Harry Timmermans, Tom Bellemans and Soora Rasouli:

A Microsimulation Model for the Evaluation of Transport Policies: Development and Application of ALBATROSS

Baekjin Lee (hereafter ‘Lee’): Would you introduce yourself? What is your major research subject?

Harry Timmermans (hereafter ‘Timmermans’): My name is Harry Timmermans. I am from Eindhoven University of Technology in the Netherlands. The research projects that I am working on are primarily related to activity based modeling and travel forecasting. Most of these belong to the field of transportation, but also urban planning or different components of urban planning – such as retailing, tourism.

Tom Bellemans (hereafter ‘Bellemans’): I’m Tom Bellemans from Hasselt University. I’m doing an associate tutor in transportation research institute in the university. I’m mainly working on transportation behavior model.

Soora Rasouli (hereafter ‘Rasouli’): I’m Soora Rasouli. I’m doing a Ph.D in Eindhoven University on a complex model of travel forecasting focusing on uncertainty of these models.

Lee: I heard that you visited several countries and attended seminars recently. Could you tell me what these seminars were for?

Timmermans: Most of them were related to activity based modeling. I participated in these seminars for general interest. But the other components were related to the major European project - uncertainty in complex models.

Lee: Could you explain ALBATROSS project briefly?

Timmermans: ALBATROSS project started in 1998 for Dutch Ministry of transportation. Actually,
Netherlands was one of the first countries working with tour based models that were somewhat similar to nowadays’ activity based models. However, their existing models were too limited. For instance, there were no constraints. They could not deal with households and also other policy domains. Thus, the link between urban planning and transportation planning was not very strongly developed.

They needed a more integrated approach to transportation modeling that could address specific issues such as the effects of opening hours on travel. They had the special program for research activities that look at the potential of new developments - that could be technology, new models, or new data collection.

> Seoyeon Yoon (hereafter ‘Yoon’): Could you explain your FEATHERS projects?

> Bellemans: FEATHERS (Forecasting Evolutionary Activity-Travel of Household and their Environmental Repercussions) project was started within Flemish research project funded by the Flemish government. It was implemented by two consecutive projects.

The first one’s primary work was on FEATHERS, we also work together with people from Eindhoven University. In order to set up the system which could simulate activity based modeling and model, we used the ALBATROSS model from Eindhoven University. The main reason that I focused on ALBATROSS is that we want to do policy evaluation such as ‘what’s the impact of certain transportation or traffic management policies’. That’s the reason the ministry justified the choice for the activity base modeling. Activity based models have this behavior component which allows for modeling the behavioral impacts of these policies on transportation fields. The second project was an application dimension, expanding the model to other policy domains - not only transportation domains, but also domains like traffic safety, emissions, human health, etc.

> Lee: Could you explain your research topic, uncertainty?

> Rasouli: My Ph.D project is a part of a very big European project which consists of 6 different organizations in Europe. It was 4 years of long project. Two key groups of this research are from England and Germany. And four of the others are taking care of case studies. Each of these 4 groups is working on a specific model - Eindhoven university is working on transportation model(ALBATROSS), the group in Oslo is working on air quality model. Fera in UK is working on land-use response to climate and economic change.

So, first of all, we need to give all the details to the key groups, to give them the ability to put all these models into the web and chain them together on the web. So the first one year of that project was just gathering data, giving data to them and getting familiar with the functionality of other models. After that, we needed to expand the existing model to be able to take into account uncertainty. At that moment, ALBATROSS didn’t cover any
component for considering uncertainty. So, I started my research expanding ALBATROSS.

Lee: Recently, many people got lots of interest in Activity based model. What do you think about the reason that people have interests in activity based model?

Timmermans: Maybe I should start saying that there is quite some variation. Now, especially the Americans are picking up very fast the development and applications of Activity based models. One of the reasons I think TRB organization has been very active in promoting Activity based models: very active task force, several conferences that were focused on the application of activity based model, training workshops, etc.

Otherwise, I think much of this increasing interest was deeply related to the increasing computing power. This means that we can simulate individuals. And I think this really creates new opportunities. Today, these opportunities are not only related to transportation issues. Indeed you can simulate from aggregate distributions all the way down to individual paths. We don’t need assignment modules anymore. We can directly get information about people due to the emergence of GPS data, and other kinds of new data. So, we no longer have to rely on traditional data. I’m pretty sure that the next breakthrough in this whole sequence.

Because it is micro-simulation, it’s much easier to deal with social problems such as health and emissions. You can attach all these kinds of indicators that are fairly different, especially for integrated policies. Thus, indicators from transportation, urban planning and health etc. come together. Integrated models have become important, linking environmental policies, urban policies and socio-economic policies in one big model system.

Bellemans: You can also see that governments started to ask questions which can not be answered by the traditional modeling tool. For example, in Netherlands, we have a similar experience in problems of social exclusion of specific sub-groups of population. If you want to assess of the impacts of certain policy measures or certain policies on these particular groups, or perhaps on other application domains, this integrated model which are the way to find of answer to those kinds of the questions – I think part of popularity, increase of interest is due to the fact that some of the questions which remain un-answered can get the answer with the support of the model. I think this is the one of the reason.

Yoon: There are many Activity Based Model models that are being developed and each of them has their own assumptions or different ways of modeling behavior or travel pattern. What do you think is the major distinction of ALBATROSS from the other models?

Timmermans: I think that much of the existing models like AMOS or the models in California which other consultants are using, are kinds of extensions of simple discreet choice models such as the nested logit. Often these model systems consist of a set of largely independent sub-models. These are integrated using a simulation
This is a page from a document discussing the development and implementation of the ALBATROSS software, particularly focusing on the FEATHERS activity-based model. The text mentions that ALBATROSS was developed for the Dutch Ministry and was intended to be used for decision-making processes. It introduces concepts of activity-based modeling and the importance of integrating different models to address various types of decision-making scenarios. The text also touches on the integration of ALBATROSS with other decision support systems, highlighting the need for flexibility in model design to accommodate different user requirements.
means that you have to start to thinking about data structure, and modular organization of the software.

Lee: What's the meaning of considering uncertainty in transportation model?

Rasouli: I think that is mostly related to policy makers decision. If they don't consider uncertainty and just rely on the deterministic model results; consider input as a fixed input or run the model once and get one result - then they might face some problems in later stages. For example, if they intend to design infrastructure based on the model result, it might be very over design or under design. I will give you an example, in ALBATROSS, two types of speed is used; free floating and peak hour speed. But, we know that it is not what usually happens in real world. That free floating speed and also peak hour speed is not constant. They change from day to day, week to week and month to month. Considering this kind of variability will lead you to capture the reality better.

Lee: As far as I know, there are several type of uncertainty - data collection, model. But I think the most important one which brings the highest impact is that uncertainty from the policy decision. That's why we always get the problem. That's always be the obstacles to make more exact results.

Rasouli: One of our researches has been done considering uncertainty at the individual level. When we run ALBATROSS several times, the trajectory of people are different in each run because of the random seed and probabilistic decision trees. If someone would argue that what is the benefit of uncertainty analysis at the individual level? The answer would be improving the model based on the result of this analysis. If the uncertainty is too high, then we could say that the decision trees don't work properly and some more influential variables are required to be added in the decision trees or so on.

Yoon: So, after all, if there is any easy way to separate impact of policy and uncertainty of the model, what would you recommend to do that?

Rasouli: We need to separate the uncertainty in terms of input/model uncertainty and uncertainty comes from different scenarios or policies. As far as the model in use is able to do that, the differentiation between shares of each uncertainty sources is more obvious for policy makers which subsequently result in more reliable decisions.

Lee: Could you explain national, regional, urban planning using ALBATROSS or FEATHERS? Could you explain on practical perspective?

Bellemans: I'd like to say one project I am currently working on. It's not the strictly planned project, but it related them. It is a research project of evaluating impacts of light trail in the context of city development. The
The purpose of this project is to identify the impact of this light-trail on the transportation system which might be different depending on the long-term evolution in terms of land-use development. Like long-term scenarios, we have to develop set of different options. One of the major assumptions is light-trail will play on the role in each of these options. That is an example of urban application of this Activity based model in this context.

> **Lee:** When we try to introduce new transport system, such as LRT - first time to introduce and we don't know the current activity. How can we apply ALBATROSS in this situation?

> **Timmermans:** The problem is that the data used for estimating the model could not reflect this transport mode. To account for that, we have developed an approach which we applied to congestion pricing. We use stated adaptation experiments to predict change in the skeleton of activity-travel patterns. The decision tables are then used to schedule the activities and travel.

What we do was using the outcomes of the Stated-adaptation models to predict seed anchor points in scheduling process. And based on that, the ALBATROSS system is applied for any secondary effect.

> **Yoon:** Do you know any comparison between different models?

> **Timmermans:** Not that many. We did compare to ALBATROSS with PCATS, famous Japanese system. Prof. Fujii helped us. We also compared it to a Nested logit structure. ALBATROSS came out best one in terms of reproducing the data. Also, we have a before & after situation and we can predict the effect of policy.

> **Lee:** Do you have any experience to apply FEATHER system or the comparison to other nations?

> **Bellemans:** No, we didn’t compare it with other models.

> **Timmermans:** I’d like to say that a fair comparison is very difficult. Just a simple example, the original model system in PCATS assumes that some activities are fixed, thus that is not predicted. But, in ALBATROSS nothing is fixed. So, what to do?

> **Yoon:** I think Activity based model structure and model depend a lot on different cultural or local situation of the countries. For example, Southern California does not really consider transit seriously in their model. But in Korean situation, we are experiencing big changes. Slow growth, aging problem, and decreasing population. What is the biggest strength of Activity based model in such situations compare to other models?

> **Timmermans:** I’m not sure if it is necessarily related in that sense to the policy issues. I think it depends on higher sensitivity to all kinds of mechanisms that may people decide how to organize activity and travel in time.
Lee: So far, we have the regulations to evaluate the new project investment. There is a manual based on four-step model. This works like the regulations. Even if private companies try to create new demand on the project site, they need to use the manual on how to use it.

Life: Do you have any idea about how? Because I think these kinds of social change problem would also be the uncertainty.

Rasul: Yeah, there are other kinds of projects that I know are quite interesting. This project considered the whole life span of people - they moved their house place and its pattern, lower level life style, when people divorce, when people get child, etc.

Lee: But what do you have an idea about how to implement the regulations? For example, do you think that Korea hasn't experienced rapid development. All economic growth and population increase.

Life: Until now, Korea has experienced rapid development. All economic growth and population increase. Then how about life quality? I mean, the concept of activity-based modeling has been misunderstood. For example, they are talking about the limitation of the cost and also of the economic crisis. But what I'm talking about is the behavioral mechanism, what I'm taking about is the outcomes.

Lee: But now, Korea started to decline - decline in everything. Change the system, whether it is increasing or not. Are you, the people who get to work or not, That could reflect the economic situation.

Timmermans: What you describe would be the situation that has people go to work. The ALBATROSS system is a process model that starts by simulating whether the people will get to work or not. That could reflect the economic situation.
nation. This is standard one, but all model have to use this data. But still, in the practical point of view, Activity based model has a little difficulty to apply. Do you have any opinion to clear this obstacle in the practical part in the database?

Timmermans: I think we should realize that in terms of data requirements, traditional 4 step models and activity based models are very similar. The one big difference is constraints. Because traditional four-step model are not considering these.

As for travel behavior data, the only condition is that you need data that allows you to say something about the dependency between activity and travel. So, if the travel survey may include ‘how often do you go shopping’, ‘how often do you work’, then you cannot estimate the dependency. At least one needs a sequence of activities and travel during the day. Most modern travel surveys thus suffice.

In case of Korea, I think you should know why Activity based models would not be possible. You don’t need all the data. You don’t need more data. Actually, based on the seminar that I attended yesterday, I could not understand why they would think other data to develop an activity based model.

Lee: Any other comments?

Timmermans: This is my second time in Korea. I think that people are slowly becoming more open minded about activity based models. When I first visited Korea, it seemed that people were thinking ‘okay, that is a different world’. Now, they seemed a little bit hesitant to try. I think this is the right time to build an activity-based model and compare it with a traditional model. And also, let people know the potential of activity based models - wide spectrum of different of policy domains, integrated approach. I think what you need is more training, open workshops and seminars.

Rasouli: This is my first visit and actually, it was very valuable time for me to know what’s going on in my research area in other parts of the world.

Bellemans: I’m happy to be here with you. I’d like to note that you should firstly take in-detail comparison between this micro-scope model and traditional 4 step model. I think Activity based model could tell you more than four-step model especially, in policy field. Thank you.