MODELING PITFALLS WHEN SIMULATING HUMAN BEHAVIOR

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ABSTRACT

When capturing human behavior in simulation scenarios, modelers face additional complexities because human entities can make autonomous decisions that may be hard to model. For example, in modeling service systems, the modeler may need to consider customer impatience. Customer impatience can leads to some uncertain behavior such as balking, reneging and in some cases, jockeying. These decisions are made under uncertainty and thus are prone to human biases, personal differences, previous experiences with similar situations, the importance or criticality of service to be received, the availability of alternative services at a future time, etc.

Modelers may apply various approaches to model such human behavior. One method for modeling impatience is the use of probability distributions. In other words, triggering the desired behavior according to random numbers generated from some probability distributions. For example, to trigger balking, the simulation model may include the following steps: Generating a random number at arrival, assigning the number as an attribute of the entity, and then triggering the behavior (joining queue or balking) at the proper moment in the simulation run based on the value of the attribute. This approach ignores the impact of the dynamics of simulation on the decision-making process and assumes that customer's behavior is completely random. Many analytical and simulation studies employ this approach to perform only what-if-analysis and to investigate the hypothetical impact of various balking patterns and rates on queuing performance.

Reneging is much harder to model than balking. Whether a customer balks or joins the queue is a one-time decision that is made at the time of arrival. Reneging events, on the other hand, can happen at any time after joining the queue. The possibility of a reneging decision lingers over a period of time that starts from the moment of joining the queue until just before the service is complete. Therefore, many more factors and conditions can influence reneging decisions over this period.

In modeling the behavior of impatient customers, the modeler faces many challenges including: estimating the necessary probability distributions and their parameters; identifying vital state variables and their relationship with customer's behavior; and finally estimating the threshold values

of such state variables that trigger certain behavior. To add to the complexity, the threshold values may also be different for various people. More often than not, the above information is not available, especially when a future system is being modeled. In such circumstances, the modeler is forced to collect field data from the existing system or a similar system.

Pitfalls of such approaches include: (1) In many instances balking, reneging, etc. does not happen often enough to produce sufficient observational data from the field, which may unreasonably require extended time and add to the cost of data collection; (2) accurate data collection for events such as reneging often needs a sophisticated data collection procedure that may be costly to implement; and (3) such data collection processes are often intrusive to people or may need consent and collaboration from them. The latter may also contaminate the collected data.

Current study focuses on a flexible, interactive computer-based data collection model. The objective is to develop an environment that allows the general population or a targeted population to experiment with the model. It is expected that the model provide the ability for identifying and quantifying state variables that are correlated with a particular behavior. Preliminary experiments have created reasonable results, and further studies and experimentation are ongoing. If successful, the proposed data collection method allows for the production of a large number of observational data that would alleviate various shortcomings of collecting data in the field.