CHAPTER 4

Current Objective: Improved Usability

In addition to improving the match of synthetic forces to human behavior itself, there are several aspects of these models that must be improved so they can be developed, tested, and used by modelers and analysts. A large amount of time is often required to build models and understand their behavior, more than we believe should be necessary. The difficulties of simply creating and manipulating models of behavior can preclude us from spending more time developing and testing models, and using these models in training or for performing "what-if" analyses.

While Pew and Mavor (1998, p. 10) initially note that their report will not address usability, they later (p. 282) note the need to have quickly reconfigurable models. They also discuss (p. 292) ease of use. This revision is completely appropriate because usability is important. Models that are too difficult to be used are not used. This issue is also being taken up in the next generation of simulation models in the United States (Ceranowicz, 1998).

4.1 Usability of the Models

As we have noted before (Ritter, Jones, & Baxter, 1998b; Ritter & Larkin, 1994), cognitive models suffer from usability problems. Few lessons from the field of Human-Computer Interaction (HCI) have been re-applied to increase the understanding of the models themselves, even though many results and techniques in HCI have been discovered using cognitive modeling.

Modelers have to interact with the model several times and in several ways over the lifetime of the model. As a first step, the models must be easy to create. As part of the creation and validation process, the models must be debugged on the syntactic level (will it run?), on the knowledge level (does it perform the task?), and on a behavioral level (does it perform the task like a human?). All of these levels are important if the costs of acquiring behaviors are to be reduced. While we can point to some recent advances in usability (Anderson & Lebiere, 1998; Jones, 1999b; Kalus & Hirst, 1999; Ritter et al., 1998b), further work will be required.

It is also probably fair to say that cognitive models can often be difficult to explain and understand. This problem has been noted as a result in a recent Air Force model comparison exercise, AMBR, covered in more detail in Section 6.2.7 (Gluck & Pew, 2001a). The difficulty in understanding a model's behavior is partially due to their complexity, but it is compounded at times by the difficulty of their interfaces not supporting the models in a structured way, not displaying the model's state, and not supporting exploration of the model's state. In many cases this is not intentional, but arises out of the modeling languages youth as programming languages, and that support for usability takes time away from applications and modeling itself.

4.2 Desired Accuracy of the Models

Another problem is knowing when to stop improving the model. In science for science's sake, there is no limit—the model is continually improved. In the case of engineering-like applications, such as behavioral models in synthetic environments, knowing when to stop is a valid question. In many cases we do not know how accurate these models have to be in order to be useful and at what point additional accuracy is no longer worthwhile. For example, does having an emotional, simulated opponent lead to better or worse training?

The purpose and goals of each modeling project will help determine when to stop development, so they need to be carefully laid out when developing a model of behavior. The stopping rule also applies to the synthetic environment as well as the model—there is no point in developing a simulation that is too detailed. This question is becoming more important as the models become more accurate and modifiable.

4.3 Aggregation and Disaggregation of Behaviors

A clear requirement for simulations in synthetic environments is the ability to aggregate or summarize subunits and, in other situations, the ability to disaggregate and place the subunits from a larger grouping. When the tanks in a platoon are each simulated in a platform-level simulation, they must be aggregated to display them as a platoon on a more abstract or larger-scale map. Similarly, higher-level units may have to be placed into a simulation when moving a larger unit into a platform-level simulation. This aggregation (or disaggregation) may need to occur multiple times when crossing levels of resolution to provide the right level for a report.

This area has received a limited amount of study, yet it is a common need across multiple types of simulations. None of the cognitive architectures examined in Pew and Mavor (1998, Table 3.1) or here offer any insight. We can only note that several of the architectures (e.g., COGNET, Soar) are designed to support multiple agents.

4.4 Summary

Environments for interacting with existing modeling architectures are generally poorer than those now provided for most programming languages. The requirements for modeling are greater than general programming, including the need for adjustable accuracy, different levels of analyses, and multiple measurements from running programs. These factors contribute to making modeling difficult. We need new models and new techniques for building and using models.