Chapter XIV

Object-Oriented Approaches to Causal Mapping: A Proposal

Robert F. Otundo
The University of Memphis, USA

Abstract

Comparing, contrasting, and collectivizing causal maps provides a useful way for extending representations of individual-level cognitions to an organization-level of analysis. Carrying out these processes can be tricky, however, because the terms used to denote nodes within causal maps are often so terse that important nuances and meanings critical to linking or distinguishing the espoused beliefs of multiple individuals may not be faithfully represented. Previous efforts in causal map research are extended by representing these linguistic and semantic nuances in associative, categorical, or other cognitive maps, then using those maps to link related elements of causal maps. These multiple types of cognitive maps are then integrated in a logical view (i.e., class and object structures) of a graph-theoretic, object-oriented design.

Introduction

Causal maps represent the network of causal relations embedded in an individual’s explicit statements, and as such provide an explicit representation of the deep-rooted cognitive maps of individuals (Huff, 1990; Nelson, Nadkarni, Narayanan & Ghods, 2000).
While causal maps provide a concise representation of an individual’s beliefs and assumptions about causality, that conciseness often fails to represent important nuances in complex beliefs and assumptions that are crucial to extending individual causal maps to an organization-level of analysis. These nuances in word use can lead to the same term being used to represent different ideas, different terms being used to represent similar ideas, or a host of words changing and emerging within a vocabulary over time as individuals share beliefs. These patterns of word use create difficulties in the comparison of individual causal maps, and suggest that while a causal map may be sufficiently “rich” to represent causal beliefs at the individual level of analysis, collections of individual causal maps do not adequately represent the richness of the problem space of social causal cognition.

The purpose of this chapter is to provide frameworks for representing important nuances in language use during social causal cognition, and to embed those frameworks in group- and organization-level causal maps. These goals will be accomplished through two objectives. First, an overall strategy for mitigating the representational limitations of causal maps will be presented. This strategy augments collections of causal maps with other representations of the cognitive, communicative, and behavioral aspects of knowledge sharing. This family of representations, collectively called cognitive maps, is a general class of physical representations of thoughts and beliefs that can represent individual assertions, or those elicited from a group (Huff, 1990; Montazemi & Conrath, 1986). Cognitive maps can provide a rich resource for comparing, contrasting, or collectivizing large numbers of causal maps. Causal maps are only one sub-class of cognitive maps. Other sub-classes of cognitive maps include such representations as categorical maps that focus on relationships of similarity and associative maps that represent frequencies and changes in word use (Huff, 1990).

The second objective of the chapter is to provide a design for a tool that can seamlessly acquire, store, and manipulate multiple cognitive maps. This is a tall order because augmenting causal maps with various types of cognitive maps would significantly increase the computational complexity of processing causal maps. Computer-based information systems are a likely candidate for this tool because they have been successfully used in the past for problem spaces of similar complexity.

The chapter is organized as follows. First, difficulties of using causal maps at the social level of analysis are examined. Second, alternative high-level designs for a computer-based tool that are commensurate to the characteristics of cognitive mapping are proposed and discussed. This discussion is then extended to a more detailed description of data and functional elements necessary for the proposed computer-based tool. Finally, conclusions, limitations, and potential applications are discussed.

**Representing Causal Beliefs at Social Levels of Analysis**

Causal maps were originally designed to represent an individual’s beliefs about causal relationships between entities in the real world. There are several reasons why these
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