Chapter V
Relationships

ABSTRACT

The focus of this chapter is on how interactions between objects create new meanings. It develops a model of business rules, and shows how mutability supports innovation. It introduces the rules that support inference and innovation by manipulating the patterns of information that constitute different meanings.

This chapter focuses on the interactions among objects. These interactions convey information and are relationships between objects. Thus, relationships between objects are also information bearing, meaningful objects. In this way, new meanings are created by objects that relate to each other. Without relationships, meanings cannot engage, patterns cannot exist, and knowledge cannot be.

Knowledge is a configuration of facts about interactions that make the world around us what it is. An interaction may be nominally scaled, ordinally scaled, difference scaled, or ratio scaled. The rule expressions in Box 4.1 were relationships. The relationship between the two signatures and the payability of the check, in which both the CFO and the CEO's signature are required to make the check payable in the case study in Module 5 on our Web site, is an example of a nominally scaled relationship between attributes. In contrast, the relationship between money per piece, number of pieces, and money in Box 4.6 is an example of a ratio scaled relationship. Relationships between object classes are nominally scaled because they merely articulate an association that asserts the mere existence, not magnitude, of a meaning.

A relationship normalizes rules about object interactions. For example, *Person* is an object class. *House* is an object class. A person may live in a house. "*Live in*" is the interaction between *Person* and *House*. "*Live in*" is a relationship and also an object. The "*live in*" relationship between *Person* and *House* will normalize information about the interaction about *Person* and *House*—information like when an individual lived in which house, why they moved, and when.[1]

A CASE STUDY

Authorizing a Check: Reusing and Modifying Process Knowledge at our Web site shows how process design may be automated with reusable components of normalized knowledge. It also demonstrates how the properties of relationships we have normalized in the different metaobjects interact to produce different business behaviors.

The case study uses a set of processes for authorizing checks. The processes are engineered differently from the same reusable components in support of different business environments. Figure 7.24 represents this process. Figure 7.24A starts with an example in which the CFO and the CEO of a company must both sign a check in order to authorize it. The case study on the Web site describes how Figure 7.24A represents this. It then describes how the processes in Figure 7.24B are polymorphisms of the pattern in Figure 7.24A and how business processes in Figure 7.24B automatically flex as rules are changed.

INVERSE OF A RELATIONSHIP

A relationship is a map between objects. At the class level, it maps between object classes; at the instance level, it maps between object instances. The map is a meaning that springs from the gulf between objects. The objects it connects frame the meaning of the map. For example, *Person* and *House* frame the context of "*lives in*" in the assertion that a "Person lives in House." "*Lives in*," the relationship, bridges the gulf between the two objects, *Person* and *House*, to create a new meaning that depends on both *Person* and *House* for its context and thus its very existence (see Figure 5.6).

Every relationship implies another—its inverse (see Box 5.1). Inverses are special relationships that reverse the sense of the relationship that implies it *and* complements its meaning. An inverse maps back in the reverse direction, from the instance level target to its instance level source.[2] In the example above, "*live in*" is a relationship between *Person* and *House*. It is also a rule that maps the set of persons to the set of houses (see Box 5.1). An instance of "*live in*" is a rule that maps an individual in the set of persons, to a particular house, in the set of houses. That a person may live in a house also implies that a house may be *lived in by* a person. As such, "*lived in by"* is the inverse of "*live in*." If an instance of "*live in*" maps a particular individual to a particular house, an instance of "*lived in by*," its inverse relationship, maps that house back to the same individual. Every metamodel discussed so far has paired every relationship with its inverse.

Box 5.1. Relationships between attributes, meanings, and expressions

Box 5.1 elaborates on the behavior and the structure of relationships between attributes and the possibility of time dependent, nonstationary relationships and constraints. It discusses multiway, conjoined interactions, recursive interactions, rules, and the difference between a meaning and its expressions. It discusses, with examples, the mathematical relationship between a meaning and its possible multiplicity of expressions.

Relationships normalize atomic rules about *interactions* between objects. Attributes and features of objects are (meta)objects too, and relationships between them are repositories of knowledge about *interactions between attributes and features*.

Relationships in examples thus far have all been about *occurrences* of object instances. We could think of them as relationships between the instance identifiers of objects that participate in the relationship. Relationships between attributes are much richer and more varied. They not only carry information about existence (occurrence), but also about *value*—nominal, ordinal, and quantitative.

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