

CANDID Specification of Commercial and Financial Contracts: A Formal Semantics Approach to Knowledge Representation, Part II: Formal Description of Economics Actors and Objects

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Abstract. The formal language CANDID is presented as a knowledge representation formalism for artificially intelligent decision support systems. The language is specifically oriented to representation of concepts in finance, commerce and administration. Later parts of the paper demonstrate the application of CANDID to explication of corporate entities and contractual objects, as well as to various concepts in elementary finance.

1 Introduction

The purpose in this part is to illustrate the use of CANDID to the formal description of principal actors and objects of economic activity. This step contributes to the larger goal of formalizing the legal and accounting aspects of contracting and commerce that they may be subjected to a system of mechanical inference. Applications of such a system include electronically assisted contract negotiation, contract monitoring and other aspects of contract management. The concepts that appear in such applications range from the mundane and commonplace, e.g., nuts, bolts, to the complex and esoteric, e.g., partially allocated costs, sale-leaseback agreements, the U.S. Securities and Exchange Commission Regulations.

The job of a formal language for describing such concepts is to render them unambiguous down to a limited set of primitive concept that are consensually understood by all parties using the language. A computer system using this language could therefore aid in rectifying definitional misunderstandings between disagreeing parties. Likewise, as an aid to individual decision making, it can explain any of its inferences in step by step elementary terms.

A critical factor, however, is that the language be based on primitive concepts that are clearly and unambiguously understood by all its users. Subsequent definitions based on these elementary terms can then be as intricate as necessary without the danger of magnifying an elementary ambiguity. A fundamental issue here is the so-called “identification of particulars”, of having

consensual recognition and labeling of the individual entities described by the language. Strawson [Str59] argues that the proper basis for such identification is the locatability of these entities in a spatial/temporal framework. Thus, for instance individual people are locatable in space/time in that they are born at a particular place and time, and have continuity in space and time until their deaths. Given sufficient factual data about a person's whereabouts throughout time, an arbitrary group of observers could presumably agree as to the identification of this individual (e.g., whether it were really an actual person, or multiple persons, an imaginary person, etc.).

Phenomena that do not have continuity in space and time are prone to much more disagreement of identification. Consider for example Beethoven's 9th Symphony. Is there one unique referent to this name, or many? We may individuate versions of this symphony by its reproductions on paper or specific performances by orchestras, but in both cases we re-case it into a representation locatable in a space/time framework. Textual works present a similar difficulty. A more modern example is a computer program, for instance SPSS (statistical package for the social sciences), as an arbitrary example. There have been numerous versions of this program and hundreds of computer installations have one of these versions. Further, at any given installation, more than one copy of the program may be executed in the machine's memory at a given time.

The problem of individuation becomes especially important when we consider not just information objects, like symphonies and computer programs, but contractual objects, like notes, bonds, stocks, options, licenses, insurance policies, etc. Clearly, it is of critical importance for a company to know it has a certain right or obligation. Indeed, it is precisely because of this problem of identification that signed documents play such an important role in contractual transactions: the signed document represents the agreement in a form locatable in space and time.

As mentioned earlier, the goal here is to formally describe the principle actors and objects of economic activity. Our criterion for formalization will be the unique identification of such entities in the spatial/temporal framework. If we consider only persons as economic actors, and physical objects as economic objects, the problem is trivial: both types of entities are locatable in space and time. However, another common type of economic entity (at least in Western societies) is a corporation. A corporation is more problematic from this perspective since it has no essential physical reality: no one of its assets, including its buildings, nor any one of its employees nor any of its executives or board members nor any one of its stockholders is essential to the identification of the corporation. Any one of these may change or be removed from the corporation, and the identity of the corporation can still continue.

The objects of economic activity, i.e., the things that are traded, present analogous problems for formal description. Money for instance is a key object of exchange. Yet money is no longer uniquely represented by physical objects