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ATIS: Proposed Future Research

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AXIOMATIC THEORIES OF INTENTIONAL SYSTEMS: PROPOSED FUTURE RESEARCH

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This report furthers the development of axiomatic theories of intentional systems. In this report I will indicate some areas for future research in the event that I do not have time to pursue them. This analysis of future research is important, in particular, to the Department of Homeland Security (DHS) concerning the value of ATIS (Axiomatic Theories of Intentional Systems) in being able to identify with specificity terrorists known as "Lone Wolves" or "Terrorist Cells" as well as their targets, a predictive capability that is not possible with data-mining techniques. Further, I will introduce two areas that I have determined to be of possible value in the emendation of ATIS: *ATIS-Topology and Mathematical Topological Vector Analyses*; and *QSARs and QSPRs for ATIS-Analyses*.

Keywords: General systems theory, intentional systems, behavioral theory, education theory, ATIS, ATIS option set, retroduction, abduction, theory development, QSARs, QSPRs, topology, topological vector analysis.

INTRODUCTION

In my earlier report, *Implementing the ATIS Option Set*, I discussed the distinction between hypothesis and axiom and demonstrated how to convert hypotheses presented in the social sciences to axioms. I also showed how a theory could be developed within the social sciences from existing hypothesis-type theories. I developed a *Theory of Memory and Learning* from J. Sweller's *Cognitive Load Theory*. I also stated and proved the *Retroduction Theorem* and *Abduction Theorem*. I also discussed and defined the various processes in theory development of retroduction, deduction, abduction, and induction. These were defined as follows:

- ***Retroduction*** is the logical process by which a point of view is utilized to devise a conjecture or theory.
- ***Deduction*** is the logical process by which a conclusion is obtained as the implication of assumptions.
- ***Abduction*** is the logical process by which a theoretical construct of one theory is utilized to analyze or interpret the parameters of another theory.
- ***Induction*** is the logical process by which theory is evaluated and validated.

Further, I introduced the complexity of analyzing a system that must include its negasystem, family of systems, and subsystems. That complexity will be further discussed in future reports.

Also in future reports I will demonstrate how an axiomatic theory of education can be developed from current education theories; that is: *Developing an Axiomatic Theory of Education from Existing Education Theories*.

Department of Homeland Security (DHS)

Before making recommendations for future analyses of intentional systems, due to the terror threats that we face in the world today, I wish to advise anyone connected with DHS that ATIS can be used specifically to identify potential terrorist individuals and their intended targets.

The problem with using only data-mining techniques for tracking terrorists is that such techniques are only group-predictive rather than individually-predictive; that is, data-mining techniques cannot identify specific terrorists and their targets. Further, patterns must be established prior to decision-making, and/or "chatter" must be recognized in order to make specific recommendations. ATIS, as an axiomatic-based theory, can be individually-predictive in terms of both identifying specific potential terrorists and their intended targets **prior** to the establishment of "patterns" or the acquisition of "chatter".

What ATIS can do is be used as the means to analyze the data-mining information and provide outcomes **before** specific patterns can be otherwise recognized.

ATIS Analyzes Data-Mining: The data-mining information is fed into an ATIS-based technology which will then predict outcomes prior to pattern-recognition.

ATIS does not replace data-mining, it utilizes acquired information from data-mining to make specific predictive outcomes, and it does so much earlier than what would otherwise be available when one has to wait for a "pattern" to develop or acquire "chatter" that indicates imminent attack. Further, it can predict outcomes that cannot otherwise be recognized by "patterns". This is possibly the greatest value of ATIS.

Recommended Areas of Research for Further Emendation of ATIS

There are two areas, in particular, that have been recognized for their potential to provide significant emendations to ATIS: *Topological Vector Analyses*, and *QSARs and QSPRs Analyses*. Their significance is that the first will provide **real-time predictive outcomes**, and the second will provide a means to determine predictive outcomes from only the **structure** of the system. Although I intend to pursue these developments, I wish to recognize these areas for possible research by others in the event that I am not able to complete their development.

ATIS-Topology and Mathematical Topological Vector Analyses

It is intended that a discussion of *Topological Vector Analyses* for determining ATIS-predictive outcomes will be discussed in a future report.

ATIS-topology is a modified mathematical topology that addresses system connectedness.

I have envisioned that topological analyses will be important contributors to the development of ATIS, but there is much work to be done in this area. The advantage of topological analyses is that they will be able to provide real-time predictive outcomes of systems. The reason that this is so valuable for ATIS is that every affect relation determines a topology on the system.

However, an *ATIS-topology* is not necessarily the *topology* that is normally studied in mathematics. We will start with its basic meaning: *Topology is the study of component-connectivity*. From there we will utilize the concepts of mathematical topology, with required modifications.

QSARs and QSPRs for ATIS-Analyses[1]

In order to properly analyze a behavioral system, and in particular, dispositional behaviors, the affect relations must be quantified in terms of their *structure-activity* and *structure-property*. That is, ***Quantitative Structure-Activity Relationships*** (QSARs) and ***Quantitative Structure-Property Relationships*** (QSPRs) pertaining to the affect relations will be used for the non-empirical parameters. QSARs are mathematical models that relate system structure to system properties.

This research is concerned with the prediction of system properties calculated directly from the structure of non-empirical structural parameters, NeSPs. The significance of this predictive tool cannot be overemphasized.

By non-empirical is meant those structural parameters that can be calculated directly from system structure without any other input of experimental data. Topological invariants (TIs); information-theoretic invariants, (ITIs); system component partitions, (𝕊CPs); and system parameters, (𝕊Ps), defined by graph-theoretic connectedness properties, (GCPs), fall in this category of NeSPs.

Quantitative structure-activity relationships, QSARs, for system analyses use NeSPs. QSARs are mathematical models that relate system structure to system properties. Two distinct processes are involved in the derivation of NeSPs: (1) defining the system model by its component structure determined by the family of relation-sets, $\mathcal{A}$, such family representing the architecture of the system, and is called the "system structure"; and (2) calculating structural quantifiers that determines the dispositional behavior, $_{\mathcal{D}}\mathfrak{B}$, of the system. New system structure is then evaluated in terms of these quantifiers to arrive at system-predictive outcomes. *Figure 1: Composition Functions* depicts the process of experimental determination of properties vis-à-vis prediction of properties using descriptors.

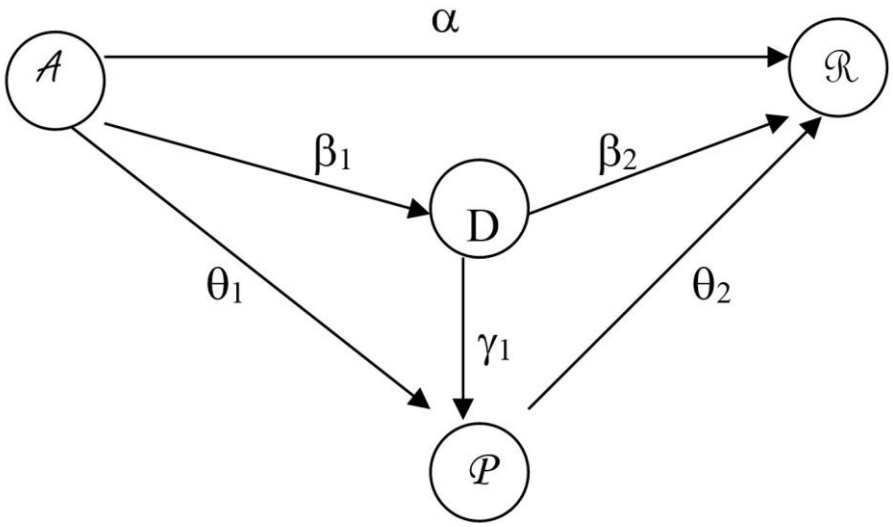

Figure 1: Composition functions for quantitative structure-activity relationship, QSAR, and quantitative structure-property relationship, QSPR. (Chart obtained from Alexandru T. Balaban (Ed.), Plenum Press, New York and London, 1997, *From Chemical Topology to Three-Dimensional Geometry*, p. 76.)

[1] QSARs and QSPRs are being incorporated into ATIS as a result of a retroductive analysis derived from the work Edited by Alexandru T. Balaban, Plenum Press, New York and London, 1997, *From Chemical Topology to Three-Dimensional Geometry*.

An analysis of QSARs and QSPRs will be provided in a future report.

It is proposed that by incorporating topological vector analyses, QSARs and QSPRs into ATIS retroductively, that real-time predictions will be possible concerning Terrorist Systems, whether comprised of a major network as in Al Qaida-type terrorist systems, or the "Lone Wolfe", or for identifying "Terrorist Cells". Of course, such analyses will also make it possible to predict; for example, changes in a school system without having to wait 12 years or longer to determine outcomes.

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