Viewing the world systemically.

ATIS: Phoenix Algorithm

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Phoenix Algorithm: A Behavior-Predictive Algorithm

The *Phoenix Algorithm* is a *Behavior-Predictive Algorithm* that is designed to predict and destroy, in particular, *Terrorist Network Systems*. The name is derived from the *Phoenix Program* in Viet-Nam that targeted enemy villages where the village leaders and other enemy-supporters were killed—an early version of the drones now being used to kill ISIS commanders. The *Phoenix Algorithm* provides a means of identifying various enemy combatants for elimination in a manner that will destroy the *Terrorist Network System*, rather than just killing top leaders which it is assumed will degrade ISIS but in fact may not be the best targets. Targeting top commanders is simplistic but may not actually be the right targets. Although counterintuitive, other, lower-level targets may actually do more to destroy the *Terrorist Network System* than eliminating the top commanders.

Analysis of terrorist behavior by means of the *Behavior-Predictive Algorithm* predicts the future behavior of terrorists in a *Terrorist Network System*. A topology defines the *Algorithm*. The *Algorithm* allows for prediction of behavior with each new component of information introduced into the system. That is, a single message may result in a predictive capability.

Every *Terrorist Network System* (*TNS*) defines an affect relation, $\mathcal{A}_n$, by the unary- and binary-component-derived sets from the *TNS*. That is, the components of $\mathcal{A}_n$ are of the form: $\{\{\mathbf{x}\},\{\mathbf{x},\mathbf{y}\}\}$ that indicates that an “affect relation” has been empirically determined to exist from “$\mathbf{x}$” to “$\mathbf{y}$.” As defined under *Basic Properties*, the $\mathcal{G}_C$, component set, is derived from these $\mathcal{A}_n \in \mathcal{A}$. $\mathcal{A}$ is the family of all such derived affect-relation-sets, $\mathcal{A}_n$. The following functions used to derive $\mathcal{G}_C$ will also be used below; that is: $\mu\mathcal{A}_i = \{\mathbf{x}_i\}$ and $\beta\mathcal{A}_i = \{\mathbf{x}_i,\mathbf{y}_i\}$.

The Algorithm

1) Every *Terrorist Network System* (*TNS*) is defined as a topological space, $\mathfrak{S}_n = (\mathbf{S}_n, \boldsymbol{\tau}_n)$, where $\mathbf{S}_n$ is the object-set and $\boldsymbol{\tau}_n$ is the topology.
   a) A topological space ($\mathfrak{S}_n$), object-set ($\mathbf{S}_n$), and topology ($\boldsymbol{\tau}_n$), are natural extensions of the affect relation sets, $\mathcal{A}_n$, as follows:
      1. $\mathbf{S}_n$ is defined by: $\mathbf{S}_n = \{x \mid \forall x \exists u(\{\{x\},\{x,u\}\} \in \mathcal{A}_n \in \mathcal{A}\}$;
      2. $\boldsymbol{\tau}_n = \mathcal{A}_n \cup \mu\mathcal{A}_n \cup \mathbf{S}_n \cup \varnothing$; and, therefore,
      3. $\mathfrak{S}_n = (\mathbf{S}_n, \boldsymbol{\tau}_n)$.
2) The topology, $\boldsymbol{\tau}_n$, has the following empirical characteristics:
   a) The $\bar{I}_{IB}$ (*Integrated Information Base*) empirically establishes the components in $\mathbf{S}_n$ from the elements of the affect relation, $\mathcal{A}_n$. Therefore, $\{\{\mathbf{x}_i\},\{\mathbf{x}_i,\mathbf{x}_j\}\} \in \mathcal{A}_n \supset \mathbf{x}_i \in \mathbf{S}_n$; and are defined as the ***empirical-based elements***.

1. **NOTE:** In view of privacy concerns, the ability to actually obtain an $\bar{I}_{\bar{I}B}$ may be greatly compromised due to the inability to acquire the data required for analysis. However, it should be recognized that the $\bar{I}_{\bar{I}B}$ can be obtained in a "black box" environment that might alleviate such privacy concerns, although it will probably still be looked upon as an infringement of privacy by those who are not knowledgeable of its application.

b) ***Singular discrete elements*** are the elements $\{x_i\} \in \tau_n$.

c) $\{\{x_i\},\{x_i,x_j\}\} \in \mathcal{A}_n \supset \{x_i\},\{x_i,x_j\} \in \tau_n$.

d) $\{x_i,x_j\} \in \tau_n \wedge \{x_k,x_j\} \in \tau_n \supset \{x_j\} \in \tau_n$ and such elements are defined as the ***structural-based elements***. The *empirical-based elements* and the *structural-based elements* are the ***relation-set-derived elements*** of the topology.

e) The above-defined topology defines all connected elements of the system.

3) The system, $\mathfrak{S}$, is defined as the union of all object-set subsystems, $\mathbf{S}_n$; and the family of all relation-set elements, $\mathcal{A}_n$. That is, if $\mathbf{S} = \cup_{i=1,\ldots,n}(\mathbf{S}_i)$, and $\forall i(\mathcal{A}_i \in \mathcal{A})$; then $\mathfrak{S} = (\mathbf{S},\mathcal{A})$.

4) By steps 1) to 3), a *system*, and *topological space*, $\mathfrak{S}$, is constructively defined.

5) The axioms and theorems of *ATIS* allow for logical; i.e., axiomatic, analysis of $\mathfrak{S}$. The construction of $\mathfrak{S}$ allows for topological analysis. **These analyses allow for predictability of the system behavior**.

a) A logical analysis of the existing system structure will result in establishing specific system behaviors that must occur as a direct result of that structure.

1. This logical analysis can currently be obtained through an *ATIS*-analysis by the application of the *ATIS Option Set*.

b) A topological analysis will result in establishing connectedness that is not obvious from the discrete messages obtained by the $\bar{I}_{\bar{I}B}$.

1. This topological analysis can currently be implemented to a limited extent, but more development is required before its full usefulness can be obtained.

6) **<u>Property-Based Predictability</u>:**

Introducing new components into the system creates a new system structure and behavior that result in **Property-Based Predictability**. Logical and topological analyses of the new system structure results in new predictable behaviors of the system. New components, derived as defined in 6.a below, produce new system structure. Analysis of the new system properties produces system behavior predictability as shown below in 6.b, etc.

a) The introduction of a new component, a, into the system results in it being connected to an existing system component, b. Thus, a relation-set element is established: $\{\{\mathsf{a}\},\{\mathsf{a},\mathsf{b}\}\}\in\mathcal{A}_n\in\mathcal{A}$. This relation-set element will generate additional elements as follows:

$$\forall i,n(\{\{\mathsf{b}\},\{\mathsf{b},\mathsf{x}_i\}\in\mathcal{A}_n \supset \{\mathsf{a},\mathsf{x}_i\}\in\mathcal{A}_n).$$

1. The introduction of each new relational message obtained by the $\bar{I}_{\bar{I}B}$, or the introduction of each new component obtained by the $\bar{I}_{\bar{I}B}$ results in the **<u>predictability of the system</u>**, $\mathfrak{S}$. That is, the introduction of a new message or component introduces a new "connectedness" network of the system. This new connectedness expands the connectedness of the system as shown above. In order to maintain a topology, that connectedness may introduce new relational elements. Analyzing the new system logically and topologically determines the impact on the system of the new structure.

   a. The ability to obtain new system components is critical to being able to provide real-time analysis of a system—**<u>which is critical for real-time predictability</u>**. In the current political climate that precludes such acquisition, the country will remain at risk of not being able to predict the next terrorist attack.

b) **Vulnerability Property:** Remove terminating components of an affect relation.

1. Project the removal of a terminating element in an affect relation and evaluate the resulting system behavior (structure). It can be **predicted** what connections need to be removed in order to obtain the desired destruction of the *TNS*.

c) **Compactness Property:** Remove short-path connected components.

1. Removing short-path connected components will create terminating components, thus creating a vulnerable system. Removing the terminating components disrupts the vulnerable system.

d) **Centralization Property:** Remove primary-initiating components.

1. Removal of primary-initiating components destroys the leadership of the system. (This is currently being accomplished through the drone-targeting program.)

e) **Adaptability Property:** Maintain adaptability factor greater than α.

f) **Strain Property:** Maintain State Property values greater than k.

7) **<u>Axiomatic-Based Predictability</u>:**

Axiomatically analyzing the *TNS* induced structure reveals vulnerabilities of the *TNS* or predictions of behavior. The vulnerabilities of the *TNS* provide a means to compromise or destroy the *TNS*. The predicted behaviors provide an alert to possible *TNS* threats.