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Issues Associated with the Isomorphic Mapping of
Natural Language Relationships, Mathematical Relations and Structured Graphics

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Introduction

Systems engineering and systems science research appears to have a difficult time in establishing and reusing basic foundational concepts and ideas. In the realm of computer science, the problem has been described as:

> "Indeed, one of my major complaints about the computer field is that whereas Newton could say, "If I have seen a little farther than others, it is because I have stood on the shoulders of giants," I am forced to say, "Today we stand on each other's feet." Perhaps the central problem we face in all of computer science is how we are to get to the situation where we build on top of the work of others rather than redoing so much of it in a trivially different way. Science is supposed to be cumulative, not almost endless duplication of the same kind of things".
>
> Richard Hamming 1968 Turning Award Lecture

In the area of systems engineering and systems science, it could be said that "Today we deny the fact that others have feet or ground to stand on."

The topics covered in the last four (4) or five (5) monthly Structural Modeling Project (SMP) video conferences are the topics that will be integrated into a Systems Concepts Technical Report that will be available for the first round of review and comment between the middle of July, 2016 and the middle of August 2016. The target release date for the final technical report is the first of September 2016.

This specific Systems Concepts Technical Report is in addition to the systematic review of the structural modeling literature. Hopefully, this will be a productive summer.

Issues Remaining

The primary issues remaining are related to the mapping of natural language relationships to mathematical relations and the processes and mechanisms that are used to verify that these mappings are rational and reasonable. These issues may be arranged into two groups, those associated with:

1. Application of proper matrix operations
2. Set theory and the partial ordering of sets.

Application of Proper Matrix Operations. The matrix operations issues are mostly centered in the application of matrix switching theory and Boolean reasoning. These 'switching theory/Boolean reasoning' matrix operations are distinctly different than the matrix operations used in the solution of sets of simultaneous equations. One key difference between these two forms of matrix operations is the role of logical relations and the properties associated with these logical relations.

Set Theory and the Partial Ordering of Sets. Set theory issues may be addressed by carefully identifying the current object 'sets of interest,' and assuring that these object sets do not violate basic set theory constraints. These issues become important in the partial ordering of set members. A set cannot have two identical members. If it is important to model a system where a single element is used in two or more roles and/or places, then a partially ordered set cannot be used. However, this type of system could be modeled as a group of ordered sets, with two or more distinct sets being evaluated and ordered by some context-specific criteria.

These remaining issues need to be addressed in a manner that contributes to the further development of structural modeling techniques.