

A Complex Categorical Decision Application

David L. Sallach

Abstract.

A variety of challenges have made the social sciences resistant to formal modeling. Among these challenges are the permeability of social processes of different types (e.g., social, economic, political and cultural) and diverse scales. Category theory provides a unique set of tools for addressing such problems, including the ability to address diverse research domains and, for example, has been used effectively in drawing upon and expressing complexity theory.

One specific difficulty in social modeling concerns the fluid intertwining of qualitative and quantitative parameters in social discourse. The present paper introduces a category (Qua) that integrates qualitative and quantitative decision spaces with a recursive discourse arrow. The core capability is based upon truth functions that combine probabilistic reasoning with a salience dimension; its contribution is based, in part, on the ability to reason over complex and variegated domains. A second capability arises from the endogenous application of this morphism, i.e., in the emergence of co-reasoning relative to shared and partially shared models. A third capability is found in the coordination of multiple social actors across multiple regions and scales.

The contribution of this formalism is found in three spheres: 1) expert analysis, 2) dynamic social inference and 3) multi-agent modeling and simulation. Accordingly, this presentation also illustrates the contribution of category theory within a challenging application domain.