

Summary

Objective

This monograph draws upon a number of the authors' past studies to illustrate with concrete examples how the methods of multiresolution, multiperspective modeling (MRMPM) and exploratory analysis relate to model validation. The studies themselves were not concerned with model validation, but rather with matters of strategic planning, defense planning, transformation-related experimentation campaigns, logistics, flood protection, and even models of adversary behavior. Nonetheless, the studies had implications for validation, and it is our objective to pull those implications together here.

The Domain of Relevance

Our conclusions are not particularly relevant to instances in which the models in question are solidly based in settled theory or empirical testing appropriate to the new application being envisaged. Rather, they apply when the models or their data are more afflicted with uncertainty. For example, one may not be entirely sure that the model is correct structurally, but one has a seemingly reasonable theory or a good deal of experience to support it. Or perhaps the model is solid, but the input data for the application are highly uncertain. Both of these circumstances are common in strategic planning and policy analysis. They are also common in military applications such as operations planning, acquisitions planning, and training. For example, no one has a "correct" model of war with all its notorious complications, and, even if such a model existed, it would have large numbers of uncertain inputs.

Broadening the Concept of Validation

In such cases, we believe that model validation should be construed quite differently than might be suggested by the usual definition of validity. A validation process might reasonably conclude by assessing the model and its associated databases as "valid for exploratory analysis" or "valid, subject to the principal assumptions underlying the model, for exploratory analysis." These assessments, of course, would apply only to the context in question. Our point is

that it often cannot reasonably be concluded that a model and its data are “valid” but less reliably predictive. They may, however, be both useful and good in more-limited ways. Therefore, one should aspire only to more-limited assessments such as those indicated.

New Criteria for Assessing Models

We believe that when working within this troubled but common domain, it is particularly important for two criteria to be met in assessing a model (and its associated data) (page 16):

- The model should be *comprehensible* and *explainable*, often in a way conducive to explaining its workings with a credible and suitable “story.”
- The model and its data should deal effectively with uncertainty, possibly *massive uncertainty*.

Crucial Enablers

If one accepts these new criteria, then it becomes important to know how to meet them. Drawing upon our experience over the years, we argue here that crucial enabling capabilities are provided by the emerging theory and practice of (1) multiresolution, multiperspective modeling, including use of families of models and games (pp. 1–3), and (2) exploratory analysis (pp. 3–4). We call upon a number of past studies that illustrate their value for at least three important functions:

1. Extrapolating, generalizing, and abstracting from a small set of analyses accomplished with detailed models (i.e., moving from results of a few scenarios to broad conclusions, which often is facilitated by having lower-resolution models than those used for the few in-depth analyses) (pp. 8–11).
2. Planning top-down, with decomposition from objectives through desired results (or effects) to tasks, which lends itself naturally to multiresolution, multiperspective methods (pp. 11–14).
3. Providing a broad, synoptic assessment of a problem area, as is crucial in the capabilities-based planning emphasized by the Department of Defense (DoD)—i.e., using exploratory analysis to understand “envelopes” of capability (pp. 14–15).

In all of the studies discussed, the enablers also proved important to achieving a deep understanding of problems and communicating insights credibly to others (pp. 30–34).