

Simulation Game for Future Mobility – Support Tool for the Discussion Process about Scenarios of Future Mobility in SUMP Processes

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1 ABSTRACT

In order to work out and draw up smart and sustainable mobility strategies, it is essential to predict the development of transport demand. This development depends on many factors so an estimation is quite complex. Therefore transport models are often used as a basis for the decision-making- and planning-process. There is a wide range of expected developments, so in order to describe future transport developments, it is helpful to work with various basic development scenarios in these models to calculate future developments. The respective topics for future mobility scenarios are often highly complex and the stakeholders as participants of the planning process have different experiences considering these topics. For this discussion the Institute for Urban and Transport Planning of RWTH Aachen University has developed the simulation game for future mobility as a guide, which uses numerous factors to illustrate the expected developments of transport demand. This game aims to involve all stakeholders in the development of future mobility scenarios through an interactive game. The goal is firstly to illustrate different influential parameters for mobility and transport demand and their possible developments as well as to evaluate the results by identifying accordance and differences in the different expectations of the stakeholders. Then, on the basis of systematical analysis of the individual results of the game, it is possible to pre-structure scenarios for the use in transport models and guide the process.

The basis of the simulation game is a schematical illustration of a city, consisting of 11 areas. Each area represents a functional part of a city (e. g. industry) or a mobility and transport offer (e. g. public transport) and is equipped with one or two question marks. Each question mark corresponds with one mobility-related issue. In the context of this game, the following three categories are considered more closely: general conditions, lifestyle and mobility/transport offers. In these different categories, general conditions and discussed measures are represented. The general conditions with influence on transport behavior in 2050 deal with the population's development, population structure and the development of the job market. Considering changing lifestyles, the handling of Social Media and its possible effects on activity behavior, as well as the influence of online commerce on shopping behavior are outlined in the area lifestyle. In the category of mobility and transport offers, possible developments in the field of electric mobility, the changes of transport costs and a stronger interlinking of different transport modes are introduced. For each of the 15 issues within the areas the game presents two or three different theses as possible developments of the respective issue in the future. One area after the other, the player can choose the thesis, which, he thinks, is most likely and plausible. In the context of a planning process as for example when drawing up a SUMP, the introduced simulation game makes it possible to create a basis for all participants at the beginning of the scenario development. At the same time, the discussion process can be guided based on the evaluation of the game by, for example extracting those theses with the greatest deviation for further discussion and eventually rating them in different scenarios according to their effects, and on the other hand using the theses which are seen equally between the different stakeholders as basis for several scenarios. Through this game the access to the complex topic of transport forecast can be simplified for stakeholders with different background so a better understanding of the scenario circumstances can be reached and through that a higher acceptance.

2 INTRODUCTION AND BACKGROUND

The promotion and development of sustainable mobility concepts in the „StädteRegion Aachen“ (association of municipalities) is currently the focal point of several initiatives and projects. The creation of a long-term framework includes, amongst other projects, the restructuring of transport development planning in Aachen, with special attention to the basic principles of sustainable mobility. In this context, current developments on the European level (Sustainable Urban Mobility Plans (SUMP)) have also been integrated. This leads to the realization of a new transport development plan in the city of Aachen within the context of an extensive

integrative process and a SUMP for the whole region of Aachen which is drawn up as part of the project CIVITAS-DYN@MO supported by the European Committee.

In order to work out and draw up smart and sustainable mobility strategies, it is essential to predict the development of transport demand. This development depends on many factors so an estimation is quite complex. Therefore transport models are often used as a basis for the decision-making- and planning-process. There is often a wide range of expected developments, so in order to describe future transport developments, it is helpful to work with various basic development scenarios and calculate various future scenarios. The respective topics are often highly complex and each participant has different experiences considering these topics. As a result, drawing up these scenarios and including all relevant participants often leads to lengthy discussions. In order to provide guidance for this discussion and include all relevant topics, the Institute for Urban and Transport Planning of RWTH Aachen University has developed the simulation game for future mobility. This has been done in the context of the SUMP-process for the region of Aachen. The goal is firstly to identify different influential parameters for mobility and transport demand as well as their possible developments. Then, on the basis of systematical analysis of the individual results, it is possible to pre-structure scenarios for the use in transport models at a later point in time.

3 SUMP-PROCESS IN THE REGION OF AACHEN

The process of transport development planning for the city of Aachen started in 2011. The latest transport development plan was published in 1995 and the latest Masterplan Mobility in 2000. These plans mainly included a sectoral view for different modes of transport. An up-to-date integral examination of the entire urban transport development for a medium- to long-term time span of 15 to 20 years is currently missing. Furthermore, there are currently no planning principals which could be used for certain modified general conditions. The development of the SUMP is based on a joint work effort in thematical teams. In these teams, the administration works together with external specialists on different topics. (Langweg, Nacken 2012)

Transport and especially environmental problems caused by traffic, e.g. noise and air pollution, cannot be solved simply on city level. Therefore, as of this year, this process has been extended to the whole region supported by the European Union's Civitas Programme. This means that parallel to the process for the city of Aachen, another process for a regional SUMP within the context of the project „CIVITAS DYN@MO“ has begun. Latter process is being controlled by “StädteRegion Aachen” and will orientate itself to the structure of Aachen's SUMP. (CIVITAS-DYN@MO 2011). Both planning processes are used as motivation for the voluntary task of sustainable transport development planning. Therefore, this plans can be classified as a Sustainable Urban Mobility Plan (SUMP).

4 GOAL AND CONTENT OF THE SIMULATION GAME

The goal of the simulation game for future mobility is to introduce the different participants in the context of the SUMP-process to the complexity of forecasts and the development of underlying scenarios. This is of such great importance, because all participants come from different work backgrounds and thus have different points of view and affinities to the subject of transport forecasts. With the help of the game, all participants are supposed to gain a deeper understanding for the development of scenarios and also the integration of complex influential parameters into the scenarios will be increased. Accordingly, not only the integration of the results which come from the transport forecasts based on these scenarios is simplified, but also the use of these results in the planning processes e.g. when drawing up the SUMP.

In the context of this game, the following three categories are considered more closely: general conditions, lifestyle and mobility/transport offers. These categories have already been researched in scientific studies. The handling of such studies and their partly also contrary results is an important foundation for the development of scenarios. In connection with the political processes when drawing up a SUMP, the participants are often overwhelmed. Reasons are the great amount of studies and the difficulty to evaluate their relevance for the respective scenario development, because several different methods have been used in these studies. In addition, such an evaluation would be a very time-consuming task. Here, the simulation game is supposed to serve as an introduction to the discussion of different development possibilities. That is why the development possibilities given as options in the game have been derived, completed and generalized based on results of various studies.

5 STRUCTURE OF THE SIMULATION GAME

Basis of the simulation game is a schematical illustration of a city (see fig. 1), consisting of 10 areas. Each area represents a functional part of a city (e. g. industry) or a mobility and transport offer (e. g. public transport) and ist equipped with one or two question marks. Each question mark corresponds with one mobility-related issue.

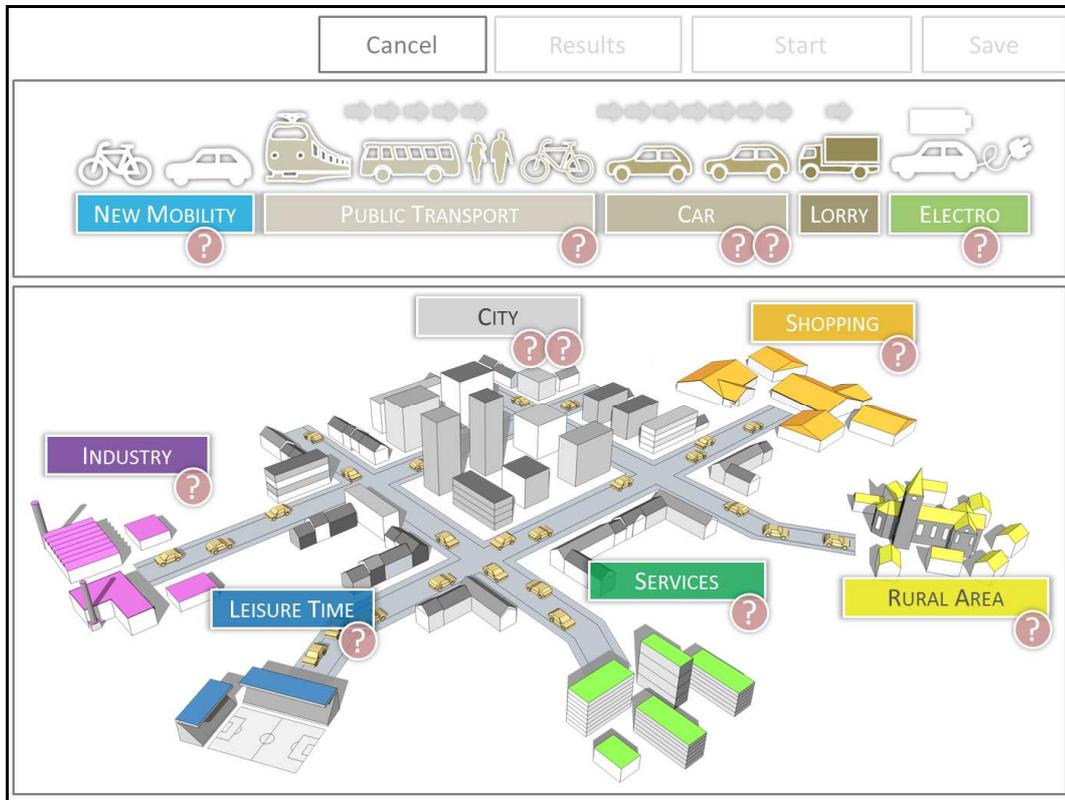


Fig.1 Graphic from the start of the simulation game

Areas and issues within the simulation game	
Area	Issue
<i>Functional part of the city</i>	
City	Population development
	Life expectancy
Shopping	Importance of online commerce
Industry	Transnational outsourcing
Leisure Time	Importance of social media
Services	Jobs in service sector
Rural Area	Suburbanisation
<i>Mobility and transport offers</i>	
New Mobility	Importance of new mobility services
	Combination of mobility services
Public Transport	Financing of public transport
Car	Invention of traffic toll
	Development of fuel costs
Electro	Distribution of electric vehicles
	Range of electric vehicles

Tab. 1 10 Areas and 14 issues within the simulation game

The 14 issues within the game are summarized in table 2 (see tab. 2) and represent circumstances as well as discussed measures. Circumstances cannot or can only be marginally influenced (e.g. the demographic change) and are therefore easier to predict. Discussed measures can be influenced by political decisions and

are therefore difficult to predict (e.g. car tolls). Both factors are of great importance for the future development of mobility and transport demand, which is why they are included in the simulation game. In contrast to the general conditions of the population's development, the general conditions of the category „mobility and transport offers“ is very closely connected to political actions, so here the predictability still has its limits. Nevertheless, in order to develop scenarios it is necessary to make certain assumptions. It is all the more important that participants of the planning process know which general conditions are given in each scenario and that they also support these conditions. Only then, the results, which base on the respective scenarios and were included into the development process, can be evaluated and be taken into account appropriately.

The general conditions with influence on transport behavior in 2050 deal with the population's development as well as population structure and the development of the job market. Considering changing lifestyles, the handling of Social Media and its possible effects on activity behavior, as well as the influence of online commerce on shopping behavior are outlined in the area lifestyle. In the category of mobility and transport offers, possible developments in the field of electric mobility , the changes of transport costs and a stronger interlinking of different transport modes are introduced.

For each of the 14 issues within the areas the game presents two or three different theses as possible developments of the respective issue in the future. One issue after the other, the player can choose the thesis, which, he thinks, is most likely and plausible. Considering the subject of the population's development, the demographic change and its consequences for the development of transport demand are of great importance. These consequences can be changes in traffic volumes, but also new user needs e.g. because the number of elderly travellers increases. With regard to the development of the job market there are studies (IZA, FIT, 2007; Bartsch, K. 2009; Fuchs, J., Söhnlein, D., & Weber, B., 2011) which show that all in all and in a long-term perspective, the number of employees in Germany is expected to decline. At the same time, an increasing number of female and elderly employees leads to a rising employment rate and therefore to a reduction of the development mentioned before. Depending on migration and changes of the employment rate, studies show different developments up until 2050. Apart from that, the subject of job market development also includes other factors such as the possible introduction of flexible working hours, the influence of telecommuting and/or the type of jobs. Will there be a rising number of jobs in the service sector while at the same time the number of jobs in the manufacturing industry declines, as predicted for Germany by the study (IZA, FIT 2007). The influence of the settlement structure and of the activity distribution throughout the area on transport demand is exemplarily represented in the game by possible changes in peoples' and businesses' choice of location (Suburbanisation or reurbanisation? Which effects will the current problem of rising costs of living in urban areas have?).

The importance of Social Media is included in the game by taking into account its possible effects on leisure activities. Respective this issue, the player can choose between the following three theses: (see Fig.2):

- The influence of social media over leisure activities increases, increasing time spent at home. Traffic towards leisure areas decreases.
- The influence of social media over leisure activities increases, but they do not influence leisure areas. Traffic towards leisure areas stays roughly the same as today.
- Social media simplify the coordination of spontaneous meetings. Traffic towards leisure areas increases.

These theses illustrate three possible effects of Social Media on leisure activities and qualitatively describe the consequential effects on leisure traffic volume.

Another main part of the total traffic volume, apart from trips toward leisure areas (32% of all trips (MiD 2008)), are trips toward shopping facilities. These trips make out 21% of the whole trip volume (MiD 2008). When predicting shopping traffic, demographic development should always be taken into account. Although in this case, not the development of the population itself, but the population structure is decisive. In the past, shopping traffic increased because of the growing concentration and the generation of new business types in retail trade. Furthermore the increase of leisure time, which was also used for shopping trips, led to an increase in shopping traffic. In addition, there has been a strong increase of online commerce in the past few years. Concerning future transport development, the question is if a further increase in online commerce will

reduce the shopping traffic volume. The study (ITB, BVU, 2007) assumes that online commerce will partly replace the errands which used to be done in person. In this case there would be a shift of passenger to freight transport. In doing so, the study comes to the conclusion that these developments will compensate each other which means that the total shopping traffic (including non-motorised individual transport (NMIT)) only slightly decreases. In comparison, the the study predicts an increase of trip lengths due to the development of settlement structures (Suburbanisation) and the tendency towards large-scale business types in retail trade. Based on this statement, the study forecasts an increase of about 4.1 % in transport for shopping purposes until 2025. (ITB, BVU, 2007)

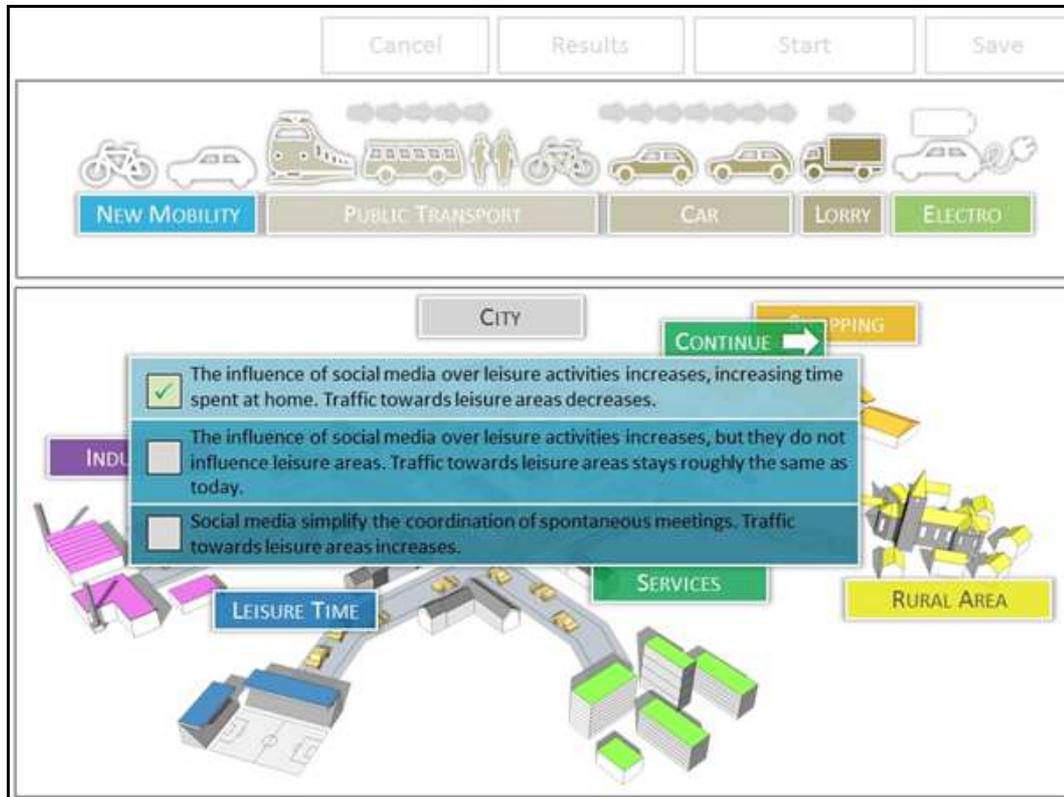


Fig.2: Selection of the possible effects of social media on leisure activities in the simulation game

In this issue, the player can choose from the following options:

- The popularity of online commerce continues to increase. In response to this increase, freight transport throughout the city also increases. Private shopping traffic decreases.
- The popularity of online commerce does not increase. Freight and private shopping traffic stay roughly the same.
- The popularity of online commerce increases. Customers, however, still travel to shop. Freight and private shopping traffic increase.

A subject concerning mobility and transport offers which has been discussed very often are the transport cost trends. These factors have already been included in many forecasts. Based on the predicted oil price development, the German Institute for Economic Research in Berlin has derived the possible development of fuel costs up until the year of 2025. (DIW, 2008, p.18) In contrast there is the development of fuel consumption, where the study predicts a decline down to 5.2 l/100 km for 2025. The Shell Forecast (Shell Deutschland Oil GmbH, 2009) from the year of 2009 assumes that fuel consumption will continue to decline in the years to come. Depending on the scenario, the average prediction are approximately 6 to 6,5 liters/100 km for 2025. All in all this would mean further rising costs in motorised individual transport (MIT). The cost trend in public transport is mainly influenced by staff (40 %) and material costs (30 %). Here, the development of energy prices is not of great importance. Nevertheless, studies also predict significantly rising costs for public transport. The study (DIW, 2008) expects an increase of about 1,5 % per year, due to declining subventions in the public sector. According to the study (DIW, 2008) and the general conditions it bases on, the transport costs will increase more strongly up until 2025 than the general price development.

The study's assumptions also lead to the fact that costs for users of public transport will increase more strongly than for average users of private (car) transport. (DIW, 2008, p. 62 f.) In another study (TRAMP, Difu, IWH, 2006), the transport cost development is seen as the main influential parameter for future travel behaviour. Depending on the scenario, the increase can be more or less strong, but the share of transport costs in the total budget is assumed to be relatively constant because of further price increases. (TRAMP, Difu, IWH, 2006, p. 73 f.) In the context of the simulation game, this subject is represented in theses on the development of fuel costs, the potential implementation of car tolls as well as the development of public transport (service improvement or service reduction because of insufficient financial aids).

Apart from the development of transport costs, the subject of electric mobility has also been discussed to a great deal. The promotion of electric transport is a main goal worldwide. In order to push ahead the distribution of electric vehicles different options are being used such as tax incentives, subventions or privileges (Randelhoff 2012). Therefore the game shows different theses on the distribution of electric vehicles and on the development of these vehicles (range of batteries, charger-infrastructure).

At the same time, changing mobility options due to electric passenger cars and E-bikes as well as the integration of electromobile services will offer new fields of application. Electric mobility can in this case also be seen as a possibility to develop new, innovative transport offers. The progress of this development can have a decisive influence on travel behavior as a whole. Since getting information has become increasingly easier and data is more and more connected, route and mode choice as well as access to services has also become much easier for users. Especially the distribution of smartphones (and similar devices) has made it possible to plan transport use in a timely and spatial flexible way. Another resulting advantage are new information offers (often in real-time) which also improve this planning. Further increase of these possibilities (real-time information, e-tickets, interlinking of different transport offers) can lead to a reduction of accessibility barriers e.g. for public transport. The effects cannot yet be estimated today. The effects of improving individualized public transport modes such as car-sharing and bike rentals by e.g. offering simpler information and booking systems are difficult to predict. Lenz 2011 claims that the linkage between information and communication technology and travel behavior is very complex. This subject is represented in the game by theses on the development and interlinking of transport services. In this issue, the following theses are shown as options:

- The importance of mobility as a service and renting out bikes and cars (Car-sharing) increases. Car traffic decreases.
- Mobility as a service and renting out bikes and cars are not accepted very well by the population. Car traffic stays roughly the same as today.

According to the combination of the player's chosen options, he receives a result which displays a changed image of the city with all changes basing on the chosen developments. At the same time the development choices of all players can be saved and evaluated, enabling the integration of these results into the SUMP process as "majority-scenarios" and also encouraging further discussion of these scenarios.

6 CONCLUSION AND PERSPECTIVE

In the context of a planning process as for example when drawing up a SUMP, the introduced simulation game makes it possible to create a base for all participants at the beginning of the scenario development. This common foundation includes general conditions which need to be taken into consideration. At the same time, the discussion process can be guided based on the evaluation of the varying individual forecasts. This can be done by, for example extracting those theses with the greatest deviation in the game for further discussion and eventually rating them in different scenarios according to their effects, and on the other hand using the theses which are seen equally between the different stakeholders as basis for several scenarios.

The purpose of the simulation is not to analyze future developments, but to encourage the discussion process, to illustrate the complexity of developing and simulating different scenarios for transport development and to make these tasks comprehensible. Therefore it is not possible to include all influential parameters – this would make the game too long-drawn. Therefore, the chosen theses can only represent a small part of the wide range of possible developments and cannot include all the details relevant for each issue. But, since the goal of the game is to introduce participants with different backgrounds to the complexity of transport forecasts and the underlying scenarios, this much detail is not necessary.

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