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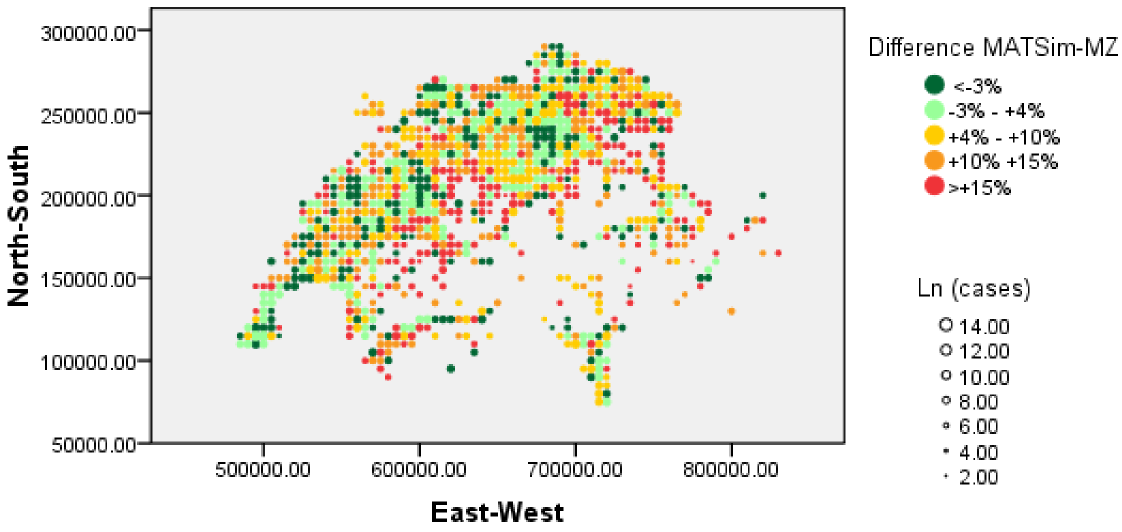
Conference Paper

Author(s):
Ciari, Francesco; Balmer, Michael; Axhausen, Kay W.

Publication date:
2008

Permanent link:
https://doi.org/10.3929/ethz-a-005697694

Originally published in:
Arbeitsberichte Verkehrs- und Raumplanung 529



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Francesco Ciari, IVT, ETH - Zürich
Michael Balmer, IVT, ETH - Zürich
Kay W. Axhausen, IVT, ETH - Zürich

Conference paper STRC 2008

STRC

8[th] Swiss Transport Research Conference
Monte Verità / Ascona, October 15. – 17. 2008

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Francesco Ciari
IVT, ETH Zürich
ETH Hönggerberg,
CH-8093 Zürich

Phone: +41-44-633 71 65
Fax: +41-44-633 10 57
email:
ciari@ivt.baug.ethz.ch

Michael Balmer
IVT, ETH Zürich
ETH Hönggerberg,
CH-8093 Zürich

Phone: +41-44-633 27 80
Fax: +41-44-633 10 57
email:
balmer@ivt.baug.ethz.ch

Kay W. Axhausen
IVT, ETH Zürich
ETH Hönggerberg,
CH-8093 Zürich

Phone: +41-44-633 39 43
Fax: +41-44-633 10 57
email:
axhausen@ivt.baug.ethz.ch

October 2008

Abstract

This paper reports the development of a new mode choice model system, embedded in a multi-agent transport simulation, aiming to obtain both a spatially and behaviourally fine representation of modal choice of the simulated individuals. The new model addresses the subtour level, substantially improving on previous work, which either addresses the trip or the tour. A subtour is any sequence of trips which starts and ends at the same location; a tour starts and ends at home. The subtour resolution allows us to consistently account for the differential availability of modes. Subtour mode choices are otherwise treated as independent events. The subtour level allows us to capture the noon peak behaviour appropriately. The model system has two stages both formulated as multinomial logit models. First, the mobility tool ownership is estimated for each agent; second, given this choice the mode choice is addressed at the sub-tour level of the individual daily activity chain. We considered car ownership and public transport season ticket ownership and their possible combinations. The subtour models for walk, bicycle, car, car passenger and public transport are estimated by subtour's main purpose to account for taste differences. The attributes of alternatives' utility functions are socio-demographic characteristics of individuals, such as age, income, mobility tool ownership, etc., and distance covered. The mode choice module is integrated in the simulation toolkit MATSim-T (Multi-Agent Transport Simulation Toolkit). The module has been tested with a large scale scenario, based on Swiss data, and proved able to reproduce real modal choices of the population with a fine spatial resolution. Results are presented for a scenario in which the whole Swiss population is simulated. They are compared to the most recent Swiss national travel diary survey.

Keywords

Agent Based Simulations – MATSim-T – Initial Demand – Mode Choice – Discrete Choice Models – STRC

1. Introduction

It is widely acknowledged that the transportation mode choice is one of the most important information that planners want to have from a transportation model. The share of public transport and private transport among travelers has a key role in transportation policies and obtaining a correct estimation of it is one of the main goals of modelers (Ortuzar and Willumsen, 2006). In traditional transportation modelling the mode choice is represented at aggregate level but the use of multi-agent simulation technology allows one to go beyond this resolution. With this approach, this choice—as all other choices which are represented in a transportation model—can be represented at the same level at which they are taken in the real world, that is, at individual level. This additional precision comes at the price of a substantial increase in the computational cost. However, the significant and continuous increase in computer calculation power, has made them a practicable option even for applications involving many millions individuals.

This paper reports the development of a new mode choice model system, embedded in a multi-agent transport simulation. The mode choice model builds on previous work, substantially improving it, aiming to obtain both a spatially and behaviourally fine representation of modal choice of the simulated individuals. The mode choice module is integrated in the simulation toolkit MATSim-T (Multi-Agent Transport Simulation Toolkit, Balmer, 2007) whose output is individual daily travel demand.

Among the literature on micro-simulations—increasingly abundant in recent years—a group of studies to which MATSim-T can be compared is the one based on activity-based demand generation. Several examples of implemented simulations of this kind can be found, such as (Bowman *et al.*, 1999; Arentze *et al.*, 2000; Vovsha *et al.*, 2002; Bhat *et al.*, 2005; Abraham *et al.*, 2005). However, most of them are able to produce results like origin-destination matrices which are then used to dynamically assign the traffic to the network. An exception to that is TRANSIMS (2008), which generates individual activity plans as input to dynamic traffic assignment packages. Another vein of agent-based modelling works where similarities with MATSim-T can be found is agent-based land use models; an example is ILUTE (Salvini and Miller, 2005).

The estimation of travel demand in MATSim is a two phase process. In the first the so called initial travel demand is generated, while in the second travel is simulated and the travel demand is optimized.

This paper focuses on the initial demand, which is composed in turn of two main processes, the generation of a synthetic population and the estimation of initial demand itself. Aiming to improve the quality of the initial demand, some modifications have been introduced both in the generation of the synthetic population and in the models which properly belongs to initial demand generation.

In the generation of the synthetic population logit models are used to estimate the distribution among the population of attributes such as the driving license and the mobility tool ownership. Such models have been improved with the goal to obtain e more precise spatial distribution with respect to the old models.

The new mode choice model addresses the subtour level. A subtour is any sequence of trips which starts and ends at the same location. The subtour resolution allows to consistently taking into account for the differential availability of modes. Subtour mode choices are otherwise treated as independent events. The mode choice estimation makes also use of logit models and the attributes of alternatives' utility functions are socio-demographic characteristics of individuals, such as age, income, mobility tool ownership, etc., and distance covered. The improvement in the mode choice is not limited to the use of the subtour resolution. In the new models the number of transportation modes taken into account is increased; they are “walk”, “bicycle”, “car”, “car passenger” and “public transport” modes. Such models are estimated by subtour's main purpose to account for taste differences. Purposes considered in the model have been also increased: The purposes “work”, “education”, “shopping” and “leisure” are considered now.

The module has been run on a synthetic population of more than 7 Mio individuals reproducing the whole Swiss population. This population has been obtained basing on the Swiss census 2000 data (Bundesamt für Statistik, 2001).

This paper is composed of 4 Sections. In the next section the generation of a synthetic population is presented. Section 3 focuses on the mode choice module. Some issue which were not tackled with the old model are discussed and the modifications introduced with the new one are presented. In Section 4 results obtained with the new mode choice model are presented. The transportation mode shares reproduced by the mode choice module and their spatial and temporal distributions are discussed. The last section is dedicated to conclusions and provides an outlook to further work.

2. Modelling individual travel demand in MATSim

The new mode choice model is implemented in the initial demand stage of the micro-simulation tool. Various processes are included in this stage, the most important are:

- Generation of the synthetic population,
- Assignment of primary activity locations,
- Distribution of activity chains,
- Assignment of locations for secondary activities,
- Evaluation of mode choice module,
- Estimation of route choice.

In this section the first four of these processes are shortly described. The mode choice is described in detail in the next section. The description of the route choice is beyond the scope of this paper. For a more detailed description of the whole generation process of the initial demand in MATSim the interested reader can refer to Ciari *et al.* (2007). Another work dealing with specific parts of the initial demand is the one of Horni *et al.* (2008).

2.1 Generation of the Synthetic Population

A micro-simulation model needs an input population of agents in order to be run. Since in a micro-simulation each individual is modelled, also socio-demographic attributes need to known at the individual level. In most of the cases this means the use of different data sets which need to be merged. In the present case the Swiss Census 2000 (Bundesamt für Statistik, 2001) is available consisting of detailed demographic about all Swiss inhabitants. Therefore, the generation of the synthetic population is reduced to a simple conversion.

Information about driving license ownership, car ownership and public transport season tickets ownership are additional socio-demographics which could not be gathered from the census. Therefore, the Swiss Mikrozensus 2005 (BfS and ARE, 2006), containing those data, can be used. But being a sample the relevant information cannot be directly attached to the initial population. Logit models were used for this task, estimated using the free software Biogeme (Bierlaire, 2007). The first information which is added to the initial population is the driving license ownership. Explanatory variables included in the model are of three different types, personal attributes of individuals, household attributes, and attributes of the municipality where the individual live. Once the driving license ownership has been added to the population, the mobility tool ownership can be estimated in turn. In fact, properly speaking in MATSim, the availability of car and the ownership of public transport season tickets are taken into account; this because of a consistency issue with micro census data. For the car three level of availability are take into account: “always”, “sometimes” and “never”. It results in a model with six different alternatives. The population enriched with license and mobility tools attributes can be used fort he estimation of the mode choice.

2.2 Assignment of Primary Activity Locations

Another, very important process step for activity based demand modelling is the assignment of primary activities such as „work“ and „education“ locations for each individual. In this case, the Swiss census 2000 contains that data already, based on the municipality level of detail. Therefore, the primary locations are directly converted from the census. In a microscopic view, Swiss municipality level of detail is actually too rough. But by using the Swiss Enterprise Census 2000 (Swiss Federal Statistical Office, 2001) a weighted random draw of work and education (weighted by the size of number of work places per location, size of the education location resp.) location is performed to distribute the locations inside the given municipality.

2.3 Distribution of Activity Chains

Again the micro census 2005 (BfS and ARE, 2006) is used as the data basis for distributing activity chains to the Swiss population. A very simple but effective and robust solution is to uniformly draw an activity chain from the micro census based on the individual socio-demographics. The survey is therefore divided into 80 groups based on „gender“, „has work“, „has education“, „has driving license“ and 5 different „age“ groups (age groups := [0-6, 7-14, 15-17, 18-65, 66-...]). The random draw is weighted according to the person weight of the micro census. As a result, the relative bias of the distributed chains compared to the micro census chains lays below 0.7 %.

2.4 Assignment of Locations for Secondary Activities

Secondary activities highly depend on the locations of the primary activities. Therefore, neither in the census nor in the micro census suitable information can be gathered to assign secondary activity locations. On the other hand, detailed information about facilities of secondary activities are modelled by Meister (2007). Based on the given locations of the primary activities a “neighbourhood search” algorithm can be adopted such that it selects given facilities around the primary locations and draws one of them weighted, based on the capacities of the facilities. It has to be noted, that the assignment of the secondary activity locations does not react on occupancy rate of the given facilities. But for the initial individual demand modelling process, that initial choice is good enough since the secondary location choice (Horni *et al.*, 2008) will be adapted in the MATSim optimization process. In this fully integrated demand optimization process, the choice of secondary activities reacts on time-dynamic occupancy rates, travel times, arrival- and departure times and also on the chosen mode.

3. Subtour Mode Choice Model

The choice of the transportation mode is probably the most important of the individual decisions of the travellers. A correct estimation of the share of public transport and private transport is one of the main information that planners want to get from a transportation model. It is planned that mode choice in MATSim will be modelled at two different stages; first in the initial demand and then in the optimization stage. The reason of mode choice module at two different stages of MATSim can be explained with the use of GA (Genetic Algorithms, Bäck, 1996) for the optimization. Genetic algorithms need to be feed up with a start solution in order to find an optimum. They can find it whatever the start solution is, but starting with an already good solution will, in general, considerably improve the speed of the optimization procedure (more precisely, the number of iterations can be decreased). Here the mode choice at the initial demand stage of the program is described. The existing model gave already satisfying results but some issues were still open. In this section the models used until now are shortly described and issues let open with this approach discussed. Strategies to deal with these issues and the new model are presented.

3.1 The existing mode choice model

The logit model for the transportation mode choice is based on the Swiss Mikrozensus 2005(BfS and ARE, 2006). The mode choice is performed at the tour level of the daily activity chain. That means; it is assumed that a single mode is used in a generic tour of home – out-of-home-activities – home. The choice among four alternatives, walk, bicycle, car, transit is modelled. All other alternatives, registered in the MZ, are not explicitly treated and a fifth alternative encompass all of them. To better capture differences in mode choice behaviour that individuals may have in different situations, three separated multinomial logit models were estimated, according to the main purpose of the tour. Purposes considered were, in hierarchical order, work, education, and shop/leisure. For a matter of simplicity cases reported in MZ referring to incomplete tours were deleted (about 4% of the original sample). Also tours where all or part of the geographic information is missing were deleted (1.5% of the remaining sample). Only socio-demographic variables are in the utility functions except for the total distance travelled for the tour and for municipality attributes

3.2 Shortcomings of the current approach

The results of a first effort introducing a mode choice module in the initial demand stage of MATSim have already been presented in Ciari et al. (2007) at the tour level. It was shown that the model was able to meaningfully reproduce shares of car and public transport travel. The spatial distribution of such shares was also satisfying, capturing the fact that private auto are used more in suburban and rural areas, while public transport is predominant within cities. However, a comparison with MZ data denoted that some important aspects of the modal choice of the Swiss population were not correctly reproduced. A systematic error in the spatial distribution of the shares was observed. The model tended to overestimate car use in the German speaking part of Switzerland and underestimate it in the French and Italian speaking parts.

A second aspect is the resolution at which the modal choice was modelled. The mode was estimated just once for each person, which means that it was fixed for the whole day plan. Now, it is clear that persons don’t necessarily use one single transportation mode for the whole day. A typical example is one commuter using the car to reach the workplace but using a different mean, for example walking, for a short shopping activity during the noon break. Therefore this approach brought us to overestimate car use, especially during the day, and in fact a too pronounced noon peak for car was observed in the results.

3.3 Improvements in the new model

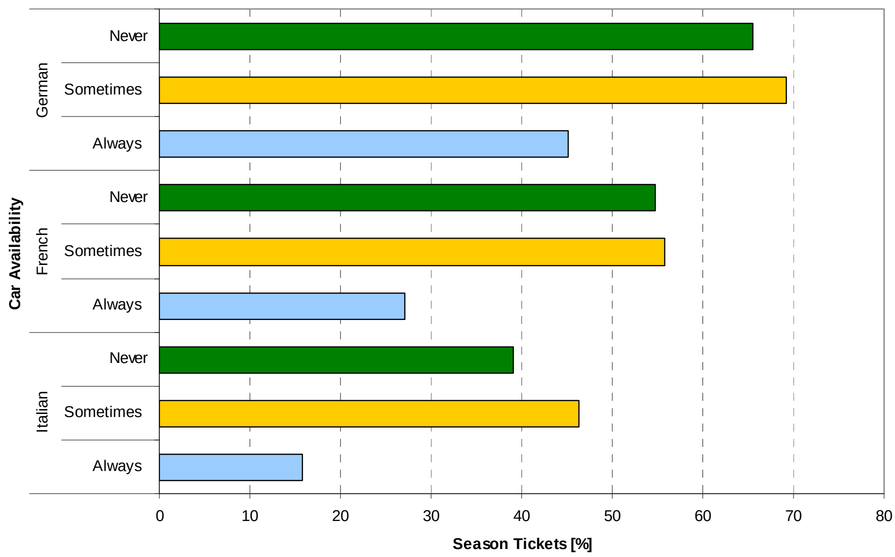
The two arguments presented above are the most important speaking in favour of a more sophisticated approach for the mode choice. The strategies used to take them into account in the model are described hereafter. Some other improvement introduced, not directly related with these two issues are also discussed.

3.3.1 Including regional differences

In the Swiss transport planners milieu it is commonly admitted that the French and Italian speaking parts of the Swiss population has a more pronounced tendency to use private car than the German speaking part does. This observation is consistent with the type of error that we found in the spatial distribution of car use. Using a single model for the whole Swiss population a systematic error was found. The model had the tendency to slightly overestimate car travel in the German speaking part and to underestimate it in the rest of Switzerland. In other words, since the model was unique for the whole Swiss population it reflected an “average” behaviour. Being the German speaking population the majority in Switzerland it is logical that this average was fitting better this part of the population.

Therefore, the first approach which was attempted in order to take into account regional differences in the mode choice was to bring into the logit model dummy variables for the regions. However, these variables weren't significant and the model didn't show any significant improvement. A deeper analysis of micro census data showed that in fact the difference lays somewhere else. It was observed that the populations of the three linguistic regions show different patterns in the ownership/availability of mobility tools (Figure 1).

Figure 1 Season ticket ownership and car availability – Regional patterns



A possible interpretation is, thus, that persons of the different linguistic groups have a different "planned behaviour" and that accordingly to this they tend to have a different availability of mobility tools. But once the mobility tools are there, the behaviour is quite undifferentiated. For this reason it was tried to go a step back and use dummy variables accounting for the region in the mobility tools model. This approach was more successful, since parameters of such variables were significant and the fit of the model was increased. The approach has been used in the new mode choice model. In Table 1 parameters estimates are presented, in Table 2 the alternatives used in the mobility tool ownership model are listed and explained.

TABLE 1 Mobility Tools Ownership Model

Alternative Variable	1 beta	2 beta	3 beta	4 beta	5 beta	6 beta
Constant	-	-1.569*	-9.511*	-1.451*	-2.312*	-1.813*
Age 18-29	-	0.065*	-0.204	0.298	0.364	-0.498
Age 60+	-	-1.094	-0.663	-0.209	-0.675	-0.122*
Age * Gender	-	-0.033	0.001*	0.001*	-0.019	0.007
Gender	-	1.704	0.728	0.013*	0.563	0.124*
French	-	-1.315	0.162	-	-1.829	-0.602
Italian	-	-0.976	0.512	-	-1.695	-0.927
Nationality	-	0.872	0.735	0.788	1.622	1.377
Distance Work-Home	-	0.000	0.000	0.000	0.000	0.000
Income (1000 Chf)	-	-	-0.019*	1.350*	0.374	0.193
Income squared	-	-	0.000*	0.000*	-0.010	-0.002*
Income ln	-	-	0.266*	0.010*	-0.405	-0.020*
Price Gasoline 95	-1.414*	-	-	-	-	-
HH Dimension	0.115	-	-	-	-	-
HH Kids	-0.032*	-	-	-	-	-
Municipality 2[1]	-	0.480	0.808	-0.657	-0.094*	0.355
Municipality 3[1]	-	1.013	1.073	-0.390	0.160*	0.615
Municipality 4[1]	-	1.267	1.472	-0.594	0.231	0.882
Municipality 5[1]	-	1.351	1.670	-0.932	-0.001*	0.687
Number of observations						33162
L(Constants only)						-48030.3
L(Beta)						-33088.7
Adj. Rho squared						0.309422

[1] Municipality 2 = Middle and ancillary centres with railway access; Municipality 3 = Middle and ancillary centres without railway access; Municipality 4 = Agglomeration municipalities, Municipality 5 = Rural areas, Main centres are the reference category.

TABLE 2 List of Alternatives – Mobility Tools Ownership Model

Alternative	Characteristics	Availability
1	Car Never + No Tickets	One
2	Car Sometimes + No Tickets	License
3	Car Always + No Tickets	License
4	Car Never + Tickets	One
5	Car Sometimes + Tickets	License
6	Car Always + Tickets	License

3.3.2 Mode choice at the subtour level

The need for a higher resolution in the mode choice has been tackled passing from the tour level to the subtour level. We define here a subtour as any sequence of trips which starts and ends at the same location. The tour, as it was defined in the old model, is a sequence of trips starting and ending at the home location.

This approach allows to consistently accounting for the differential availability of modes. Subtour mode choices are in general treated as independent events but it is assumed that a transportation mean is available if it was available also at the end of the previous subtour. Some modes are assumed to be available for everybody at any point and at any moment (walk for example), but other modes (car and bike), are available only if they have been used in the previous subtour. Remounting back, the first of a chain of subtours of an agent is always starting at home, where it is assumed that all possible modes for the specific agent are available. Note that the concept of previous is both temporal and spatial. The previous of a given subtour is the first, in temporal terms, of the previous subtours containing the starting point of the considered subtour. In the Microcensus 2005, our data source, only about 10% of tours contain subtours. In this sense it is not expected any particular improvement in the ability of the model to reproduce modal shares, since the impact on global figures is intrinsically limited. But it is expected for example that the model will able to appropriately capture the noon peak, since the old model produced a too high noon peak mainly due to commuters agents using the car also for a short workplace based subtour.

3.3.3 Other improvements

With respect to the existing model some other improvements have been introduced in the new one. In the new model five different modes are taken into account: walk, bike, public transport, car passenger and car. Four different purposes are taken into account to characterize the type of subtour. They are: work, education, shopping, and leisure. Aiming to account for taste differences different models are estimated for the four different purposes. Moreover, two separate models are estimated for individuals aged up to 17, one for subtours having education as the main purpose and another for all other purposes. Thus, in total, in this version of the mode choice, six different models are estimated and implemented. Since in the simulation we are representing a typical week day for the estimation of the mode choice models only data of days between Monday and Friday are used. Some modification was introduced in the data used for the estimation of initial demand with the specific intent of improving the quality of the modal choice. The first regards the activity chains. Now all existent activity chains of the Microcensus are assigned to the synthetic population according to their distribution among the population (see Section 2.1). Priory a part of the less common chains where not taken into account and chains containing too many short trips where simplified. Obviously, since the distance travelled is one of the variables of the models, this simplification had an influence in the modal choice results. The second is related with data used for the estimation of the mode choice models. A deeper “cleaning” of Microcensus data have been performed. Day plans with non home-based tours and day-plans containing point with missing coordinates already excluded. Now, also day-plans containing trips with mode “undefined” and with walk trips longer than 20 Km are eliminated. This latter decision has been taken in order to avoid that such outliers influence to much the estimation of model’s parameters. Trips starting end ending at the same point have been also excluded, since they would not produce traffic in the simulation.

4. Results

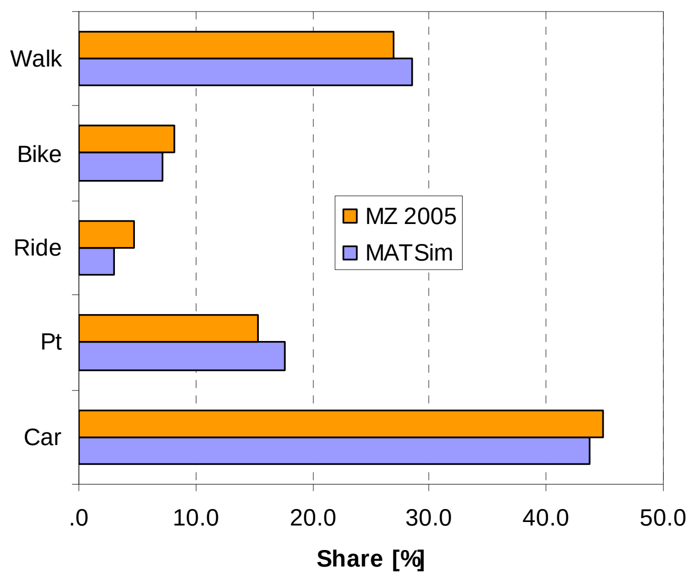
The module has been run on a synthetic population of more than 7 Mio individuals reproducing the whole Swiss population. The analyses have been performed on a table of about 12 millions lines, where each line represents a subtour. The most important aspects which need to be verified and will tell if the new model is working as expected are:

a) The spatial distribution of the modes' use

b) Transportation mode change from one subtour to another

However, the first thing to show is that the new model is able to reproduce reasonable global shares for all the transport modes represented.

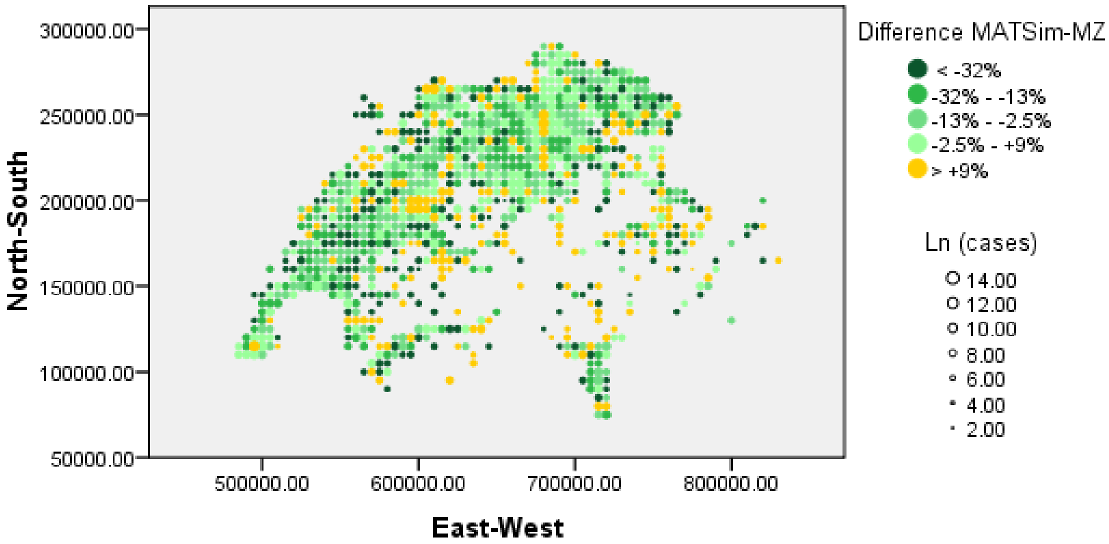
Figure 2 Aggregate market shares of the modes



In Figure 2 the shares predicted by MATSim, at the subtour level, are compared with mode shares observed in MZ 2005 (aggregated at the same level). Results are similar to those obtained with the tour based mode choice, which means that the same level of precision has been maintained even if now the resolution is higher. It can be observed that car travel is slightly underestimated and public transport travel slightly overestimated, but globally results seem quite reasonable.

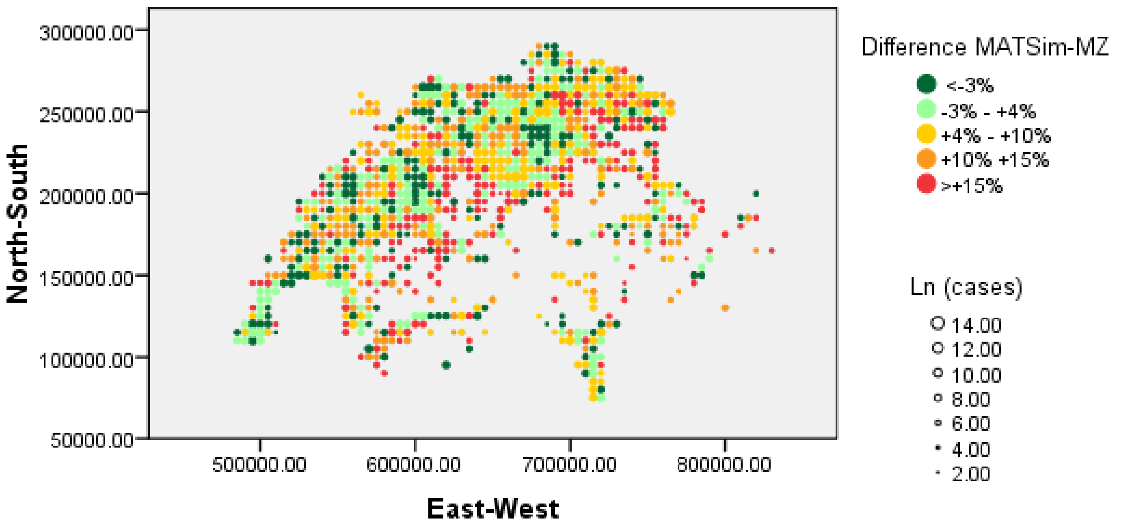
Now it is interesting to see how the use of the different transport modes is distributed in the space. From the initial demand it is possible to know the coordinated at which a subtour is starting. Such data have been aggregated on a 5 by 5 Km grid. In each cell a certain number of subtours are originating, each with a certain transport mode. It is calculated which percentage of the global subtours originating in the cell is made with a given mode. A similar calculation can be made for Microcensus as well. The deviation of the MATSim initial demand from Microcensus data in terms of mode use can be estimated for each cell. The results are shown in Figure 3 for the car mode car and in Figure 4 for the public transport mode.

Figure 3



It can be observed that that, most of the greater errors (dark green and yellow dots) are happening where the number of cases is smaller (a smaller dot), with only some few exceptions. These exceptions are concentrated in some of the biggest Swiss towns, like Zurich, Basel, Bern and Geneva. A possible explanation is that the five different urbanisation degrees which are considered in the model are not enough. Being in the same category as the cited cities also smaller cities where car use is more frequent might have biased the parameter, causing an overestimation in biggest centres. However, the most important annotation is that the addition of regional differences in the mobility tool ownership models worked out as expected. Using the old models it was clearly observable a systematic error of car travel underestimation in French and Italian speaking Swiss regions. Now the same error appears at least mitigated. Indeed, over and under estimation errors seems to be randomly distributed, except for an area approximately corresponding to the Zurich urban area where the error is in general low.

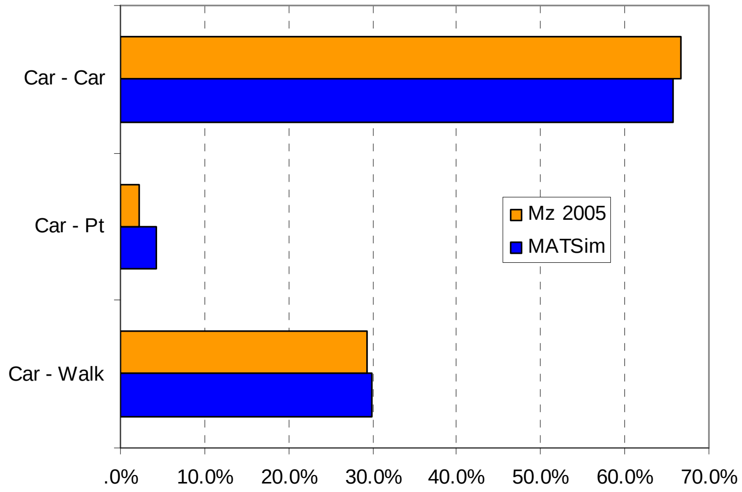
Figure 4



In Figure 4 is shown that also in the case of public transport most of bigger errors are committed where the number of originated subtours is lower. A systematic error at the regional level is not recognized; in general the estimations of the shares are a bit better than in the case of car travel.

The other important question was if the agents of the simulation having day-plans composed of more than one subtour are changing transportation mode consistently with Microcensus data. It is worth to remember here that only about 10% of day-plans of Microcensus are composed of more than one subtour. However, to appropriately capture the behaviour of such individuals is important. Results obtained with the tour based model, where agents got a transportation mode assigned for the whole day, showed the tendency to predict too much traffic during the central part of the day, producing a sort of “noon peak”. It is well know, and confirmed also by Microcensus data, that many persons going to work with the car doesn’t necessarily use the car also if going for another activity from the workplace, especially if this happens during a break and not at the end of the working time. In Figure 5 it is shown how persons using car in a subtour are behaving in the next subtour, comparing MATSim results with Microcensus data.

Figure 5 Combination of modes in consecutive subtours



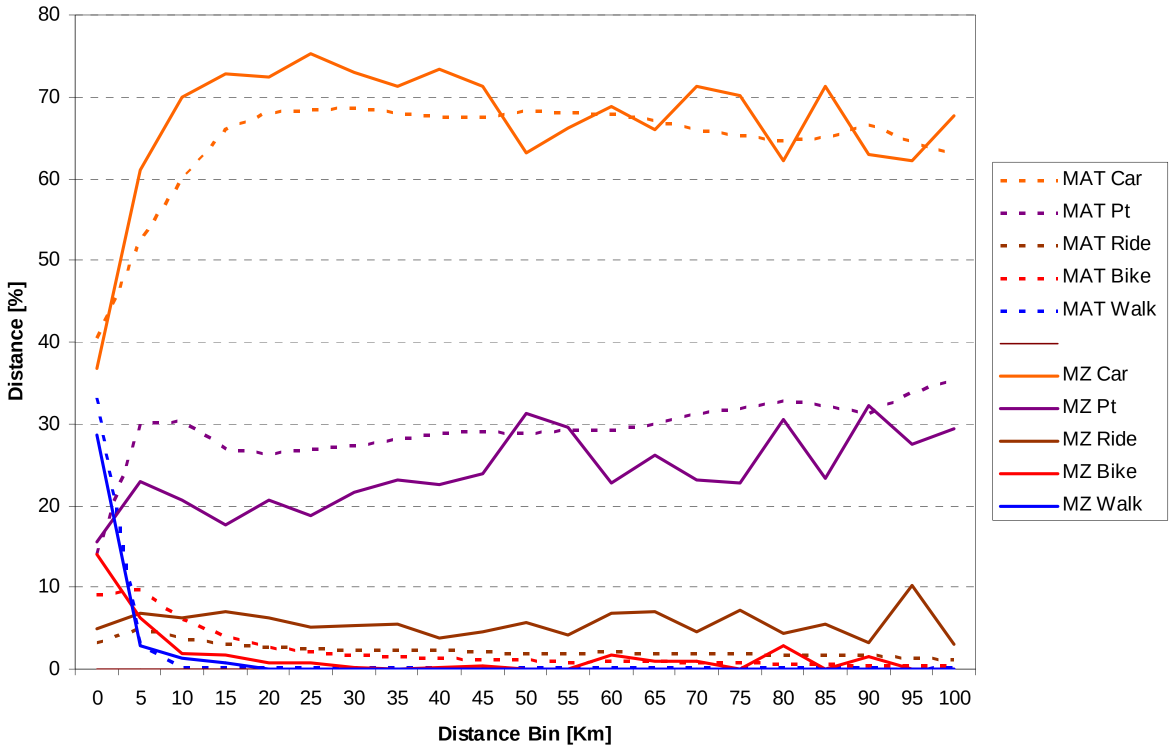
The figure shows that the use of different transport mode in different subtours is reproduced by the model consistently with proportions observed in the reality.

An additional verification of the goodness of the model is to look at the use of the different transport modes according to the distance travelled. Subtours have been grouped according to their length and the share of each of the five modes among these groups has been calculated. The results are showed in Figure 6. Some observations can be made:

- The car mode is the most used for all distance ranges
- Walk has a very high share for short tours.
- Car and public transport sum up for the large majority of subtours starting from trips longer than 10 km.

These observations bring us to the conclusion that also from this point of view the model prediction is quite meaningful, since the same pattern can be observed also in Mikrozensus data. The curves showing MATSim initial demand shares has quite the same form as Microcensus curves, even if a deviation is present. Indeed, it can be noted that overestimation of car travel is mirrored by an underestimation of public transport travel, and vice versa. That can be interpreted as an additional sign that models are working in a reasonable way; public transport travel is occasionally erroneously assigned instead of car travel by the models (and to a lesser extent, for some distance ranges also vice-versa) but this doesn't happens with other modes with which a long journey would be not meaningful.

Figure 6 Main Mode - Distance



The results presented in this section show that the new mode choice model is able to estimate modal choices of the Swiss population realistically. The level of precision of the estimations is comparable with the one of the old model, but it is obtained working at the higher resolution, the subtour level. It seems also that the main shortcomings of the old approach have been overcome by using the new one. In conclusion the new model seems to be suitable to substitute the old one, outperforming it to many extents.

5. Summary and Outlook

The subject of this paper was the introduction of a new mode choice model in the traffic microsimulation tool MATSim-T. The aim of the new model was to provide a better precision and to overcome some shortcomings of the existing model. The model has been embedded in the initial demand stage of the tool.

The paper shortly described the generation of a synthetic population and the other processes which make up the estimation of the initial travel demand. A more detailed description is dedicated to the mode choice, main shortcomings of the old model are discussed and strategies to overcome them in the new model are proposed. The transport mode is now assigned to each agent at the subtour level. This approach constitute an important step forward for the precision of the mode choice model, since before a single mode for a whole day-plan was assigned to simulated individuals. Moreover, this approach allows taking into account in a meaningful way which modes are available for one agent at each stage of his day-plan. The subtour based mode choice model allows capturing the behaviour of persons using different modes in their day-plan. The model is not overestimating anymore the use of car in the central part of the day. A possible further improvement might be to model the travel at an even higher level of resolution, like the trip or the stage, but conserving the consistency of the mode availability at the subtour level.

The main shortcoming of the old model was the fact the behavioural differences at the regional level weren't correctly accounted for. It has been shown in this work that such differences are mostly depending on different planned behaviour which is reflected by the availability of the mobility tools. The modification introduced showed that the model is now reproducing better the reality; however, to overcome the residual error a possible approach might be to use different models for each region. This will be tried in the continuation of this work.

Overall, the presented results show that the method used is effectively able to realistically estimated modal choices of the Swiss population and that it is improving the performance of the old model. Different analyses have been performed in order to test the consistence with Swiss MZ data. A good mode choice model of the initial demand in the pre-process stage of MATSim-T guarantees that the optimization stage will be not too costly. A mode choice module is being integrated also in the optimization stage. When also this tool will be integrated in MATSim-T, it will be possible to estimates if the mode choice module in the pre-process stage will need to be further improved.

6. References

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