Viewing the world systemically.

ATIS: Types of Systems

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Types of Systems

ATIS has been described as an *Options Set*. The reason is that it can be applied to a variety of system types rather than being restricted to one or two types of systems. To conduct an *ATIS-Analysis*, one must first identify the system to be analyzed, and, in particular, the affect relations of the system. Those affect relations will then define the system object-set. The affect relations will then determine the *Structural Properties* of *ATIS* that are relevant to the system. Those Structural Properties will then determine the theorems, or projections, of the system that results in the predictability for the system. In this report, the various types of systems will be discussed. *System type* is part of the metatheory and describes configurations and properties that characterize a particular system.

We will first define *system* and *general system* from which all other types of systems are derived.

System, $\mathbb{S}$, $=_{\mathrm{df}}$ an ordered pair consisting of the system object-set and family of affect relations.

$$\mathbb{S} =_{\mathrm{df}} (\mathcal{G}_0, \mathcal{A}) = (\mathbb{S}_0, \mathbb{S}_\varphi)$$

System is a set of components and a family of affect-relations.

Frequently, the definition for system is in reference to an *object-set* and *relation set*, which here are defined as *object-set* (or *component set*) and *affect-relation set*. Since the relations of an *intentional system* will be determined by *affect relations*, the relation set is so identified.

General system, $\mathcal{G}$, $=_{\mathrm{df}}$ a set of *partitioned components*, *affect relations*, *transition functions*, *linearly-ordered time set*, *qualifiers*, and a *system state-transition function*. A set of *affect-relations*, $\mathcal{A}$; which determine a set of *partitioned components*, $\mathcal{P}$; defined by *component-qualifiers*, $\mathcal{Q}$; *transition functions*, $\mathcal{T}$; a *time sequence*, $\mathscr{T}$; and a *state-transition function*, σ.

$$\mathcal{G} =_{\mathrm{df}} [\mathcal{A} \vdash (\mathcal{P}\,(\mathcal{Q}, \mathcal{T}, \mathscr{T}, \sigma)]$$

General system is defined as a set of affect-relations that define (yield) partitioned components that are controlled by a qualifier-set, sequenced by a time-set, changed by a state-transition function, and mapped by a state-transition function.

Allopoietic system, $_{AP}\mathfrak{S}$**,** $=_{df}$ an *open system* that has *derived production output*.

$$_{AP}\mathfrak{S} =_{df} {}_{O}\mathfrak{S}({}_{DP}\mathit{f}_{T})$$

Allopoietic system is an *open system* that has *derived production output*; where:

Open system, $_{O}\mathfrak{S}$**,** $=_{df}$ A system that has feedin.

$$_{O}\mathfrak{S} =_{df} \mathfrak{S} \mid \mathfrak{S}(\mathit{f}_{I}) \supset \mathcal{A}(\mathit{f}_{I}) = \langle \mathit{f}_{I} \rangle$$

Open system is a system; such that, the system has feedin.

Examples: Practically all social systems are open; that is, they all have feedin of some kind. In particular, with few exceptions, schools are open systems.

Derived Production Output

Derived production output, $_{DP}\mathit{f}_{T}$**,** $=_{df}$ Feedthrough with a high dissimilarity of toput and output in which output is significantly more complex.

$$_{DP}\mathit{f}_{T} =_{df} \mathit{f}_{T} \mid \exists \mathcal{B} \subset \mathcal{A}\, (\mathrm{T}_{\mathcal{P}}(\mathcal{B}) \Vdash \mathrm{O}_{\mathcal{P}}(\mathcal{B}) \wedge \mathcal{M}\, [\mathcal{X}(\mathrm{T}_{\mathcal{P}}(\mathcal{B})] \ll \mathcal{M}\, [\mathcal{X}(\mathrm{O}_{\mathcal{P}}(\mathcal{B}))])$$

Derived production output is defined as feedthrough; such that, there is a family of affect relations, $\mathcal{B}$, that is a subset of the family of system affect relations, such that, the toput with respect to $\mathcal{B}$ yields the output with respect to $\mathcal{B}$, and the measure of the complexity of the toput affect-relations are substantially less than the measure of the complexity of the output affect-relations.

Examples of *derived production output*: Manufacturing plants produce derived production output. These plants bring in raw materials from which their products are manufactured; that is, produce the derived production. A school system may be viewed as producing derived production output in that students who enter the school system are expected to change substantially as a result of their education.

Catalytic Components

Catalytic components, $\mathbb{C}(\mathfrak{S})$**,** $=_{df}$ system components that are required for *derived production output* that are not part of the output.

$$\mathbb{C}(\mathfrak{S}) =_{df} \mathfrak{W} \mid \mathfrak{W} \subset \mathfrak{S}_{o} \supset [\exists_{DP\mathit{f}_{T}}(\mathfrak{x} \in \mathfrak{W} \supset \exists_{\mathcal{DP}\mathit{f}\mathcal{T}}\mathfrak{S}_{\mathrm{O}\mathcal{P}}(\mathfrak{x}) \notin \mathrm{O}_{\mathcal{P}})];$$

where ‘$_{\mathcal{DP}\mathit{f}\mathcal{T}}\mathfrak{S}_{\mathrm{O}\mathcal{P}}$’ is the *deprived production output* process.

Catalytic components comprising a set; such that, the set is a subset of the object-set implies that if there is derived production output and a component is an element of the subset, then there is a derived production output process such that the component is not in the output.

Most systems are *allopoietic systems*; that is, they take in energy or material products and produce as output something other than themselves. Biological systems are allopoietic in that they reproduce rather than self-produce. Even intentional systems that attempt to establish similar systems are still allopoietic in that replication is not perfect; that is, replication is not cloning.

Examples of *allopoietic systems*: In franchised store operations, the product of the franchise results from the production as an allopoietic system. That is, whereas the store was set up with all of its equipment and production components, an autopoietic process, the product being produced for sale is distinct from the system, an allopoietic process. Schools are allopoietic systems; that is, their output, the students, are not a reproduction of the school, but the result of the school's production process.

Autonomous system, $_{A\mathcal{U}}\mathbb{S}$, $=_{df}$ a system that is component-closed.

$$_{A\mathcal{U}}\mathbb{S} =_{df} {}_{C}\mathbb{S}^{C}$$

Autonomous system is a system that is component-closed.

Closed System

Closed system, $_{\sim O}\mathbb{S}$, $=_{df}$ a system that has no feedin; that is, that is not open.

$$_{C}\mathbb{S} =_{df} \sim({}_{O}\mathbb{S})$$

Closed system is defined as a system that is not open.

Examples of *closed systems*: There are probably no truly closed social systems. Even communities existing in mountains, remote areas, rain forests, jungles, etc. will probably have contact with other such communities, making each one an open system. However, certain schools may strive to be closed. Religious or certain paramilitary schools attempt to indoctrinate their students with certain beliefs and block all influences that could "corrupt" the desired vision or instruction. Such schools are selectively closed.

Examples of *autonomous systems*: *Autonomous systems* are similar to *autark systems* but are not as restrictive. That is, *autark systems* are closed with respect to the organic-essential subsystem, whereas an autonomous system is closed with respect to the input of all system components. Biospheres, whether on earth or mars, are supposed to function as autonomous systems. With all such systems, the one excluded input is energy from the sun. Public schools, by their very organization are not autonomous. However, specialized school clubs or private clubs may be organized such that the initial members become the only members. Such organizations are autonomous systems. Autonomous systems also included those systems that are controlled by a well-defined set of management rules that are controlled by one person, group or organization. Any system that blocks entry by other components is an autonomous system.

Independent system, ${}_{I}\mathbb{S}$**,** $=_{df}$ a system characterized by *primary-initiating associated component affect-relations*.

$${}_{I}\mathbb{S} =_{df} \mathcal{Y} \mid \forall v_i, v_j \in \mathcal{Y}(\mathcal{V}) \exists \mathscr{r}_{d(\mathcal{I})}(\mathscr{e}) \in \mathcal{Y}(\mathcal{R})[\mathscr{e} = (v_i, v_j) \supset \mathscr{r}_{d(\mathcal{I})}(\mathscr{e}) \geq 1 \wedge \mathscr{r}_{d(\mathcal{T})}(\mathscr{e}) = 0]$$

Independent system is a system such that for every pair of components in the system, there is a radius-measure of the initiating components in the Reals that is greater than 1, and the radius of the terminating components is 0.

$\mathcal{M}$**: Independent system measure,** $\mathcal{M}({}_{I}\mathbb{S})$**,** $=_{df}$ a measure of primary-initiating component affect-relations.

$$\mathcal{M}({}_{I}\mathbb{S}) =_{df} [(\Sigma_{i=1,\ldots,n}[|\mathscr{r}_{d({}_{I}\mathbb{S})}(\mathscr{e}) \geq 1|) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

Autark system, ${}_{AT}\mathbb{S}$**,** $=_{df}$ an *organic system* that is closed.

$${}_{AT}\mathbb{S} =_{df} {}_{\mathcal{O}}\mathcal{W} \mid {}_{\mathcal{O}}\mathcal{W} = {}_{C}\mathbb{S}$$

Autark system is defined as an *organic system* that is closed.

Organic System

Organic System, ${}_{\mathcal{O}}\mathcal{W}$**,** $=_{df}$ A system that has a homeostatic-maintenance subsystem that maintains the viability of the system.

$${}_{\mathcal{O}}\mathcal{W} =_{df} \mathbb{S} \mid \exists_{H}\mathbb{S} \; ({}_{H}\mathbb{S} \subset \mathbb{S})$$

Organic System is a system; such that, there is a *Homeostatic-Maintenance Subsystem* that maintains system homeostasisness.

Homeostaticness / Homeostasisness

Homeostaticness, or homeostasisness, ${}_{H}\mathbb{S}$**,** $=_{df}$ the maintenance of stability under system or negasystem environmental change.

$${}_{H}\mathbb{S} =_{df} \mathbb{S} \mid \Delta\mathbb{S} \vee \Delta\mathbb{S}' \Vdash {}_{SB}\mathbb{S}$$

Homeostaticness is defined as a system; such that, a change in the system or negasystem yields system stability.

That is, it is the affect-related system components that maintain a homeostatic system state; that is, exhibits dynamic self-regulation such that it maintains essential system variables within acceptable limits when the system experiences disturbances.

Examples of *Homeostaticness/homeostasisness*: The Cold War Balance of Power is the primary social example of homeostatic systems. Each side reacts to military advances by the other in order to maintain its organic-essential components—food resources, power resources, transportation resources, etc. Organic-essential components are those parts of the system that are absolutely essential to maintain the system identify. The evolution-creationism conflict within school systems is an on-going conflict to maintain the scientific identity of the school system. A stable scientific behavior is required if the school system is to maintain its prominence as one that produces students that are responsible scientific researchers.

When an *organic system* is closed, it is an *autark system*.

Initially an autarky was conceived as an economic system. However, the precepts of such a system being one that establishes an organic-essential closed system can be extended to any system that establishes an organic-essential closed partition. Any system that can be viewed as having its own "ecosystem" that it closes to its negasystem is an autark system. Economic autarky, biological autarky, social autarky, and education autarky are some of the systems that can be designed as autark systems.

An autark system is a self-sufficient system; for example, a system that is economically independent. A country may attempt to establish a national autarky by adhering to a policy of self-sufficiency and blocking imports and economic aid. Certain religious communities attempt to isolate themselves from the rest of the country in which they live. The Amish and initially the Mormons attempted to sustain a viable autarky. Schools established to further a particular faith attempt to further a religious autarky where they attempt to close off all other religious influences.

Examples of *autark systems*: There are few sustainable social autark systems. North Korea comes the closest today to a society that attempts to maintain itself as an autark system; that is, a society that restricts as much as possible all input. Prior to 1970, villages on the Bolovens Plateau may have been autark systems; that is, villagers would never travel more than 5 miles from their home and the community was self-sufficient with crops and hunting. Only in very closed societies are schools an autark system in that the entire community represents the instructional process, and the community is closed to the "outside world." Further, only societies in which the school is an organic-essential entity would such schools be considered autark systems. The school is an entity of the society and receives input from the society and is, therefore, not an autark system.

There are commercial enterprises that develop what are described as "autark homes". One of these is FirmTec, http://firmtec.com/eng/projects. They describe their homes as follows:

> FirmTec helped build the very first Passivhaus in the Netherlands: Autark Home. The client's aim was to construct and market an affordable and self-sufficient dwelling. Autark Home is a floating passive houseboat with a European Passivhaus certificate. The houseboat does not need a dock connection, which enables it to be completely grid-independent. The use of proven technologies makes the dwelling extremely sustainable and in many respects it serves as an example for the construction of fully sustainable homes in the future. There are no dock connectors for energy or water; energy is provided by solar hot water collectors and solar PV, while water is processed through a built-in water treatment system. Additionally, Autark Home has a heat recovery ventilation system, EPS insulation, Mosa tiles, Desso carpet and IKEA interior furnishings. FirmTec helped build this very first Passivhaus in the Netherlands. The concept for the house also offers perspective for organizations such as IKEA, which is promoting this innovative achievement at its Barendrecht store. The first Autark Home was built in Maastricht and can be seen at a prominent location in the Rijnhaven at the Port of Rotterdam

To the extent that the *population* of the system never leaves the home, this might be considered an autark system.

Anomie system, $_{AN}\mathbb{S}$**,** $=_{df}$ a system in which affect relation complexity approaches zero.

$$_{AN}\mathbb{S} =_{df} \mathbb{S} \mid \forall i[\mathcal{M}(\mathcal{X}(\mathcal{A}_i \in \mathcal{A})) \rightarrow 0]$$

Anomie system is a system; such that the measure of the affect relation complexity approaches zero.

Anarchy does not necessarily represent an anomie system. An anomie system is one in which behavioral norms are difficult to identify. Anarchy is a system that lacks a defense subsystem; that is, a police force that can control a population. Under these circumstances, proper behavior is still known, but is unenforceable. An anomie system is one in which there may be a generation transition from one code of behavior to another. Within each generation the norm is established, but when considered as a whole, the norms are confused—hence the continual criticism of the younger generation's behavior by the older.

Examples of *anomie systems*: A social system that is moving toward political anarchy and/or social disparity. A school system that has many individual "failing schools" may be considered an anomie system in that each school is being separated from all others in the system.

Deterministic system, $_{DT}\mathbb{S}$**,** $=_{df}$ a system behavior that is predictable from a preceding system behavior.

$$_{DT}\mathbb{S}, =_{df} \mathcal{B}(\mathbb{S}) \mid \mathcal{B}(\mathbb{S})_{t(1)} \Vdash \mathcal{B}(\mathbb{S})_{t(2)}$$

Deterministic system is a system such that the system behavior at time t_1 yields the system behavior at time t_2. The behavior of a deterministic system is predictable given known relevant conditions.

Examples of *deterministic systems*: Strategic paralysis produces a deterministic system; that is, it is determined that by inflicting certain conditions on a system the system will behave in a non-threatening way. Product production lines are designed to be deterministic systems; that is, a company wants to make sure that every product that is produced meets the same predictable standards. A school system may strive to develop certain aspects of its subsystems as deterministic; for example, if a particular teaching method results in consistent desired outcomes, then other classes will be designed to meet the same production standards.

'$\Vdash$' $=_{df}$ *Time-sequential yields*: *Time-sequential yields* are required in order to account for the dynamic aspect of these properties. This is not to be confused with the logical "yields," $\vdash$, of the predicate calculus. The intent is somewhat the same, but, in particular, the Deduction Theorem does not apply. For example, in the definition of adaptable system, it is first recognized, possibly by means of an APT&C analysis, $\mathcal{A}(_A\mathbb{S})$, that there is a change in the negasystem from t_1 to t_2. At those times, it is also recognized, again by $\mathcal{A}(_A\mathbb{S})$, that there is a change in compatibility; and it is also recognized by $\mathcal{A}(_A\mathbb{S})$ that stability has remained within acceptable limits. When this occurs, the system is *adaptable*.

'$\Vdash$' is ***not*** a "causal" relation, but one of recognizing system structure. The logic is one of recognition, not causality. That is, it is recognized that the first listing is observed first, followed by the second listing and then the third. As a result of this total observation, the measures are determined at each time to verify the changed values. As a result of these observations, it may be appropriate to establish a continual monitoring of the system to anticipate a validating of adaptableness, or to determine if stability is approaching its limit.

Autopoietic system, $_{A\mathcal{T}}\mathbb{S}$**,** $=_{df}$ an autonomous system that is self-producing.

$$_{A\mathcal{T}}\mathbb{S} =_{df} \mathbb{S} \mid \mathbb{S} = {}_{A\mathcal{U}}\mathbb{S} \wedge (A\mathcal{T}: \mathscr{L}_{A\mathcal{T}} \times {}_{A\mathcal{U}}\mathbb{S} \to {}_{A\mathcal{T}}\mathbb{S}_{O\mathcal{P}} \mid (\mathscr{I}({}_{A\mathcal{U}}\mathbb{S}, {}_{A\mathcal{T}}\mathbb{S}_{O\mathcal{P}})) \wedge {}_{A\mathcal{U}}\mathbb{S} \cap {}_{A\mathcal{T}}\mathbb{S}_{O\mathcal{P}} = \varnothing$$

Where '$A\mathcal{T}$' is a production process of the autopoietic system; '$\mathscr{L}_{A\mathcal{T}}$' are the controls for the production process; and '$_{A\mathcal{T}}\mathbb{S}_{O\mathcal{P}}$' is the autopoietic system output.

Autopoietic system is a system; such that, the system is autonomous, and there is a production-process function from the product of the production process controls and the autonomous system to the autopoietic system output, such that the autonomous system and autopoietic system output are isomorphic and disjoint. **Autopoiesis** is a process of system self-production.

Examples of *autopoietic systems*: Corporations that franchise their stores attempt to do so as an autopoietic system; that is, they try to make every new unit the same as all the others. Societies may be autopoietic when they try to extend their own societal organization—culture, values, beliefs, etc.—onto another society. The "westernization" of the world is an autopoietic process. School expansion may be an autopoietic process whereby a successful school system attempts to replicate that experience.

Autocatalytic system, $_{AC}\mathbb{S}$**,** $=_{df}$ a system with an increasing number of similar existing affect relations.

$$_{AC}\mathbb{S} =_{df} \mathbb{S} \mid \exists \mathcal{A}\, \forall \mathcal{A}_i \in \mathcal{A}\, ([\mathcal{A}_m, \mathcal{A}_n \in \mathcal{A} \supset \underline{\mathscr{M}}(\mathcal{A}_m, \mathcal{A}_n)] \wedge |\mathcal{A}_i|^{\uparrow})$$

Autocatalytic system is a system; such that, there is an affect relation family with similar affect relation sets and the family has an increasing number of components.

Examples of *autocatalytic systems*: Supply-and-demand economics may result in an autocatalytic system; that is, when those outside the initial market desire a product that is supplied, the greater demand creates an autocatalytic system. When a particular school produces high-achieving graduates, then other schools may desire to duplicate that success, creating an autocatalytic system. Autocatalysis is not the process of product production, but is the process of demand by which products have to be produced to meet the demand.

Adaptable system (adaptableness), $_{A}\mathbb{S}$, $=_{df}$ a system compatibility change within certain limits to maintain stability under system environmental change.

$$_{A}\mathbb{S} =_{df} \Delta\mathbb{S}'_{t(1),t(2)} \Vdash \Delta\,\mathscr{C}_{t(1),t(2)} < \alpha \Vdash {}_{SB}\mathbb{S}_{t(1),t(2)}$$

Adaptable system is defined as a change in system environment from t_1 to t_2, that yields a change in system compatibility within certain limits from t_1 to t_2, and that yields system stability at t_1 and t_2.

$\mathcal{M}$: **Adaptable system measure**, $\mathcal{M}({}_{A}\mathbb{S})$, $=_{df}$ a measure of system stability at time t_1 and t_2, given a change in the environment at time t_1 and t_2, and a change in compatibility within limits at time t_1 and t_2.

$$\Delta\mathbb{S}'_{t(1),t(2)},\ \Delta\,\mathscr{C}_{t(1),t(2)} < \alpha \vdash$$

$$\mathcal{M}({}_{A}\mathbb{S}) =_{df} \mathcal{M}({}_{SB}\mathbb{S}_{t(1)},\ {}_{SB}\mathbb{S}_{t(2)}) < \beta :\equiv: \ |\mathcal{M}({}_{SB}\mathbb{S}_{t(1)}) - \mathcal{M}({}_{SB}\mathbb{S}_{t(2)})| < \beta;$$ where β is a value that defines a range within which the system remains stable.

Note that for the measure of adaptability, '$\vdash$' is the "yields" of the predicate calculus.

Efficient System (Efficiency), $_{EF}\mathbb{S}$, $=_{df}$ a system that has commonality between feedthrough and feedin.

$$_{EF}\mathbb{S},\ =_{df}\ \mathbb{S} \mid \mathcal{A}(\mathfrak{f}_{T})_{\mathbb{S}} \equiv \mathcal{A}(\mathfrak{f}_{I})_{\mathbb{S}}$$

Efficient system is one for which the APT score of system feedthrough is equivalent to the APT score of system input.

Efficiency measure is determined by the ratio of *input-utilized derived production output* to corresponding *feedin input-components*.

$$_{EF}\mathbb{S},\ =_{df}\ \mathcal{M}[({}_{DP}\mathfrak{f}_{T})_{\mathbf{I}\mathcal{P}} \div \mathbf{I}_{\mathcal{P}}];\ \text{where, } ({}_{DP}\mathfrak{f}_{T})_{\mathbf{I}\mathcal{P}} = \mathbf{I}_{\mathcal{P}} \setminus {}_{SP}\mathbb{S} \cup \mathbf{S}_{\mathcal{P}}$$

Efficiency is defined as a measure of *input-utilized derived-production feedthrough* divided by *input*; where *input-utilized derived-production feedthrough* equals *input* less *spillage* and *storeput*.

That is, to obtain a value for the *efficiency* of a system, we must know what *input* is being utilized, and we must consider only that *input* that is processed for *output*. That *toput* that is initiated for transmission to *input* but results in *spillage* is not considered, and neither is the *input* that remains in storage and is not made available to *fromput*.

Before considering *efficiency*, as it will be used in *ATIS*, we need to consider the fact that *efficiency* has been defined in several different ways contrary to the way this theory model has been developed.

Initially, SIGGS defined efficiency as follows:

Efficiency, $_{EF}\mathfrak{S}$, $=_{df}$ a system that has commonality between *feedthrough* and *toput*.

The problem with this definition is that *feedthrough* and *toput* are two different types of terms. *Feedthrough* is a morphism and *toput* is a set of components.

Then, the first revision of the SIGGS definition made both terms the same type as follows:

Efficiency, $_{EF}\mathfrak{S}$, $=_{df}$ a system that has commonality between *feedthrough* and *feedin*.

$$_{EF}\mathfrak{S},\ =_{df}\ \mathcal{A}(\not{f}_{T}) \equiv \mathcal{A}(\not{f}_{I})$$

Efficiency is a measure of the commonality of feedthrough and feedin.

However, while this definition suggests what is wanted, we still do not have a good grasp of just what is happening and the measure that can be easily identified with the definition. As a result of these considerations, the definition provided above seems to provide the best indicator of just what is meant by *efficiency*. However, feedthrough can give us valuable perspectives on efficiency by identifying the **efficiency maximization principle** and the **efficiency minimization principle**. The **Efficiency maximization principle** results when feedin produces the largest possible feedthrough and **efficiency minimization principle** results when feedthrough is obtained with the least possible feedin. This efficiency relationship is between *feedthrough* and *feedin*, and not *feedthrough* and toput. The reason is that, as noted above, *feedthrough* and *toput* are different types of properties.

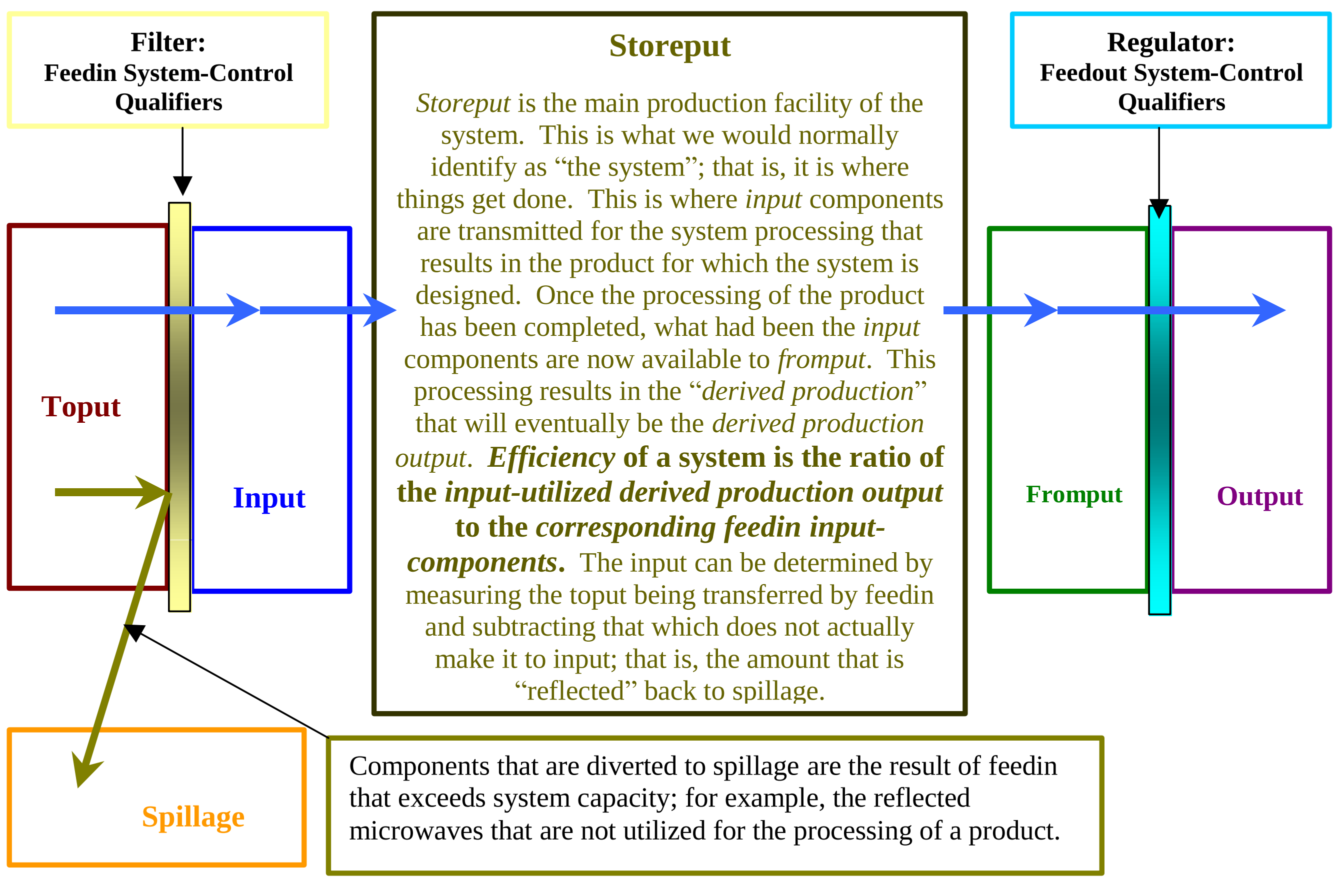
Efficiency is normally measured as a ratio of *output*:*input*. However, for *ATIS*, this ratio must be more carefully considered. For example, the efficiency of microwave energy used to dry beech wood was determined as follows:

> To investigate the energy efficiency, input and reflected microwave power were detected. Energy efficiencies with respect to MW-power of up to 80% were reached depending on the moisture content of the samples.
>
> (*Vacuum Microwave Drying of Beech: Property Profiles and Energy Efficiency*, Matthias Leiker, et al., Matthias.Leiker@mailbox.tu-dresden.de, Technische Universität Dresden, Thermal Process Engineering and Environmental Technology, 01062 Dresden, Germany; http://www.vtt.fi/rte/bss/coste15/cost%20e15%20esitelmat/CD/17Leikeretal.pdf).

In this example, **efficiency** was determined by evaluating the amount of microwave *spillage* with respect to the energy *input*; that is, the “reflected microwave power” (*spillage*) to the microwave power *input*. In this example, **efficiency** is determined by evaluating the input that is used for *derived production output* as determined by measuring the amount of *spillage*. Therefore, **efficiency** is the ratio:

Input-utilized derived production output : *corresponding feedin input-components*.

Determination of System *Efficiency*



<u>Examples of *efficient systems*</u>: School systems may be viewed from either a maximization or minimization efficiency principle. That is, efficiency maximization could be obtained when each student obtains the greatest achievements, and efficiency minimization could be obtained when the learning of each student is optimized with respect to resources.

Equifinality System, $_{EQ}\mathfrak{S}$, $=_{df}$ a system that is behavior-predictable from more than one preceding system behavior.

$$_{EQ}\mathfrak{S} =_{df} \mathfrak{S} \mid \mathcal{B}_1(\mathfrak{S})_{t(1)} \vee \mathcal{B}_2(\mathfrak{S})_{t(1)} \vee \ldots \vee \mathcal{B}_n(\mathfrak{S})_{t(1)} \Vdash \mathcal{B}(\mathfrak{S})_{t(2)}$$

Equifinality is a system such that various system behaviors at time t_1 yield the system behavior at time t_2. The behavior of a system that results from equifinality is absolutely predictable from any of the preceding system behaviors. Equifinality determines the predictability of system behavior from more than one preceding system behavior.

Equifinality can also be applied to achieving the same output from different inputs, and as the result of different derived production processes.

Examples of *equifinality systems*: The education system of the United States exhibits equifinality; that is, there are numerous distinct school systems that result in comparable student output.

Homeostatic system, or Homeorhetic system, $_{H}\mathfrak{S}$, $=_{df}$ a system that maintains stability of organic-essential subsystem under system environmental change.

$$_{H}\mathfrak{S} =_{df} \mathfrak{S} \mid \Delta\mathfrak{S}' \Vdash {}_{SB}\mathfrak{S}({}_{\mathcal{E}}\mathcal{W})$$

Homeostatic system is defined as a system; such that, the organic-essential subsystem is stable under a change in the negasystem.

Organic-Essentials Subsystem

Organic-essentials subsystem, $_{\mathcal{E}}\mathcal{W}$, $=_{df}$ the subsystem that maintains the derived-production output for the stability of the system's subsystems.

$$_{\mathcal{E}}\mathcal{W} =_{df} \mathfrak{S}^{\hat{u}} \mid \mathfrak{S}^{\hat{u}} = (\mathcal{O}_E, \mathcal{A}_{SB(\mathfrak{F}(\mathfrak{S}^{\hat{u}}))})$$

Organic-essentials subsystem is defined as a subsystem; such that, the organic-essential components, $\mathcal{O}_E$, define the object-set of the subsystem and the stable-state affect relations, $\mathcal{A}_{SB(\mathfrak{F}(\mathfrak{S}^{\hat{u}}))}$, define the relation-set of the subsystem.

Organic-Essential Components: The *Organic-Essential Components*, $\mathcal{O}_E$, are defined as such components as food, power, petroleum, bearings, weapons and other such products which if not produced would result in the demise of the (social) system. **They do not include any human components**.

Examples of *homeostatic systems*: The Cold War Balance of Power is the primary social example of homeostatic systems. Each side reacts to military advances by the other in order to maintain its organic-essential components—food resources, power resources, transportation resources, etc. Organic-essential components are those parts of the system that are absolutely essential to maintain the system's identify. The evolution-creationism conflict within school systems is an on-going conflict to maintain the scientific identity of the school system. A stable scientific behavior is required if the school system is to maintain its prominence as one that produces students that are responsible scientific researchers.

Ergodic system, $_{EG}\mathbb{S}$**,** $=_{df}$ A system in which there are subsystems that have dispositional behaviors similar to the system.

$$_{EG}\mathbb{S} =_{df} \mathbb{S} \mid U \subset \mathbb{S} \;.\!\supset\!.\; {}_{\mathfrak{D}}\mathcal{B}(U) \sim {}_{\mathfrak{D}}\mathcal{B}(\mathbb{S})$$

Ergodic system is defined as a system; such that, the dispositional behavior of a subsystem is similar to the dispositional behavior of the system.

Examples of *ergodic systems*: The education system of the United States attempts to be designed as an ergodic system in which every school can produce students who meet prescribed standards set by the Federal or State governments. Political polls are based on this property; i.e., it is assumed that the outcomes obtained from a "sample" reflect the outcomes that would be obtained if the entire system were analyzed in a similar manner.

Eudemonic system, $_{EM}\mathfrak{S}$**,** $=_{df}$ a *strategic system* whose behavior converges toward predicted outcomes.

$$_{EM}\mathfrak{S} =_{df} \mathfrak{S} \mid {}_{\mathfrak{J}}\mathcal{W} \mid \mathcal{B}({}_{\mathfrak{J}}\mathcal{W}) \rightarrow {}_{PD}\mathcal{S}$$

Eudemonic system is defined as a system such that it is a strategic system; such that, the strategic system behavior converges to a predictive state.

Examples of *eudemonic systems*: A *strategic system* controls its inputs and outputs. In an eudemonic system, the strategic system controls its inputs and outputs in a manner to achieve an outcome that is valued. For a corporation that produces a product, the production is not the eudemonic system, but what the corporation values as a social entity results in an eudemonic system. A school system produces students with certain academic capabilities, but it is not these, but the desired exhibited individual personal and social values held by the students that are a result of the predicted outcomes of the eudemonic system. The D.A.R.E. program is designed as a eudemonic system. The scouting program is a eudemonic system. Sports programs and extra-curricular programs are frequently designed to promote certain values as part of a eudemonic system.

Strategic system, $_{\mathfrak{J}}\mathcal{W}$**,** $=_{df}$ a dynamic teleological system that controls its input and output.

$$_{\mathfrak{J}}\mathcal{W} =_{df} \mathfrak{S} \mid \mathfrak{S} = {}_{\mathfrak{D}}\mathfrak{S} \wedge \exists f_1({}_{\mathfrak{L}}\mathcal{W})({}_{\mathfrak{L}}\mathcal{W} : \mathrm{I}_{\mathcal{P}} \rightarrow \Re) \wedge \exists f_2({}_{\mathfrak{L}}\mathcal{W})({}_{\mathfrak{L}}\mathcal{W} : \mathrm{O}_{\mathcal{P}} \rightarrow \Re)$$

Strategic system is defined as a system; such that, it is a dynamic teleological system, and there is a function defined by the leadership subsystem such that it is defined from the input into the reals and there is a function defined by the leadership subsystem such that it is defined from the output into the reals.

Dynamic teleological system, $_{\mathcal{D}}\mathfrak{S}$, or Intentional subsystem $=_{\text{df}}$ Leadership subsystem-directed system behavior, such that the leadership subsystem controls the system's behavior in a manner determined by the subsystem's goals.

$$_{\mathcal{D}}\mathfrak{S} =_{\text{df}} \mathfrak{S} \mid \exists_{\mathfrak{L}}\mathcal{W} \subset \mathfrak{S}\ (\mathcal{G}:(_{\mathfrak{L}}\mathcal{W}) \to \mathcal{B}(\mathfrak{S}))$$

Where, '$\mathcal{G}$' is a goal-function-process that maps the leadership subsystem-directed goals onto the system behavior.

Dynamic teleological system is defined as a system; such that, there is a leadership subsystem of the system such that the goal-function-process maps the leadership subsystem goals onto the system behavior.

Dynamic teleology and predictability: Dynamic teleology consists of directed processes of the Leadership subsystem defined by system structure that yields a final state. It is as a direct result of the nature of this dynamic teleological process that such structure and operation implies that the system is predictable.

A basic observation of behavioral systems, whether the behavior of a person or of a system comprised of many persons, is that they are not chaotic. Such systems are observed to operate in a manner that directs them toward certain goals. This characteristic of these systems will be identified as 'intentional'; that is, these are 'intentional systems'. Further, it is asserted that for **intentional systems**, the *intent* controls the behavior and has been recognized as the best predictor of behavior. Such an assumption has long-standing support, even when applied to individuals.

With respect to individuals, in the late 1960's and early 1970's, Icek Ajzen and Martin Fishbein, as a means of predicting individual behavior, developed the *Theory of Reasoned Action* (TRA) and the *Theory of Planned Behavior* (TPB). TRA/TPB were developed in the field of social psychology and were designed:

1. To predict and understand motivational influences on behavior that is not under the individual's volitional control.
2. To identify how and where to target strategies for changing behavior.
3. To explain virtually any human behavior such as why a person buys a new car, votes against a certain candidate, is absent from work or engages in premarital sexual intercourse.

— Jill Levine and Cara Pauls, PHC 6500 Foundations of Health Education/Fall 1996, and Marsha Levine, Sonjia Little and Susan Mills, PHC 6500 Foundations of Health Education/Fall 1997, University of South Florida, Community and Family Health, http://hsc.usf.edu/~kmbrown/TRA_TPB.htm.

Ajzen and Fishbein assert that three things determine intention:

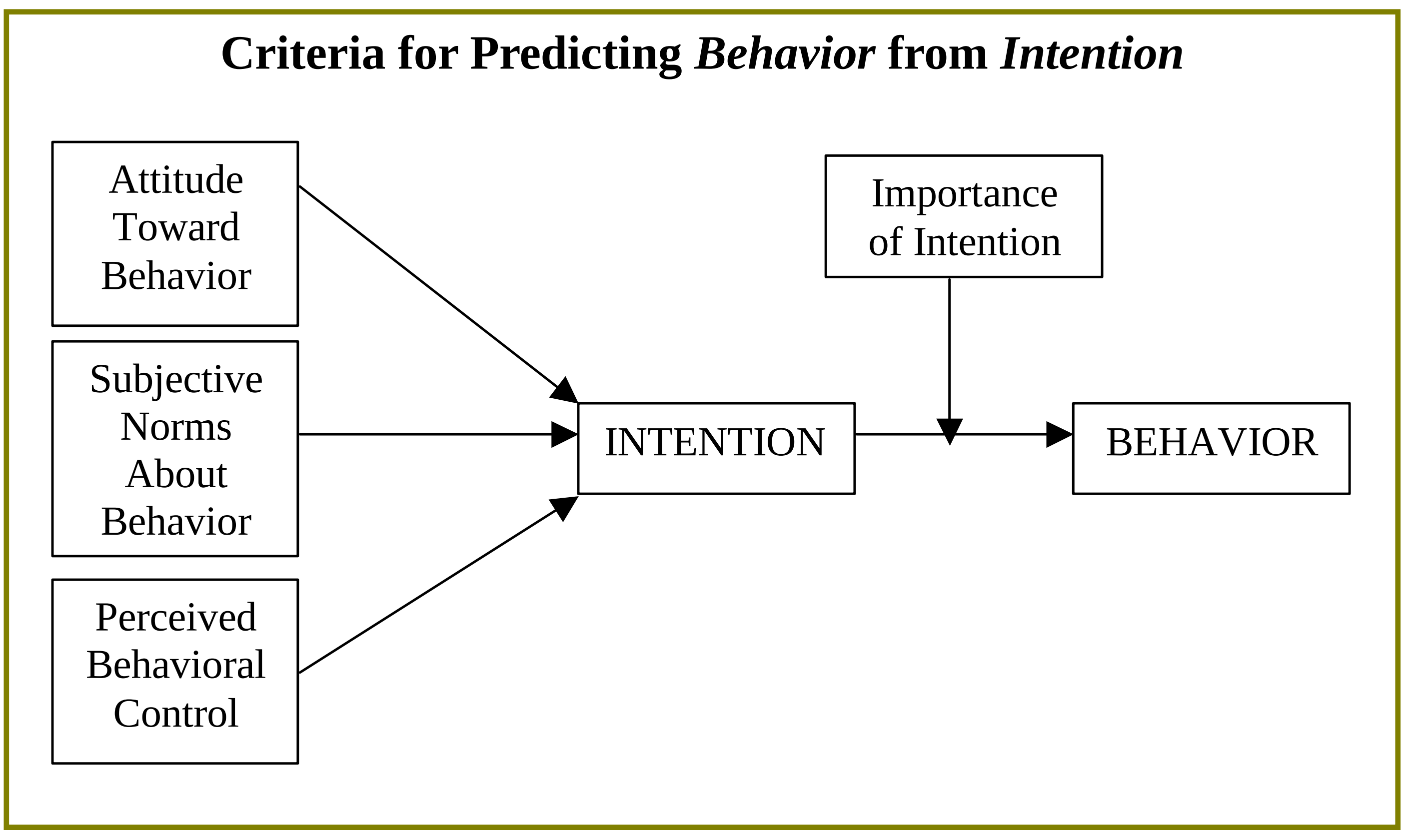
1. Attitude toward the specific behavior,

2. Subjective norms (that is, beliefs about how people they care about will view the behavior in question), and

3. Perceived behavioral control.

The stronger these three factors, then the more likely it is that the person's intention will result in action—the *intended* behavior. The actual behavior is also controlled by the importance of the intention. Even though there may be actual intent, acting on that intent may be influenced by how important the outcome behavior is perceived to be. For example, I may want to and intend to have some ice cream, but to obtain it I will have to go to a store to get it when I find that there is none in the freezer. "Oh, well, it's not really that important!" The *Importance Criteria* provides a final block to the behavior, or allows it to continue to action. The chart below portrays the process for predicting behavior from intention.

Now, whereas Ajzen and Fishbein are concerned with predicting human behavior individually, even to the point of predicting (or explaining) "any human behavior," our concern is with predicting intentional systems comprised of "several" individuals. How small the intentional systems can be that are of concern for *ATIS* has yet to be determined. However, even for *ATIS*, individual predictive outcomes are available when the individual is acting as a component of the larger intentional system. And, under these conditions, the Ajzen and Fishbein criteria do apply. In fact, while the intentional systems with which *ATIS* is concerned are not the social-psychological systems of an individual, it is apparent that the three Ajzen and Fishbein criteria shown in the chart above characterize the criteria for the intention of the individuals as they relate to the larger intentional system.



That is, the very fact that the individuals are components of the larger intentional system lends support to the belief and assumption that these individuals already have the appropriate attitude, acceptance of subjective norms and behavioral control that allows them to function behaviorally in a manner that furthers the goals of the intentional system. Further, their "commitment" to the goals of the intentional system is confirmed by their presence in the system, hence it is reasonable to predict that they will act behaviorally in a manner that furthers the goals of the larger intentional system. Ajzen and Fishbein provide support for the position here taken that behavior is predictable when system intentions are known.

Examples of *dynamic teleological systems*: It appears as though all social systems are dynamic teleological systems in that they are designed to meet certain social outcomes; that is, they all have specific social goals. All schools are dynamic teleological systems in that they all have been designed with a specific goal to achieve.

Coterminous systems, $_{CT}\mathfrak{S}$, $=_{df}$ two or more systems that are coextensive in scope, range, time, limit, or duration.

$$_{CT}\mathfrak{S} =_{df} \mathcal{F} \mid \mathfrak{S}_{i=1\ldots n} \in \mathcal{F} \wedge i > 1 \wedge \exists^1 P_{coextensive} \forall \mathfrak{S}_i(P(\mathfrak{S}_i))$$

Coterminous systems are a family of systems; such that, there are two or more systems in the family, and there is a unique coextensive predicate that describes all systems in the family.

Examples: Possibly the easiest way to visualize coterminous systems is to consider the "coterminous 48 states" of the United States and the two that are not—Alaska and Hawaii. However, coterminous systems can also be such due to time; that is, all high schools within a school system are coterminous in their daily operation. Essentially, any systems that can be identified as occurring together in some respect can be considered as coterminous systems.

Indirect-influenced system, ${}_{ID}\mathbb{S}$, $=_{df}$ a system with affect relation sets characterized by indirectly connected components.

$${}_{ID}\mathbb{S} =_{df} \mathbb{S} \mid \exists \mathcal{A}_i({}_{ID}\mathcal{C})$$

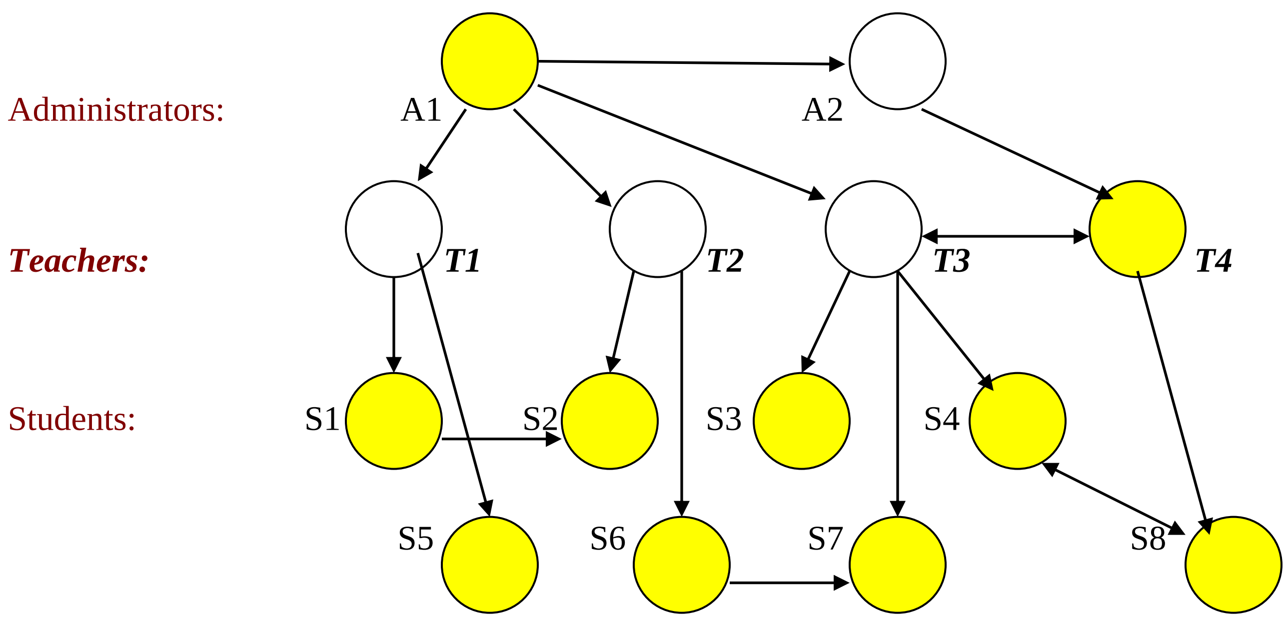
Indirect-influenced system is defined as a system; such that, there exist affect relation sets that are characterized by indirectly connected components.

$\mathcal{M}$**: Indirect-influenced system measure,** $\mathcal{M}({}_{ID}\mathbb{S})$**,** $=_{df}$ a measure of the average of the indirectly connected component sets of the affect relation set.

$$\mathcal{M}({}_{ID}\mathbb{S}) =_{df} [(\Sigma_{i=1,\ldots,n}[|({}_{ID}\mathcal{C}_{j:\mathcal{A}(i)})_{j=1,\ldots,m}| \div m] \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

The diagrams below show indirect influence in a school system:

Indirect-Influence in a School System



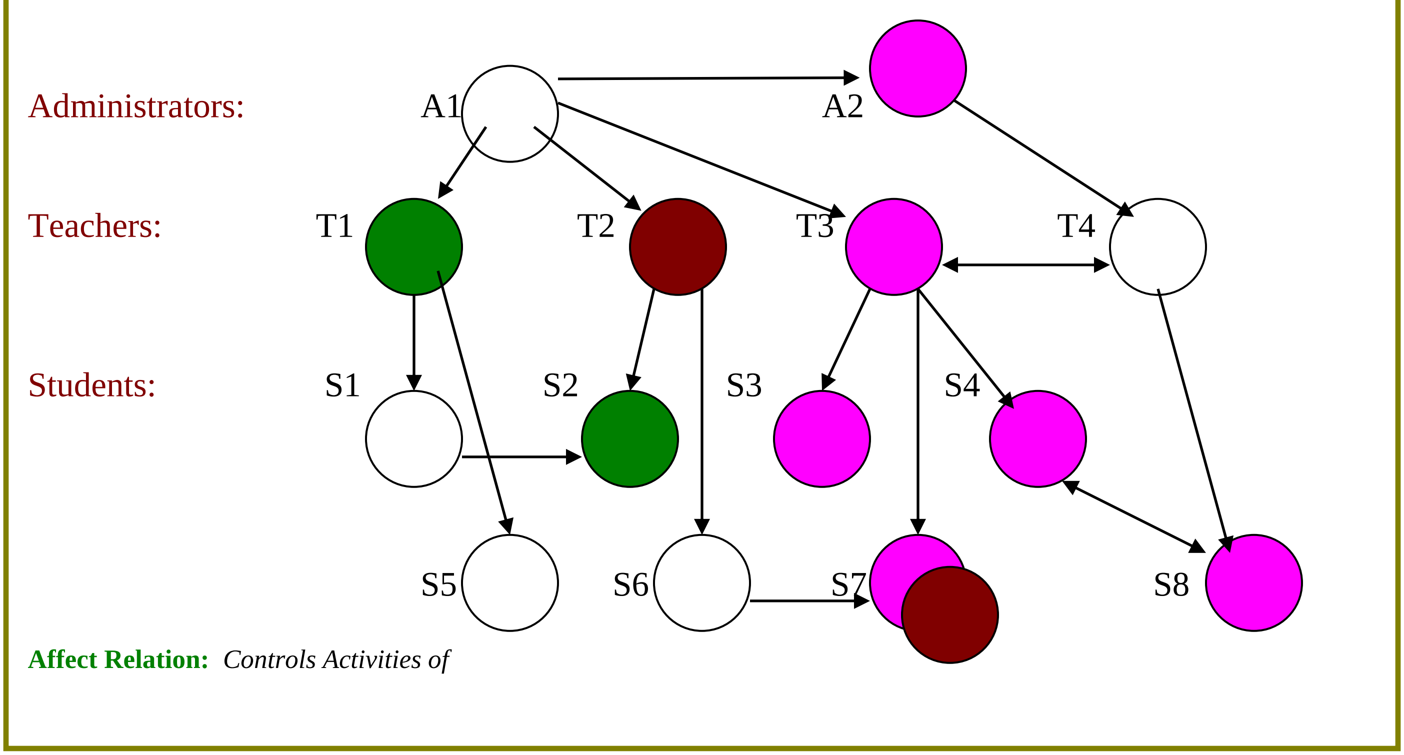
Affect Relation: *Controls Activities of*

In this system, there are 6 distinct *Indirect-Influenced Subsystems* that *Control Activities of* other components with respect to *Indirect-Influence*. Since there are 14 components, then the total possible affect relation paths is 236,975,181,590. Therefore, $\log_2|\mathcal{A}_i| \approx 37.78594$. There are 24 paths related to *Indirect-Influence*.

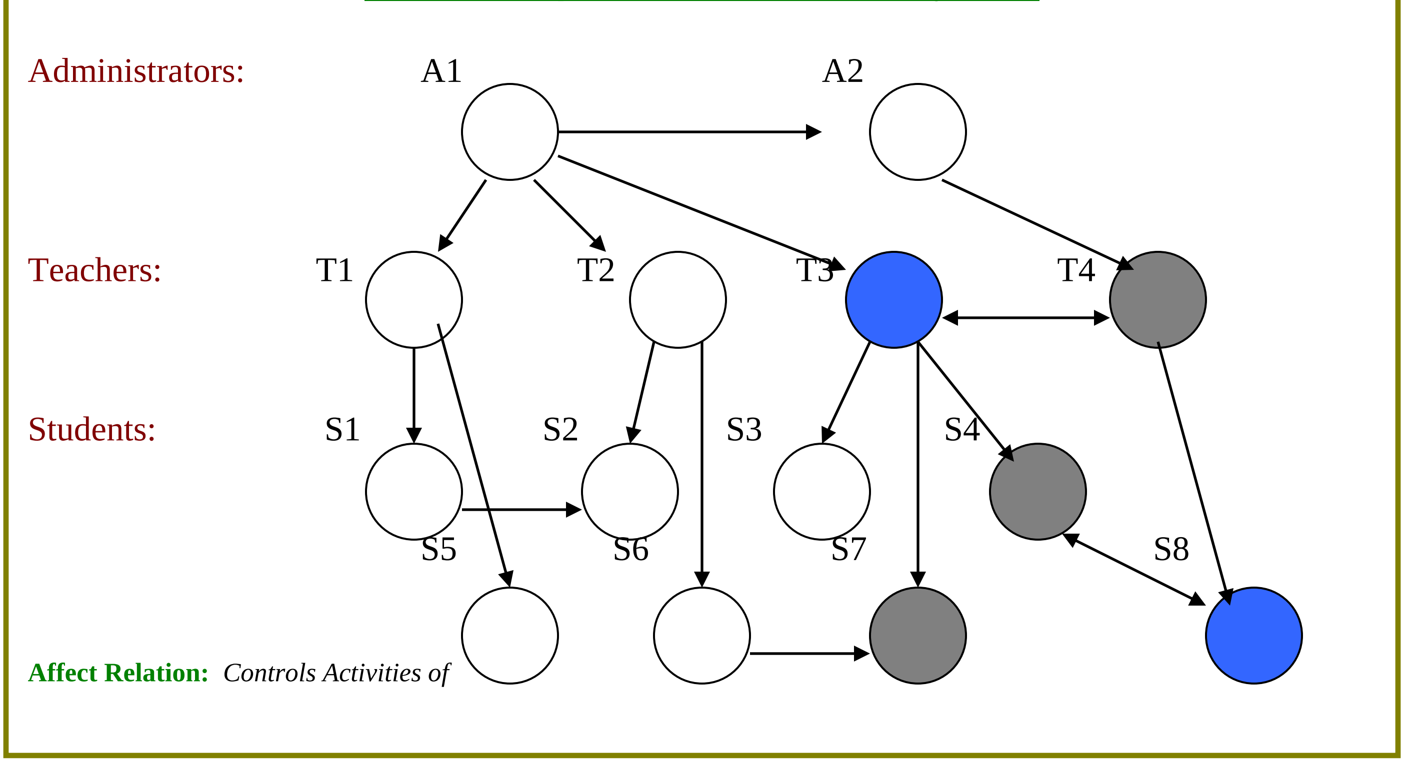
Note: Since there are numerous *Indirect-Influenced Subsystems* within this school system, additional figures on the next page will indicate the additional subsystems.

Therefore: $\mathcal{M}({}_{ID}\mathbb{S}) \approx 11$**.**

***Indirect-Influence* in a School System**



***Indirect-Influence* in a School System**



Designer Systems

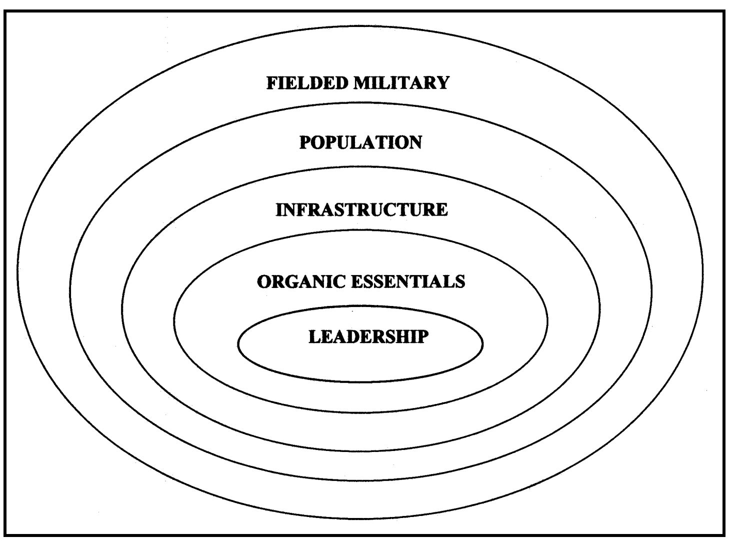
If a specific type of system is being considered in-depth, it may be advisable to define specific subsystems so that the system may be more easily evaluated.

All that is needed to define a *Designer System* is to define the object-set and relation-set of the system so that it is defined by the ordered pair: $(\mathbb{S}_{\mathbf{o}},\mathbb{S}_{\varphi})$. Once the system has been defined, then it can be analyzed as any other system by ATIS. That is, the *ATIS-Options Set* is applied to the analysis of the *Designer System*.

One of these *Designer Systems* is the *Five Rings System* developed by Colonel John A. Warden III, USAF.[1] Due to it being a well-developed theory with well-defined systems, it will be considered here and can possibly be used as an exemplar of how such *Designer Systems* can be developed for other systems of interest; for example, education systems, business systems, and social systems of various kinds.

The advantage of a *Designer System* is that the analysis can be more focused. The *Warden*^{3rd} *System* is designed specifically for the targeting of military or terrorist networks. As a result, the ATIS-Analysis is restricted to the *Five Rings System* (*Warden*^{3rd} *System*) of concern. This initial analysis of the system to be analyzed helps to clearly define the system of concern.

There are a number of ways in which *general system* can be defined. One contributor to the development of *general systems theory* is Colonel John A. Warden III, USAF. His development introduces the *Five Rings System* (*Warden*^{3rd} *System*). His basic concept is of five concentric rings, each identifying a critical partition of the system: *Leadership Subsystem*, *Organic Essentials Subsystem*, *Infrastructure Subsystem*, *Population Subsystem*, and the *Fielded Military Subsystem* (or *Defense Subsystem*), as portrayed in the following figure.



[1] The Five Rings System Theory is published by Colonel John A. Warden III, USAF, in the following: "The Enemy as a System," *Airpower Journal*, Spring 1995; "Air Theory for the Twenty-first Century" in *Battlefield of the Future*; and *The Air Campaign, Planning for Combat*.

Although this system has been developed for military systems, it may also be applied to such analyses relating to combatting disease in humans, where; for example, the *Fielded Military* is considered to be the *Immune Subsystem*, and the other subsystems are appropriately identified. The *Leadership Subsystem* might be the medical doctor and staff in charge of combatting the disease.

> Although an *education system* will be defined differently, it also could be defined in terms of the *Warden*[3rd] *System*. In the world we live in today, the *Defense Subsystem* could take on the real meaning of the military term and is identified by the security personnel required to protect a school. The *Leadership Subsystem* would most likely be the principal and staff in charge of running the school. From there, however, it is seen that it would probably be better defined in terms of *student*, *teacher*, *context*, and *content*; where an *education system* is an intentional system consisting of at least one teacher and one student in a context. The content is introduced according to the subjects being studied and other manipulatives, outside resources, etc., that may be used in the instructional process. This definition of *education system* is taken from Elizabeth Steiner's *Methodology of Theory Building*[2] where she states:
>
> > In devising education theory from SIGGS, teacher, student, content, and context are taken as forming a system of education. (p. 107)
>
> As with any *Designer System*, once the system components have been identified and partitioned, and the affect-relations identified with respect to the system components, then an *ATIS-Analysis* can be performed to determine the outcomes (theorems) of the system. See Theodore Frick's *Restructuring Education through Technology*[3], for an in-depth discussion of content and context, and other considerations in the development of an education system.
>
> Also, Frick points out other considerations that should be made when designing an *education system*; for example, see *Epistemology of Educology*[4].
>
> > Educology is more than only discourse (i.e., warranted assertions, explanatory theories, justificatory arguments), for this would be to limit signs to symbolic propositions (Peirce, 1932). Common usage would appear to further limit knowledge to quantitative knowledge, which excludes performative knowledge and qualitative knowledge about education. Moreover, educology as defined here is not limited to knowledge about educational processes. Educology includes knowledge of educational structures as well as processes. Educology further includes other components in the domain of education that are not processes or structures, especially knowledge of education systems, which include but are not limited to teaching-studenting processes. (Page 2)
>
> As seen here, a *Designer System* for an *educational system* may include various subsystems including educational structures, educational processes, teaching-studenting processes, etc.

The *Five-Rings Methodology* was developed as a means for understanding enemy threats against a nation and how one can most easily and efficiently counter that enemy threat. In order to understand an enemy, Col. Warden states that we must think strategically and in so doing:

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[2] Steiner, Elizabeth, Indiana University, Methodology of Theory Building, Educology Research Associates, Sydney, 1988.
[3] Frick, Theodore W., Phi Delta Kappa Educational Foundation, Bloomington, Indiana, *Fastback #326*, "*Restructuring Education through Technology*"
[4] Frick, Theodore W., *Epistemology of Educology* draft, 2015,

"If we are going to think strategically, we must think of the enemy as a system composed of numerous subsystems."

Also, the enemy, as well as our own nation, must be thought of as a "strategic entity"; that is:

> A ***strategic entity*** is a system that can function on its own and is free and able to make decisions as to where it will go and what it will do. A ***strategic entity*** is a self-contained system that has the general ability to set its own goals and the wherewithal to carry them out. A ***strategic entity*** is any system that can operate autonomously, is self-directing, and is self-sustaining.

The Five Rings

The *Five Rings* defined by Col. Warden are as follows:

- **First Ring: Leadership Subsystem**

  The *Leadership Subsystem* is comprised of the *command and control subsystems*, the *communication subsystem*, and the *intelligence subsystem* (C^3I *subsystems*).

- **Second Ring: Organic Essentials Subsystem**

  The *Organic Essentials Subsystem* is comprised of those subsystems that are essential for the survival of the system in its current state. These are subsystems that are required for system-maintenance processes.

  For a nation, such *organic essentials* include the *power production subsystems* [electric power plants], *petroleum production subsystems* [petroleum refineries], *bearings production subsystems* [roller bearings, etc.], *weapons production subsystems* [biological and nuclear capabilities], and *food production subsystems* [for soldiers].

  The number of organic essentials is relatively small. It is comprised of those subsystems that are absolutely necessary to maintain the viability of the system.

- **Third Ring: Infrastructure Subsystem**

  The *Infrastructure Subsystem* is comprised of those subsystems that are non-essential for the survival of the system in its current state yet maintain the integrity of the system by carrying out various system functions.

  For a nation, such subsystems are those that maintain the political, social and cultural integrity of the system. These infrastructure subsystems include the *transportation subsystem* and all *non-essential industry subsystems*. In particular, it would include *rail, air, sea, and highway subsystems*, *communication lines subsystems* and *pipelines subsystems*. Further, it includes all *industry subsystems* not considered as organic essential; for example, *grocery stores subsystems* (for the non-military population), *clothing stores subsystems* (for the non-military population), etc.

- **Fourth Ring: Population Subsystem**

  The *Population Subsystem* is comprised of the system's individual components. For an organic system, these are the components that establish relations that identify the integrity of the system.

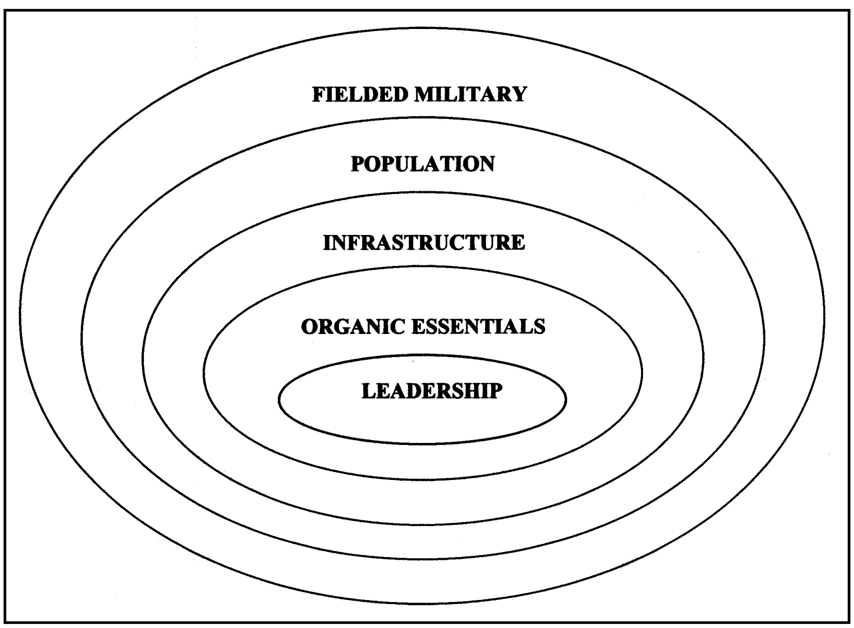
  For a nation, this subsystem is the population of the nation. These are the people, the components, who enter into various political, social and cultural relations that maintain the integrity of the system.

- **Fifth Ring: Fielded Military (Defense) Subsystem**

  The *Fielded Military (Defense) Subsystem* is comprised of those subsystems that provide the self-defense capability of the system.

  For a nation, this is comprised of the aircraft, ships, troops, etc. of the military subsystem.

The *Five Rings* are graphically portrayed as follows:



These systems are defined below.

The Warden^{3rd} Partition Properties, $_{X}\mathcal{W}$

The Warden^{3rd} Primary System Partition Properties

Organic system, $_{\mathcal{O}}\mathcal{W}$**,** $=_{df}$ A system that has a homeostatic-maintenance subsystem.

$$_{\mathcal{O}}\mathcal{W} =_{df} \mathbb{S} \mid \exists_{H}\mathbb{S}\ ({}_{H}\mathbb{S} \subset \mathbb{S})$$

Organic system is a system such that there is a homeostatic subsystem of the system.

Inorganic system, $_{IS}\mathcal{W}$**,** $=_{df}$ A system that does not have a homeostatic-maintenance subsystem.

$$_{\sim\mathcal{O}}\mathcal{W} =_{df} \mathbb{S} \mid \forall_{H}\mathbb{S}\ ({}_{H}\mathbb{S} \not\subset \mathbb{S})$$

Inorganic system is a system such that for all homeostatic subsystems they are not a subsystem of the system.

Homeostaticness, $_{H}\mathbb{S}$**,** $=_{df}$ the maintenance of stability under system or negasystem environmental change. $_{H}\mathbb{S} =_{df} \mathbb{S} \mid \Delta\mathbb{S} \vee \Delta\mathbb{S}' \Vdash {}_{SB}\mathbb{S}$

Homeostaticness is defined as a system; such that, a change in the system or negasystem yields system stability. That is, it is the affect-related system components that maintain a homeostatic system state; that is, exhibits dynamic self-regulation such that it maintains essential system variables within acceptable limits when the system experiences disturbances.

The Warden^{3rd} Secondary System Partition Properties

Leadership subsystem, $_{\mathcal{L}}\mathcal{W}$**,** $=_{df}$ the system comprised of the C^{3}I subsystems.

$$_{\mathcal{L}}\mathcal{W} =_{df} \mathbb{S}^{\hat{a}} \mid ({}_{\mathcal{Command}}\mathcal{W} \cup {}_{\mathcal{Control}}\mathcal{W} \cup {}_{\mathcal{Com}}\mathcal{W} \cup {}_{\mathcal{Intel}}\mathcal{W}) = \mathbb{S}^{\hat{a}}$$

Leadership subsystem is the system that is comprised of the *command subsystem*, *control subsystem*, *communication subsystem*, and *intelligence subsystem*.

The Warden[3rd] Secondary System Partition Properties—continued

Organic-Essential Components: The Organic-Essential Components are defined as such components as food, power, petroleum, bearings, weapons and other such products which if not produced would result in the demise of the system. **They do not include any human components**.

Organic-essentials subsystem, $_{\mathcal{E}}\mathcal{W}$**,** $=_{df}$ The subsystem that maintains the homeostasis of the system.

$$_{\mathcal{E}}\mathcal{W} =_{df} \mathbb{S}^{\hat{u}} \mid \mathbb{S}^{\hat{u}} = {}_{H}\mathfrak{S}$$

Organic-essentials subsystem is the system that is a homeostatic system.

Infrastructure Subsystem, $_{\mathcal{I}}\mathcal{W}$**,** $=_{df}$ the subsystem defined by the non-organic-essential system relations.

$$_{\mathcal{I}}\mathcal{W} =_{df} \mathbb{S}^{\hat{u}} \mid \mathbb{S}^{\hat{u}} = (\mathcal{I}_E, \mathcal{A}_{\mathcal{U}})$$

Infrastructure subsystem is a subsystem; such that, the non-organic-essential components, $\mathcal{I}_E$, define the object-set of the subsystem and the non-organic-essential component affect relations, $\mathcal{A}_{\mathcal{U}}$, define the relation-set of the subsystem.

Population Subsystem, $_{\mathcal{P}}\mathcal{W}$**,** $=_{df}$ the subsystem defined by all human components of the system.

$$_{\mathcal{P}}\mathcal{W} =_{df} \mathbb{S}^{\hat{u}} \mid \mathbb{S}^{\hat{u}} = (\mathcal{P}_E, \mathcal{A}_{\mathcal{P}})$$

Population subsystem is a subsystem; such that, the population components, $\mathcal{P}_E$, define the object-set of the subsystem and the population affect relations defined by all human components, $\mathcal{A}_{\mathcal{P}}$, defines the relation-set of the subsystem.

Fielded military subsystem, $_{\mathcal{F}}\mathcal{W}$**,** $=_{df}$ the subsystem that maintains a system as a homeostatic system.

$$_{\mathcal{F}}\mathcal{W} =_{df} \mathbb{S}^{\hat{u}} \mid \mathbb{S}^{\hat{u}} = (\mathcal{F}_E, \mathcal{A}_{H(\mathbb{S})})$$

Fielded military subsystem is defined as a subsystem; such that, the fielded military components, $\mathcal{F}_E$, define the object-set of the subsystem and the system's homeostatic affect relations, $\mathcal{A}_{H(\mathbb{S})}$, define the relation-set of the subsystem.

The FieldedMilitaryComponents, $\mathcal{F}_E$, are those components of the system object-set, $\mathfrak{S}_O$, that are defined by the HomeostaticAffectRelations, $\mathcal{A}_{H(\mathbb{S})}$.

The Warden^3rd^ System Properties

C^{3}I subsystem, ${}_{C3I}\mathcal{W}$, $=_{df}$ the subsystems consisting of command, control, communication and intelligence.

$$ {}_{C3I}\mathcal{W} =_{df} \mathfrak{F}(\mathcal{W}) = \{{}_{\mathcal{C}}\mathcal{W}, {}_{\mathcal{L}}\mathcal{W}, {}_{C}\mathcal{W}, {}_{\mathcal{I}}\mathcal{W}\} $$

C^{3}I subsystem is defined as the family of *Warden Partition Subsystems* equal to the command, control, communication and intelligence subsystems.

Command subsystem, ${}_{\mathcal{C}}\mathcal{W}$, $=_{df}$ the subsystem that controls the system as a dynamic teleological system.

$$ {}_{\mathcal{C}}\mathcal{W} =_{df} \mathfrak{Y} \subset \mathfrak{S} \mid \mathfrak{Y} = (\mathcal{C}_{E}, \mathcal{A}_{\mathcal{D}(\mathbb{S})}) $$

Command subsystem is defined as a system; such that, the command components, $\mathcal{C}_E$, define the object-set of the system and the system dynamic teleological affect relations, $\mathcal{A}_{\mathcal{D}(\mathbb{S})}$, define the relation-set of the system.

Control subsystem, ${}_{Control}\mathcal{W}$, $=_{df}$ the subsystem that maintains the system as a dynamic teleological system.

$$ {}_{Control}\mathcal{W} =_{df} \mathfrak{S} \mid \mathfrak{S} = (\mathcal{L}_{E}, \mathcal{A}_{\mathcal{D}(\mathbb{S})}) $$

Control subsystem is defined as a system; such that, the control components, $\mathcal{L}_E$, define the object-set of the system and the system controlling dynamic teleological affect relations, ${}_{\mathcal{L}}\mathcal{A}_{\mathcal{D}(\mathbb{S})}$, define the relation-set of the system.

Communication subsystem, ${}_{Comm}\mathcal{W}$, $=_{df}$ the subsystem that consists of the object-set system-partition defined by the communication qualifiers, and the relation-set system-relations defined by the command and control communication affect relations.

$$ {}_{Comm}\mathcal{W} =_{df} \mathfrak{Y} \subset \mathfrak{S} \mid \mathfrak{Y} = (C_{Q} \subset \mathfrak{S}_{\mathcal{O}}, \mathcal{A}_{C(\mathcal{C},\mathcal{L})} \subset \mathfrak{S}_{\phi}) $$

Communication subsystem is defined as a system; such that, the communication qualifiers, C_Q, define the object-set of the system and the command and control communication affect relations, $\mathcal{A}_{C(\mathcal{C},\mathcal{L})}$, define the relation-set of the system.

The Warden[3rd] System Properties

Intelligence subsystem, $_{\text{Intel}}\mathcal{W}$, $=_{\text{df}}$ the subsystem that provides feedback for monitoring the effectiveness of the command and control subsystems.

$$_{\text{Intel}}\mathcal{W} =_{\text{df}} \mathfrak{S} \mid \mathfrak{S} = (\mathfrak{I}_E, \mathfrak{f}B(\mathcal{A}_{\mathfrak{I}_E})_{\text{Command}\mathcal{W}, \text{Control}\mathcal{W}})$$

Intelligence subsystem is a system; such that, the intelligence components, $\mathfrak{I}_E$, define the object-set of the system and the intelligence feedback affect relations, $\mathfrak{f}B(\mathcal{A}_{\mathfrak{I}_E})_{\text{Command}\mathcal{W}, \text{Control}\mathcal{W}}$, define the relation-set of the system.

Background population subsystem, $_{\mathfrak{B}\mathcal{P}}\mathcal{W}$, $=_{\text{df}}$ the subsystem defined by human components that are not in any other system partition.

$$_{\mathfrak{B}\mathcal{P}}\mathcal{W} =_{\text{df}} \mathfrak{S}^{\hat{u}} \mid \mathfrak{S}^{\hat{u}} = ({}_{\mathfrak{B}}\mathcal{P}_E, \mathcal{A}_{\mathfrak{B}\mathcal{P}} = \{(x,y) \mid (x,y) \in \mathcal{A}_{\mathfrak{B}\mathcal{P}} \supset (x,y) \notin \mathcal{A}_{\mathfrak{R}} \subset \mathcal{A}_{\mathcal{P}}\})$$

Population subsystem is a subsystem; such that, the background population components, ${}_{\mathfrak{B}}\mathcal{P}_E$, define the object-set of the subsystem and the background population affect relations defined by all human components not in any other affect-relation partition, $\mathcal{A}_{\mathfrak{B}\mathcal{P}}$, defines the relation-set of the subsystem.

Strategic system, $_{\mathcal{S}}\mathcal{W}$, $=_{\text{df}}$ a dynamic teleological system that controls its input and output.

$$_{\mathcal{S}}\mathcal{W} =_{\text{df}} \mathfrak{S} \mid \mathfrak{S} = {}_{\mathcal{D}}\mathfrak{S} \wedge \exists f_1[({}_{\mathfrak{L}}\mathcal{W})({}_{\mathfrak{L}}\mathcal{W} : I_{\mathcal{P}} \rightarrow \mathfrak{R}) \wedge \exists f_2({}_{\mathfrak{L}}\mathcal{W})({}_{\mathfrak{L}}\mathcal{W} : O_{\mathcal{P}} \rightarrow \mathfrak{R})] \wedge [H(I_{\mathcal{P}}) = 0 \wedge H(O_{\mathcal{P}}) = 0]$$

Strategic system is defined as a system; such that, it is a dynamic teleological system, and there is a function defined by the leadership subsystem such that it is defined from the input into the reals and there is a function defined by the leadership subsystem such that it is defined from the output into the reals.

System strategic paralysis, $_{\text{SP}}\mathcal{W}$, $=_{\text{df}}$ A system that controls none of its input and output.

$$_{\text{SP}}\mathcal{W} =_{\text{df}} \mathfrak{S} : H(I_{\mathcal{P}}) = 1 \wedge H(O_{\mathcal{P}}) = 1$$