.3 Slack time inclusion

Are travel plans changed at higher or lower levels of slack time inclusion? Looking at the diagram in figure 7, below (- triangles represent extensions of travel plan, squares are reductions), we see that in the leisure scenario, changes seem mostly to be done as smaller changes at very low absolute values of slack time inclusion over the entire course of travel. This may be reaction to a previous step's temporal turnout (see next section for a discussion on the ratio between anticipated and actual step times). Very high or low slack time inclusion does not seem to instantly cause drivers to change travel plans. Instead, the planning is independently done after personal preferences that may allow travel to be pursued with high or low slack time inclusion until the proximity of the finish time triggers a change of plans. The travel under very high and low slack time inclusion in diagram indicate the existence of such "individually styled" travel planning.

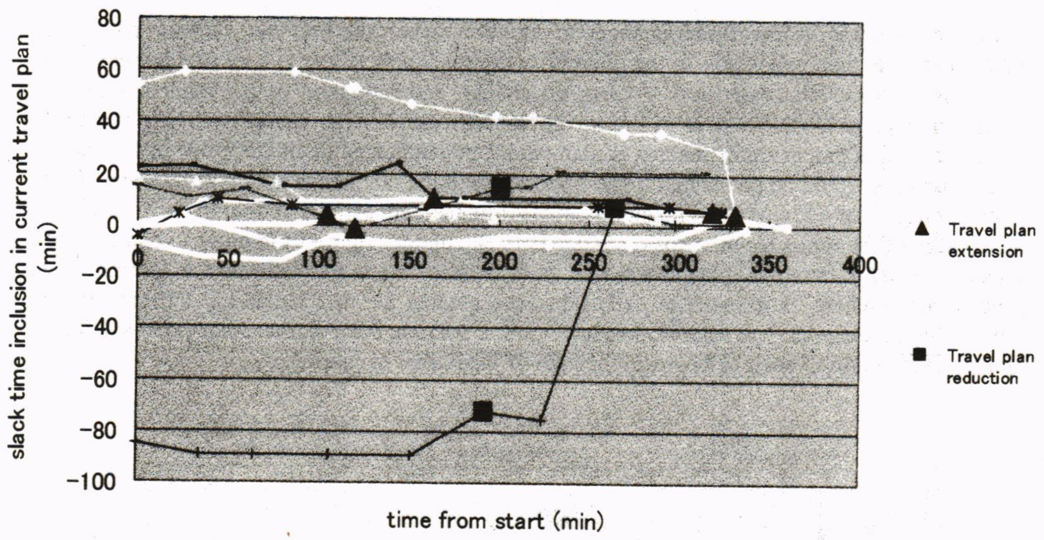

Figure 7. Slack time inclusion over the course of travel. White line = no plan change. Simulator data; leisure scenario.

In the more heavily constrained "work" scenario (figure 8), all recorded changes occur at the very end of the travel. It seems the drivers feel pressured to complete all tasks and will hold on to the original travel plan, containing all given tasks, until a point is reached when there is no longer any question about the travel plan being unfeasible. So, regardless of the varying levels of slack time inclusion traveled under, presuming drivers perceive them in that way, it seems that the travel motive and background have control over how en route travel planning is done in comparison with the driver evaluating the plans en route.

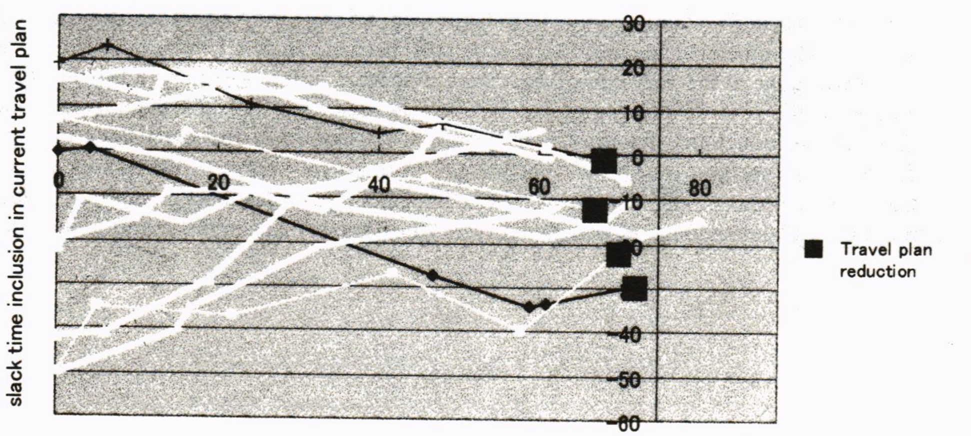

Figure 8. Slack time inclusion over the course of travel. Simulator data; leisure scenario.

5. 5 Anticipated time and actual time

Do drivers react with travel plan changes to situations when the previous step turned out to take more time than expected? In the diagrams (figures 9 and 10); it is here divided between different action levels: extension of plan, no change and reduction of the plan to indicate when drivers add or delete steps in the travel plan change. For the leisure scenario, it would be expected that extension of the travel plan would be connected to situations of lower ratios and reductions would be connected to the opposite with the no change action in between. This does not hold; there seems to be no significant difference between the action levels even when an average of the ratios for all steps completed are calculated (figure 9) in order to connect the measure closer to the travel plan as a whole. In fact the averages are positioned in a intuitively reverse order where more cases of extension occurs when the travel plan has suffered more delay than occurs when the actual times have on the average been shorter than expected. This leads to a rejection of such behavior in the case of the leisure scenario.

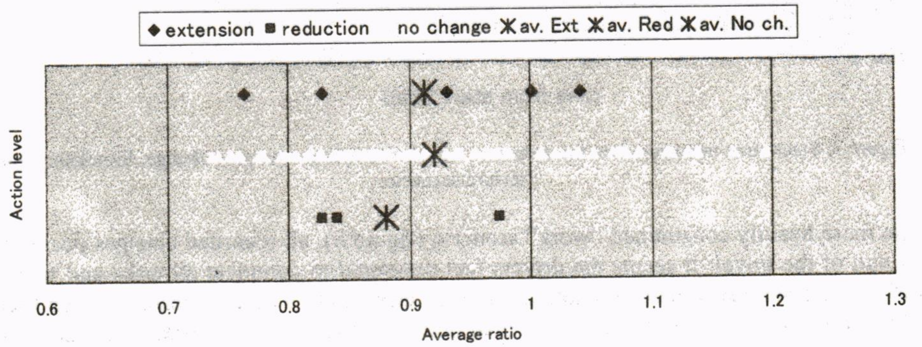

Figure 9. Values for ratio actual/anticipated step time as an average over the steps completed "so far" for different actions in travel plan change. Simulator data; leisure scenario.

For the work scenario; looking only at the latest step, no triggering effect reveals itself easily (figure 10). The time distance to finish is of interest here but since all changes under the work scenario was done at the very end of the travel, it appears difficult to show a trigger effect in this case. In the case of an average "so far" for the ratio, we find that the average ratio is higher for the reduction situations than for the no change ones (no extensions took place under the work scenario). The fact that we get an intuitively correct effect under the work scenario in contrast to the leisure scenario indicates again the background variables an important for understanding the way that drivers adjust travel plans in the en route situation.

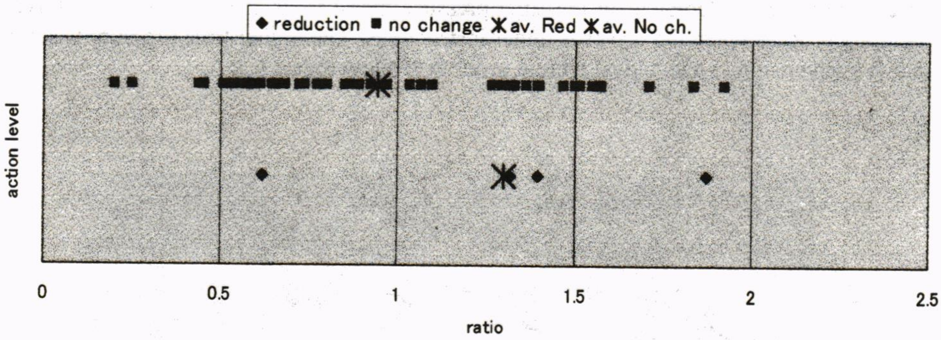

Figure 10. Values for ratio: actual/anticipated step time in as an average over the steps completed "so far" for different actions of travel plan change. Real world data; work scenario.

5.6 Subjective time pressure measure

The leisure scenario (see figure 11); the three cases of plan reduction are followed by decreases in time pressure levels or leveling out of a rising curve. On the other hand, the three early cases of plan extension are all positioned at points of basically different nature ("local low", Local high" and "platform" respectively). Some behavior seems to have been targeted at reducing time pressure but reactions in the other directions are unclear, making it difficult to make a statement on whether the hypothetical behavior is consistent. In the work scenario (figure 12), time pressure levels are higher from the start probably as a result of the strict frames for activity choice and return time. All the travel plan changes are

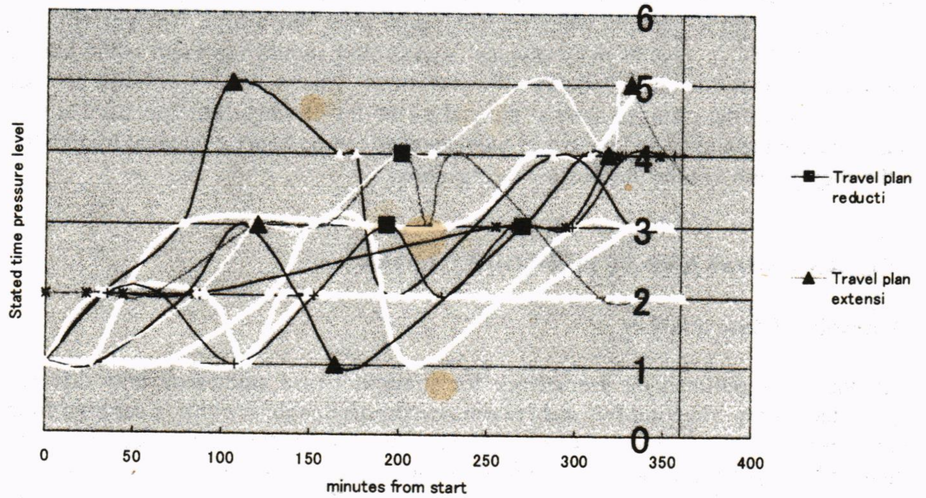

Figure 11. Time pressure over the course of travel with indications of travel plan change. White line = no change over the course of travel. Simulator data; leisure scenario

here done at the end of the travel, giving the impression that the personal perception of stress, here thought to be depicted by the time pressure measure, is locked out of the travel plan handling process when the driver is under instructions. The higher time pressure is something that the driver simply has to deal with in order to "follow orders".

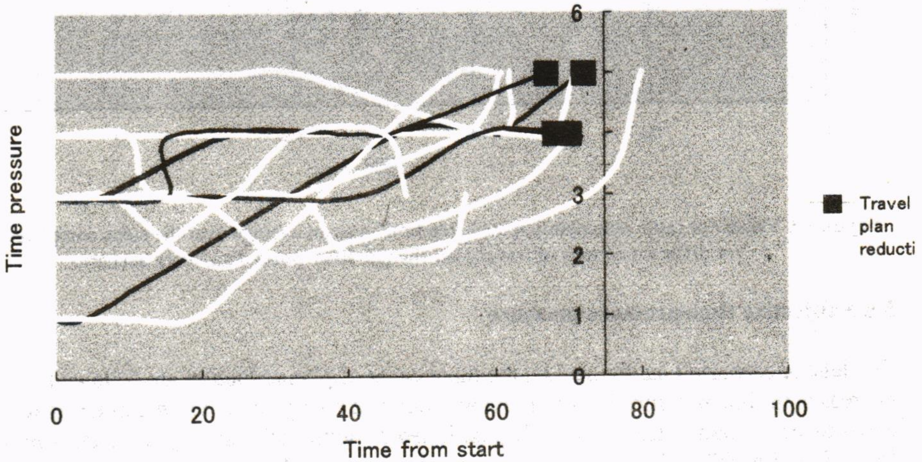

Figure 12. Time pressure levels over the course of travel with indications of travel plan change. White line = no change. Real world data; work scenario

About time pressure itself it should be noted that, the passage of time in itself might be related to the formation of time pressure. This should not involve any evaluation process from the drivers' side but rather be related to the "personal clock" that works autonomously inside all people. This refers to an instinctive perception of time that should here automatically increase time pressure as time goes by when traveling with a set finish time. The perception of time has been verified in several psychological studies and should represent some kind of base assumption about the development of travel time. This makes it difficult to make any comments about the changes done at the end of the travel where time pressure is likely t be caused by the proximity and the travel plan changes can be better evaluated by the driver due to the short period of time that has to be considered.

6. CONCLUSIONS AND FUTURE DIRECTIONS

6.1 Results of data analysis

This paper has outlined the framework for straightforward studies on how drivers handle travel plans when traveling by car between several destinations within a set time frame. The study presented the first steps to analyze how drivers handle travel plans in the en route situation by exploring data with graphical methods and with a base in hypothetical cognitive processes among drivers. The objective was to see if intuitively correct behaviors reveal themselves in the data using simple graphical methods. If so, we can guess that the cognitive processes proposed are really in work among drivers.

The results do not support any single process specifically but rather suggests that the processes may interact, work in parallel or work at different intervals at the discretion of the other. We see in the data that the process of evaluating the remaining part of the travel may well take place but is included in, or subordinated to, other processes that govern the change of plans. Here, adherence to demands connected to the travel motive may overrule the use of the process outcome and prevent plan changes in the case of a work-like scenario. The same may apply to the evaluation of actual times for links and activities. Even thought he results seem to support the fact that travel plan changes occur at the occasions when the experienced travel times have been higher than the expected ones, these occasions are all located at the end of the strict scenario when the motive of the travel and the temporal proximity of the finish time leaves the driver with no choice.

A subjective sense of time pressure is a promising way into understanding the leisure driver where our displayed cases seem to suggest that drivers who experience stress are able to reduce it by modifying the travel plan. The analysis above uses three different but plausible cognitive processes as a basis for studying data on time pressure changes among car driver in the en route situation. The three are here treated separately and do then both speak for and against the suggested processes. It would be useful to apply a modeling technique that can estimate the multivariate effects that several measures potentially have. This would be facing the difficulty in separating processes in a comprehensible way since the interactions or simultaneous use of the sane data in several processes can cause statistical problems fir the most commonly known techniques.

6.2 Use of results for design of intelligent services

The interrelationship between subjective time pressure and travel plan changes is of interest for the design of intelligent services, where particularly agent technology, allowing the driver to interact and submit travel plans and motives to intelligent systems, may develop a stress relieving potential that could directly enhance safety and comfort among drivers. A possibility would be to continuously calculate the "temporal state", or delay, of a travel plan that the driver has submitted and, if the driver has reported flexibility, such as in a leisure drive, give the driver a report containing suggestions for plan modifications.

If the results above are valid and the cognitive processes proposed are actually the ones at work inside drivers we can propose guidelines for how information systems should be configured in order to support the driver en route:

Example: Supporting of the "prospective" evaluation by ATIS:
An active driver support system could constantly update the evaluation of a driver's travel plan based on the most recent situation (supporting the "prospective" evaluation process). The driver would thus be reminded as soon as the used travel plan was no longer feasible and recommended to change. The result is to have the driver change travel plan at an earlier stage and continue the travel under lower time pressure than would have been the case if the original travel plan had been held until the evaluation capacity of the driver had rendered it unfeasible. This may have occurred at a later stage when the alternatives for altering the travel plan are fewer.

It is an interesting future research to check if drivers react this way. Perhaps there is a contradicting effect in that drivers who are not aware of the unfeasibility of their travel plans are not influenced negatively by time pressure. The future research will be important to the evaluation of personalized agent technologies which are current front runners of personalization of services on the WWW and may also be the working force there for ATIS to find information for drivers.

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