

## ***Activity-Based Modeling Language as a Communication Tool***

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### **Getting Better or Worse?**

Effective communication between the model developers and the wider community of model users and transportation planners has always posed a certain problem, even with 4-step models. More sophisticated modeling techniques such as Activity-Based (AB) models magnify the communication challenges, especially, when it comes to understanding the underlying intricate mathematics and algorithms. However, AB models also offer new opportunities for communication, particularly, in view of the more behaviorally realistic model outputs that essentially take the form of, and can be reported in the same manner as a full daily household travel survey.

This paper is based on the extensive experience of AB model development, support, and application in New York, Columbus, Montreal, Atlanta, San-Francisco Bay Area, and other cities during the period of 2000-2008. It represents a summary of critical issues associated with communication between the model developers and users at different stages of model development, and in planning applications, including the unique experience of special hands-on training courses on AB modeling organized for the New York Metropolitan Transportation Counsel in 2003 and for the Bay Area Metropolitan Transportation Commission in 2006.

### **Golden Rule: Client is a Partner**

Many communication problems are more psychological than technical in nature. They largely stem from the wrong self-positioning of the model developers with respect to model users in their business relationship. These problems can be easily avoided if the appropriate steps are taken by the model developer, but one should not expect that it will happen automatically. The following general rules and principles can be recommended to model developers:

- It all starts with the right attitude. Explain to your clients that they are not being asked to *buy* a model, and that we the consultants are not *selling* models. Instead, both sides are entering a partnership to develop a tool that is going to be integrated into the agency's everyday life. The developer provides knowledge and technology options. The client has the final word and will be taking a full responsibility for the final product. Co-creation is probably the best word to characterize a successful model development project. Consultants and clients develop a model jointly.
- We find it useful to refer to the following developer-client analogies taken from other businesses for illustration and compare them to travel modeling. The following examples are ranked from the worst to best in terms of their relevance to the travel modeling business (in the interactive presentation the audience will be asked to rank these examples before the actual ranking is revealed):
  - (0) MPO buys a model from the consultant like you buy Microsoft products,
  - (I) MPO is a patient and the consultant is a doctor who prescribes what to do,

- (II) MPOs is a client and the consultant is a lawyer who defends them,
- (III) MPOs is investor and the consultant is a financial consultant who advise where to invest,
- (IV) MPO is a home owner who decided to re-build a house and the consultant is a contractor,
- (V) MPO is a model developer and the consultant is a temporary employee.
- It is important to avoid the following two attitudinal extremes that are very frequently found in travel modeling profession from the client side in order to and bring the client to a balanced and correct level of understanding:
  - Skepticism:
    - “I do not understand models and do not trust them...”
    - “I heard from other people ...” (masked resistance stemming from the fear).
    - “I took a look at the results in some particular area or link and it looks ugly...”
  - Worship / high expectations:
    - “A model can give answers to all questions”
    - “A model can replicate the reality 100%”
  - Balanced / Right attitude:
    - A model can do a certain job it is designed to do; not less but not more either; it is not a piece of artificial intelligence.
    - There is no need to test a model beyond the design features. If a feature is missing it is not going to emerge by itself. A clear recognition of the model limitations is probably one of the most important elements of professionalism.

## Five Constructive Ways to Communicate

We can recommend five constructive ways to foster good communication between the model developers and users. The choice of the communication method largely depends on the qualification and background of the client staff. These ways are not mutually exclusive, and can be effectively combined in any manner. All of them eventually lead to an understanding of AB models, and each of them is beneficial in its own way. We rank them by level of technical sophistication, from the least technical to most:

- (I) Sensitive behavioral instrument for simulation of the reality as the bottom line (good starting point for planners dealing with the reality):
  - Emphasis on sensitivity and realistic consequences of projects or policies,
  - Explaining what are the variables / impacts that generated a particular output, with separation of impacts whenever possible,
  - Good and concise reports / tables/ maps is one of the key methods (examples will be included in the presentation),
- (II) Data view (especially efficient for those who are proficient with travel surveys):
  - AB model can be viewed as an entire-population survey,
  - First, you synthesize population (like having a full Census),
  - Then, you add fields (like asking questions in the survey) in a certain order,

- Tour construction procedure (example is provided in the presentation) normally works as a very good and revelatory exercise,
- Processing and summarizing the survey data is very similar (frequently identical) to certain model estimation and/or application steps,
- A very good exercise would certify one as a first-grade AB modeler if he/she could build a trip table (for a particular purpose, mode, and time-of-day period) from a tour-format file (use SAS, SPSS, Fox or any other programming language).
- (III) The model as a piece of software (that is an attractive way for those who have a computer science or at least some minimal programming background). The following grades of “taking over the model” that listed below (from the simplest to most advanced) have to be encouraged on the client side:
  - Ability to run the model and test it,
  - Understanding and manipulation of inputs,
  - Understanding and processing of outputs/reports,
  - Ability to make adjustments/amendments on the open code architecture,
  - Connecting the pieces of the program to meaningful parts described in the model development report.
- (IV) Extension of a 4-step model (a natural way for experienced 4-step modelers); the following points can be made:
  - There are many analogues and similar modeling components between 4-step and AB models (more than most practitioners would think); using these analogies whenever possible makes the AB model much easier to understand; the presentation includes several examples,
  - Leaning on familiar terminology, for example:
    - Tour is a round trip, half-tour as a journey (to work) or linked trip,
    - Activity pattern is a simultaneous tour-frequency model,
    - Primary tour destination choice is very much like trip distribution for linked trips.
  - The idea of micro-simulation (that is the major technical difference between 4-setp and AB models and frequently the main stumbling block for 4-setp modelers) can be very effectively explained as an extreme sample enumeration approach (models are applied to individuals rather than aggregate Origin-Destination matrices, but many models are essentially the same or very similar); it just requires one to think in “lists” rather than in “matrices”; the presentation includes an Excel-based example illustrating the micro-simulation technique.
  - Graphical presentation of the network simulation results (maps with traffic/transit volumes, V/C, delays, etc) is exactly the same for AB model as for 4-step model; experienced 4-step modelers who are proficient with networks immediately feel very comfortable with this part; in this regard, AB model can be viewed as just a different way to produce assignable trip tables.
  - FTA User-Benefit calculation technique is essentially the same for AB models with minor modifications:
    - Fixed tour table in terms of the list of tours and primary destinations (instead of fixed trip table),

- Entire-tour (round-trip) mode choice, logsum, and User Benefits (instead of one-directional trip unit).
- (V) Decision-making chain that is an attractive way for behavioral modelers and specifically for younger generation of graduates who have learned about AB models in the university setting, but do not have an extensive practical experience with 4-step models. Interestingly, this way of approaching AB models might be attractive for practitioners who are not extremely technical, but who are interested in travel behavior dynamics and traveler preferences. The following aspects can be mentioned in particular:
  - The key factor in understanding an AB model from this perspective is a certain level of proficiency with (sometimes) intricate choice constructs, where the decision-making unit, choice alternatives, and /or utility components might not be easily identified,
  - It is very beneficial to gain an insight into the estimation of some AB models using a standard statistical software package such as ALOGIT, where rows and columns in the data file are directly associated with decision-making units, alternatives, and variables,
  - The presentation contains a set of examples and an interactive part where the audience is asked questions before the answer is revealed; it starts with simple / obvious examples and ends with some examples that might confuse even a top-level behavioral modeler (for example formation of a travel party for joint tours through individual binary choice).

## Conclusion

Building an effective communication with the client is the most essential prerequisite for success in a project to develop and deploy an AB model in a MPO or other planning agency. Despite the more complicated analytical structure of AB models compared to 4-step models, they also provide many additional opportunities for communication that can be appreciated by both model users and the wider community of transportation planners who consume model results. Only through effective communication and partnership with the clients, can consultants ensure real progress in the travel modeling profession. In particular, both sides – model developers and planner clients – contribute their professional judgment to the process in different forms. The following 5 steps can be outlined to summarize what we see as the most productive approach:

1. Develop the best and most advanced model within the given time budget & data constraints,
2. Communicate closely with the planners who know the local reality, analyze the results, be open to see what is right or wrong, and aim to understand why,
3. Identify directions for the further model improvement / missing features,
4. Communicate with the top-level modelers / academics / researchers to see what can be done (useful ideas, new research directions),
5. Go to back to 1. A full convergence can not expected, however, at each iteration you will definitely have a better model.

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