

## Chapter 2

# Modeling Using a Semi-Formal Visual Language

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### ABSTRACT

- Basis of the MOT Modeling System
  - Schema representation in MOT
  - Objectives of the representation system
  - Construction Principles
- Basic Knowledge Types and Relations
- Syntax Rules of the MOT Language
  - The MOT meta-model
  - Rules regarding the origin and destination of links
  - Rules regarding cycles and multiplicity of links
- Representing other types of models in MOT
  - Semantic trees and a conceptual maps
  - Semantic networks
  - Flow charts
  - Causal Diagrams and Decision Trees
  - Inference trees

In this chapter, we present a visual knowledge representation method that can be used by software designers to construct a learning system or task support system. The *Modeling using Object Types* (MOT) method can also be used in other contexts, especially as a support tool for learners or by experts wishing to represent a particular area of knowledge. In the context of constructivist pedagogy, such activities overlap. Because it places users in a problem-solving environment, a task support system allows them to construct *new* knowledge. Conversely, a constructivist

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learning system can use a task support system as a basis for learning activities that focus on solving *existing* problems, either real or imagined. Such an environment can also engage learners in instructional engineering activities per se by applying the principle that one understands what one can explain clearly to others.

The representational method presented here was developed in 1992 as part of a university course on integrating knowledge modeling into the field of instructional design. The method was further refined and became the basis for a modeling tool used in an instructional engineering workshop (Paquette, Crevier & Aubin, 1994). The tool is now integrated into the ADISA system (Distributed Workshop in Learning System Engineering), but also exists in two versions, MOT and MOT+, which will be presented in Chapter 8. More recently, this representation language has evolved into a scenario editor and ontology editor, first incorporated in MOT then adapted as a central tool in the TELOS system, which we will introduce in Part III.

In Chapter 1, we outlined various forms of knowledge representation used in education and computer engineering. The different models used by a project require modeling techniques that are distinct yet complementary. Instructional designers need an integrated formalism that is easily accessible and able to provide them with a coherent overview of key processes, concepts, and strategies that describe a learning system. Rather than distinguish between conceptual models, procedural models, and theoretical models, thus creating a proliferation of models, the system presented here stresses an integrated approach to different types of knowledge, notably concepts, procedures, and principles, and to their instantiation as facts. Such an approach is necessary in order to facilitate acquisition of the technique by learning system designers and users.

This effort at simplification is offset by the general nature of modeling using object types. Our representation system can serve the same

function as many of the techniques presented in the previous chapter; indeed, these can be re-expressed as MOT models, and will be described more fully in this chapter.

In the MOT system, creating a typology of knowledge objects and links is essential because pedagogical treatment differs for each type. For example, if the knowledge object is a concept, we can construct it through a process of induction, alternating between the specific and the general through examples and counter examples. If the knowledge object is a process, we can simulate and construct it by solving increasingly complex problems. If the knowledge object is a principle, we can test it in various applications and then formulate it more precisely through discussion forums.

We will first present the basic principles of the representation system, then its main components and modeling rules. We will then conclude the chapter with an analysis of the possibilities and limits of the representation system with regard to certain criteria.

## **2.1 THEORETICAL BASIS OF THE MOT MODELING SYSTEM**

In this section, we will present the basic principles of the MOT representation system. We will apply the concept of schema and identify the different types of knowledge and links used in other representation systems. We will then define the objectives and principles of the MOT system.

### **Schema Representation in MOT**

The MOT representation system is based on the theory of schemas presented in the preceding chapter. The distinction between two broad categories of schemas—declarative or conceptual schemas, and procedural schemas—is now well accepted. The first category involves data, while the second includes the procedures and methods

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