Research Article

QMH (Quantifying Mental Health) Key Technologies

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In order to understand the chaotic nature of mental health, a forensic simulation of the mental health system is under development. This paper discusses the requirements and key techologies based on Ontological Engineering. Ontological engineering is expected to provide a foundation of so-called Content-Directed Artificial Intelligence which relies on the development of an *integrated World Knowledge DataBase* (*WKDB)* necessary for the understanding of mental health.

In their 2019 paper in Journal of Global Health[1] "Artificial intelligence and algorithmic bias: implications for health systems. ," Panch, Mattie, and Rifat Atun define algorithmic bias as the application of an algorithm that compounds existing inequities in socioeconomic status, race, ethnic background, religion, gender, disability, or sexual orientation and amplifies inequities in health systems.

The technologies advocated in this paper when integrated from a "left to right" and at the same time from a "right to left" perspective removes the "bias creep " which is inherent in the human. The level of "pain" endured by the stakeholders, practioners, and designer's of the system is mitigated by satisfying the Ethics, Economics and Education fusion metric of QMH and will be treated in a following paper. Fusion is nothing more than a ratio of "summing it up and dividing by the parts". For the understanding of the physical universe is autodidactic and thus yields an understanding of pain and it's quantification from metrics derived from the bias error. This error is a result of the theo-logic difference between ethics and rational principles of morality.

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Overview

Cause and Effect

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How can “one” change the world? By examination of **Figure 1** and minimizing the error that exists between the Ontological Engineering′s: a) Design and it′s b) Signal Processing

perspectives as shown in **Figure 2** when aided by the measurement of one′s **LOS** (**L**ine **O**f **S**ight) vector and the Albus/Mystel **EOTB (E**ye **O**f **T**he **Beholder**) of **Figures 3** and **4.**

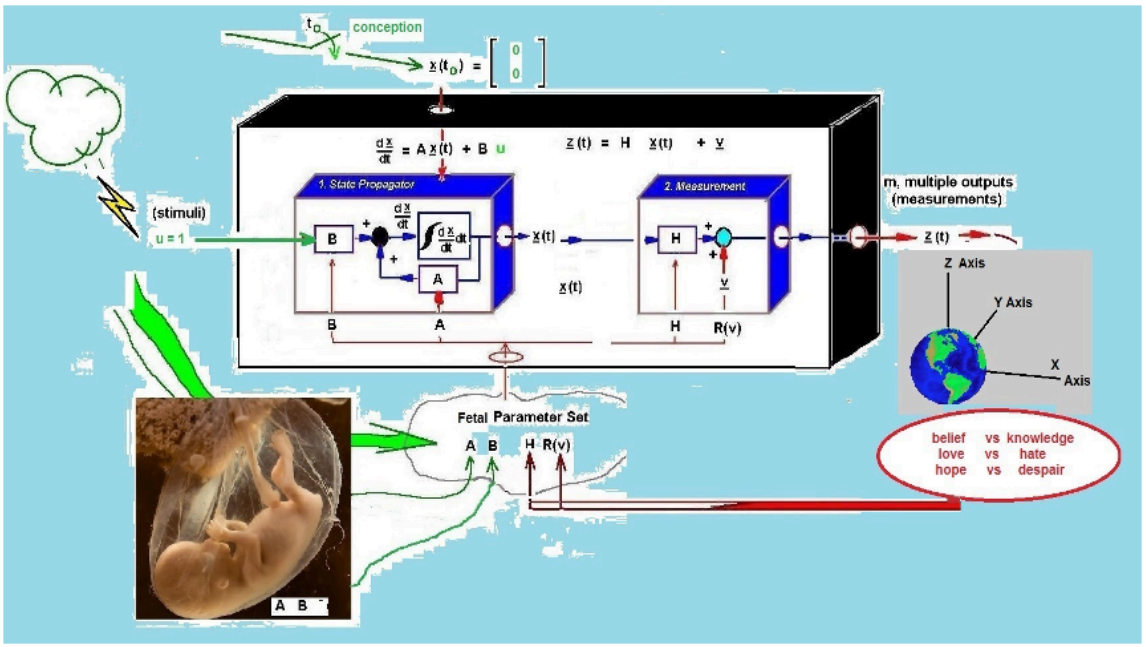

Figure 1. The Variables of Spiritual and Secular Space

$$\text{Error} = \begin{cases} \text{Signal Processing} - \text{Design} \\ \text{Design} - \text{Signal Processing} \end{cases}$$

$$\underbrace{\text{Design}}_{\text{BRAIN}} - \underbrace{\text{Signal Processing}}_{\text{LOS}}$$

$$(\ \text{left} \quad \text{vs} \quad \text{right}\ )$$

doi.org/10.32388/37C74M

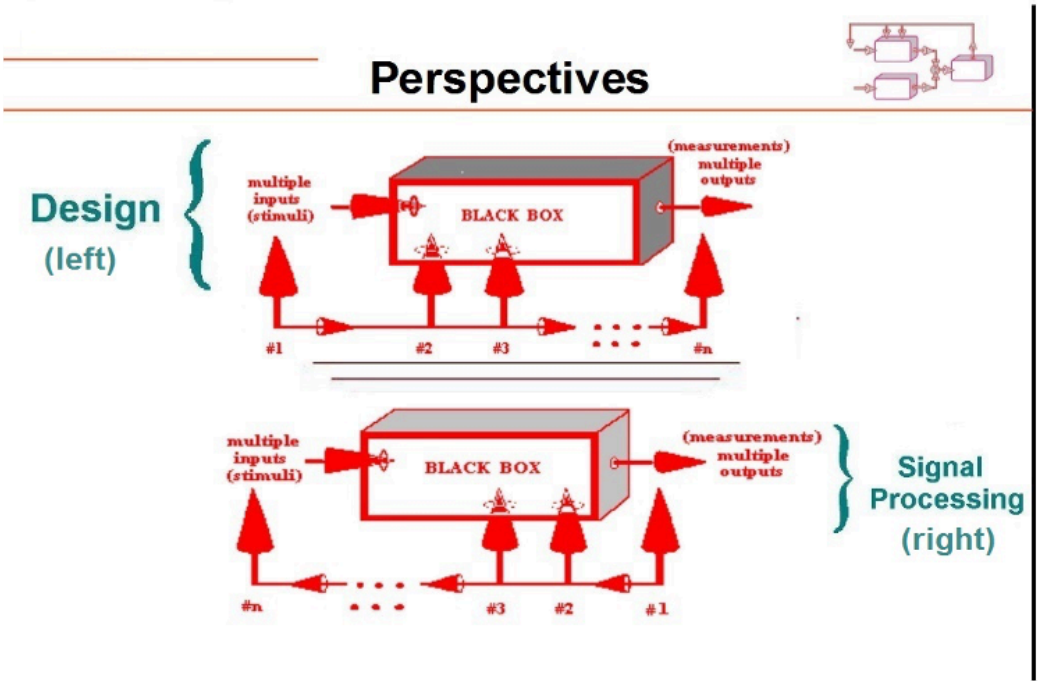

Figure 2. Ontological Engineering Perspectives

Stakeholders, practioners, and designer's of Mental Health systems design and deployment typically consist of people being governed by their *sense of morality which is equivalent to answering "The Primary Question of Ethics: How Shall I Live?"* and requres understanding of the correlation of Ethics, Economics and Education as measured from the **m** observer's[1] the **LOS** (**L**ine **O**f **S**ight)[2] as illustrated in:

- **Figure 3**,
- the *output* of **Figure 1,** and
- **Figure 4** - *life's* **EOTB** *homeostatis design*[3]

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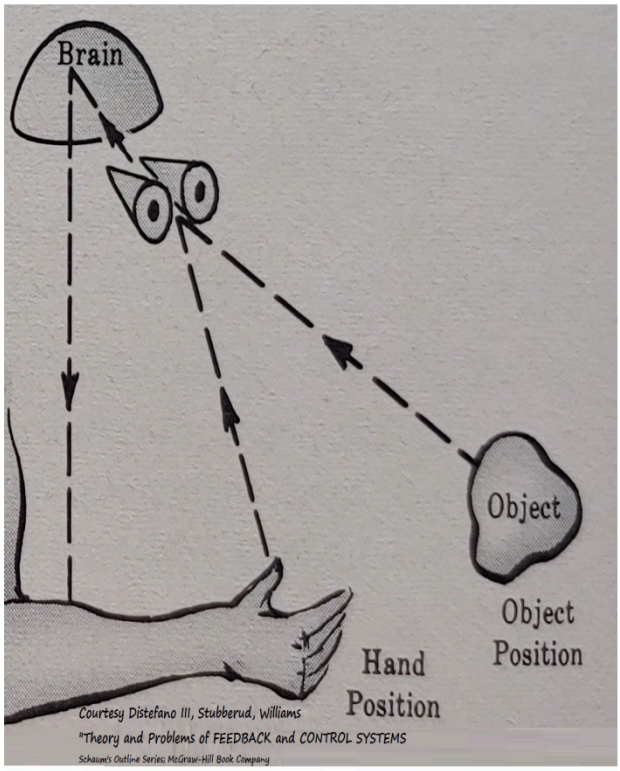
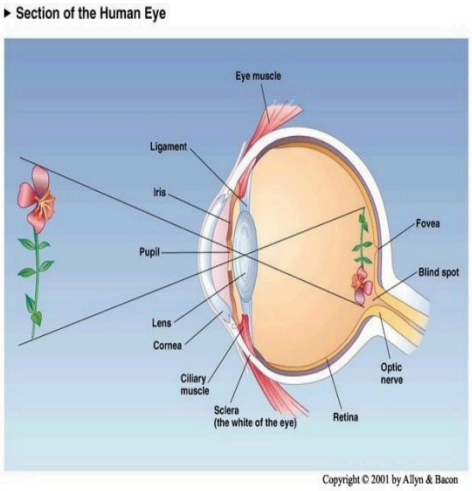




Mental Instability from inverse measurement system -- visual to mental transition broken? Law of Optics satisfied it is the same as Optical Communication. For example: Use of Lens performs the necessary integration funtion of analytics input to output via the convolution of impulse function with input function.

a) Homeostasis Hand Control via LOS **b) External vs Internal Info Transfer**

Figure 3. LOS (Line Of Sight) **via Feedback and Control of Systems**

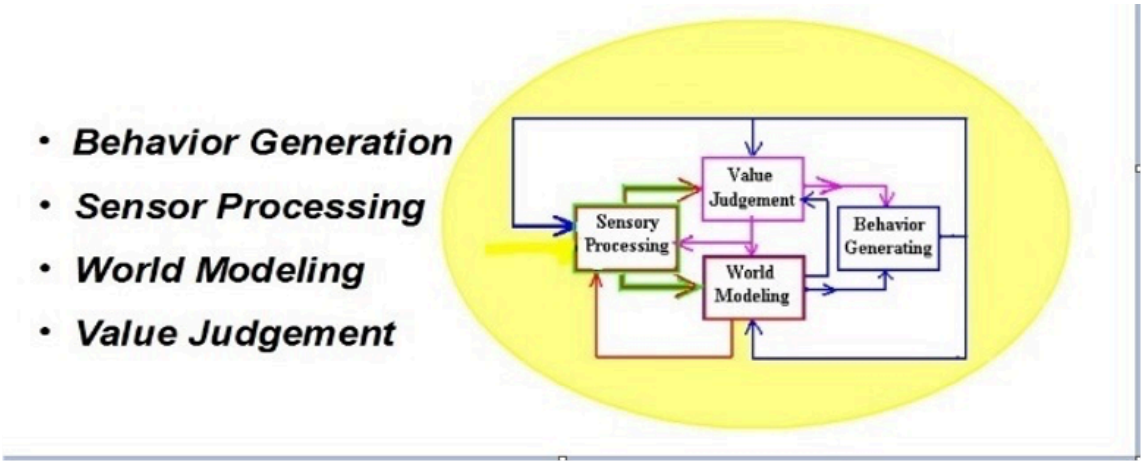
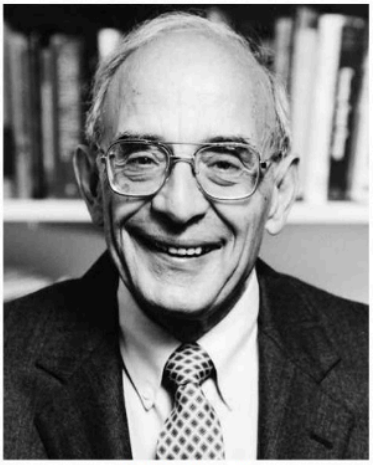


Figure 4. Albus/Mystel EOTB Homeostasis Architecture

(Feedforward and Feedback Signal Flow)

Intelligent system design involves the notion of *planning* which can be evaluated by the signal processing of life's homeostasis loops. The *stability of these loops* are controled by the brain's internal error signal as generated by it's feedforward and feedback neurological current flow. For example: Consider the thought process involved in the *Education of others to problem solve:*

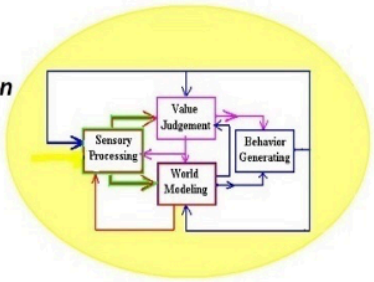
First, most people define learning too narrowly as mere "problem solving," so they focus on identifying and correcting errors in the external environment. Solving problems is important. But if learning is to persist, managers and employees must also look inward. They need to reflect critically on their own behavior, identify the ways they often inadvertently contribute to the organization's problems, and then change how they act. In particular, they must learn how the very way they go about defining and solving problems can be a source of problems in its own right.



Chris Argyris
James Bryant Conant Professor
Harvard Business School

Albus/Mystel EOTB

- Behavior Generation
- Sensor Processing
- World Modeling
- Value Judgement



"Unaddressed mental health problems can have a negative influence on homelessness, poverty, employment, safety, and the local economy. They may impact the productivity of local businesses and health care costs, impede the ability of children and youth to succeed in school, and lead to family and community disruption."[4]. Hence in order to mitigate of mental health problems it's stakeholders, practioners, and educators, must have a *mimimal understanding of control theory* for successful implementation of **QMH.**

A. QMH Mental-Health System Requirements

1. **Design**
   - **Shall support cooperative management of educational platforms and their associated measurement sensor assets such that:**

     it's WKDB (World Knowledge DataBase) be based on

     - *intelligent system design*

that will provide

- *plan generation*

that will be

- *evaluated*

with respect to its

- *effectiveness*

- **Shall provide the mechanism that will provide**

  - feedback

  in the planning process in order to optimize performance

2. **Satisfy The Architecture Design Definitions:**

- Architecture: the structure of components, their relationships, and principles of design, including the assignment of functions to subsystems and the specification of the interfaces between subsystems
- *Reference model* architecture: an architecture in which the entire collection of functions, entities, events, relationships, and information flow involved in interactions between and within subsystems are defined and *modeled to be:*
- ***Design Elements of Reference Model Architecture***

  - Knowledge Database - World Modeling

  - Sensory Processing - Evaluation/Optimization

3. **QMH Tool Box Educational Notions To Be Accessed[2]:**

- ***- ontological engineering - knowledge databases***

  - optimization of performance metrics - data fusion

  - adaptive processing/reasoning - sensor processing

  ***- model based reference systems* - data mining**

  ***- estimation, identification, control* - fuzzy logic**

  - qualitative reasoning - image processing

  ***- modeling methodologies* - communication theory**

  - cognitive reasoning

B. Cause and Effect of QMH: The analysis of

- *high level planning* **based on human reasoning.** considers for example:how the prefrontal cortex uses

  . *task knowledge*

  to hypothesis

  tentative plans

  which are submitted to the dorsolateral prefrontal cortex which

  simulates

  the plan (via the imagination) in order to

  predict plan results

  which are then

  evaluated

  via the subcortical limbic system

The neurological signal flow of this process is illustated in the simplified diagram of **Figure 5.**

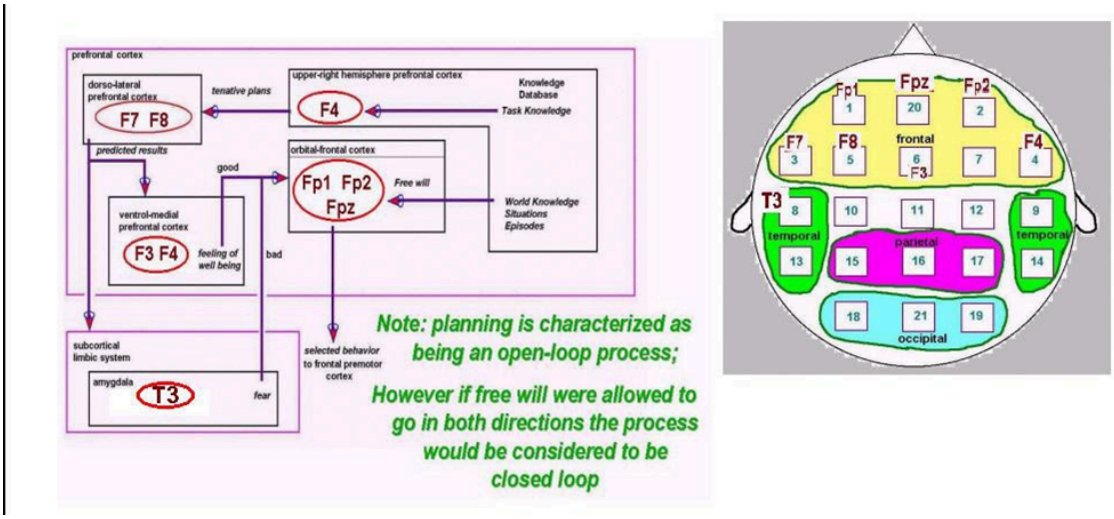
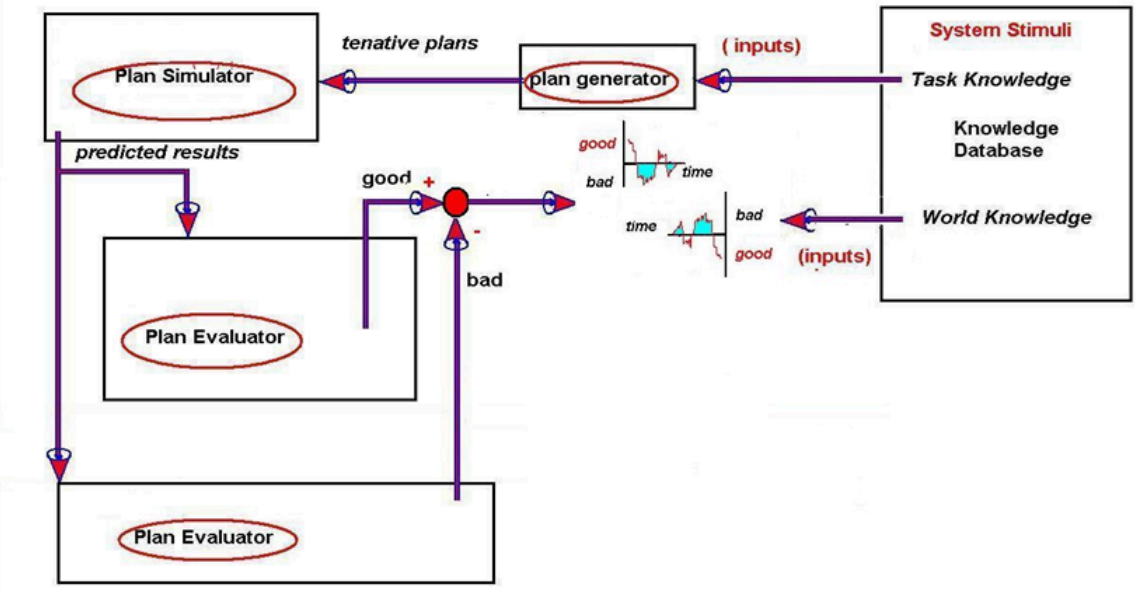


Figure 5. A Simplified Flow Diagram Of The Brain And It's Measured EEG High-level Planning System

Recall 1) architecture requirement demands that the structure of planning must be achieved via the use of feedback, and 2) reference model architecture is based on modeling theory satisfying the error optimization of the right to left difference. Ontological models exhibit two types of structure, either they employ no feedback, i.e, the employ homeostasis control via the methodology of - ***Open-Loop-Control***



Good vs Bad

Figure 6. Open-Loop-Control of Systematic Homeostasis

or they incomporate error feedback (**Figure 7)** by employment of - ***Closed-Loop-Control***

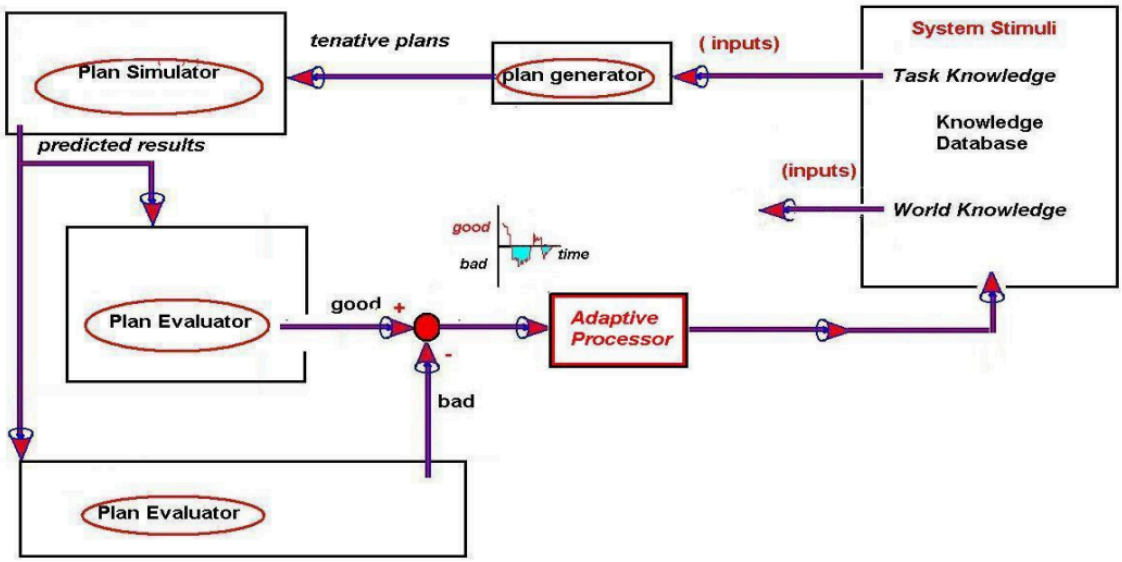


Figure 7. Closed-Loop-Control via the Adaptive Processor Yielding Systematic Homeostasis Stability

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The organic sensor (the brain) provides the *good vs bad* measurement (**Figure 8)** and as such yields a contradition of *"thought over a given time-frame"* - **Figure 9.**

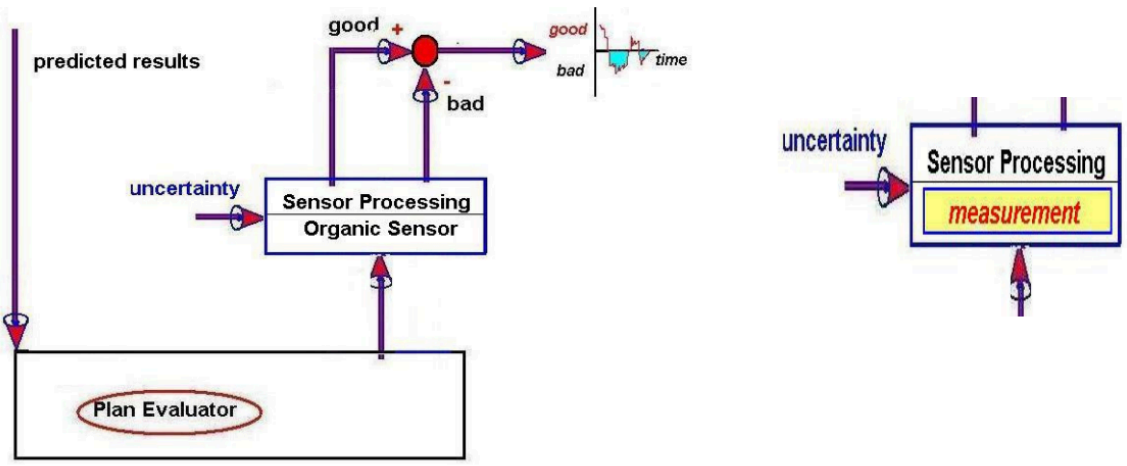

Figure 8. OLM Organic Sensor Signal Processing

task knowledge is dependent upon the problem TBS (To Be Solved)

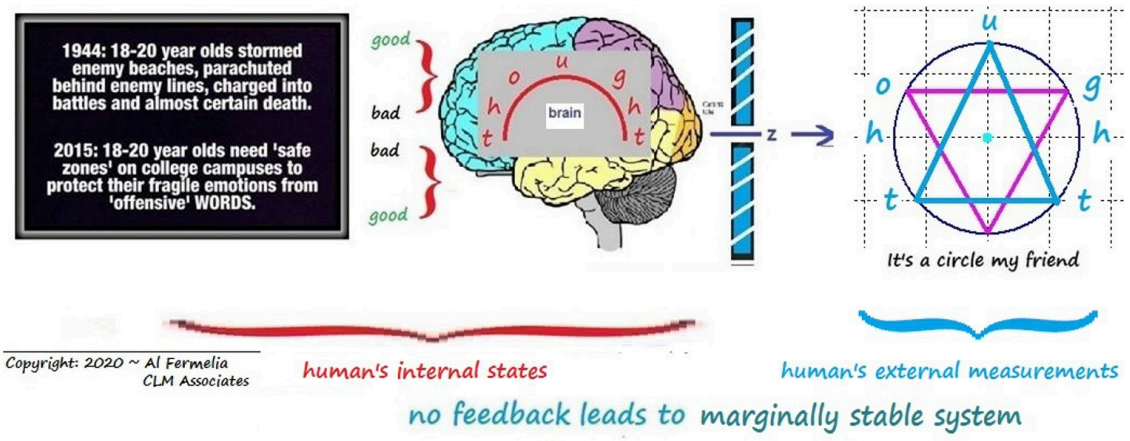

Figure 9. OLM Organic Sensor Changing Thought

C. Conclusion ~Mitigation of Pain (Mental and Physical): *Anxiety and depression are the most common problems, with around 1 in 10 people affected at any one time. How do mental health problems problems affect people? Anxiety and depression can be severe and long-lasting and have a big impact on people's ability to get*

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on with life. Predictions of beliefs and thoughts (good and bad) are brain outputs due to the measured vision, hearing inputs, and autonomic activation of one's residual WKDB.

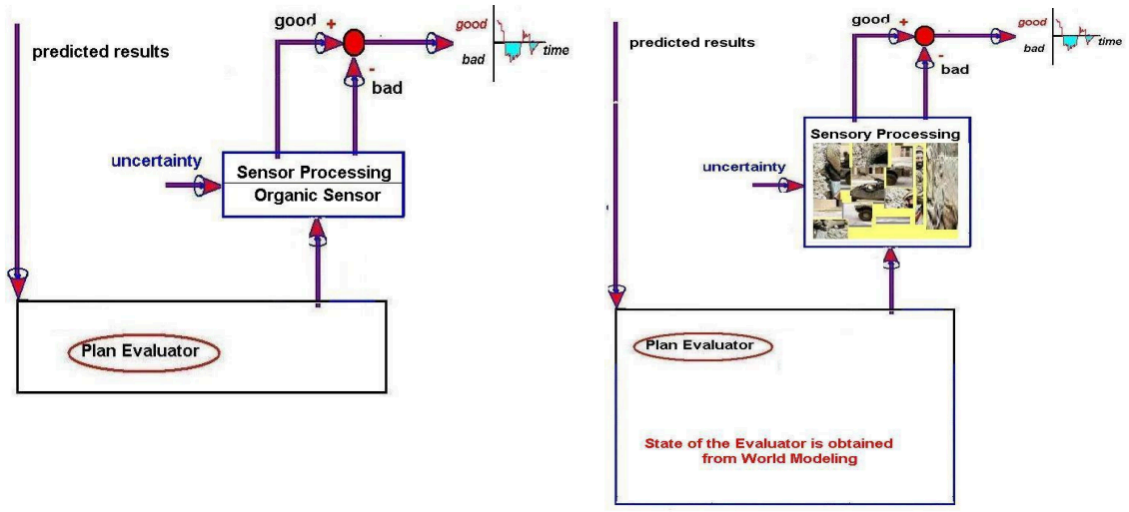

Figure 10. Measurement Of Thought

Is it good or bad?

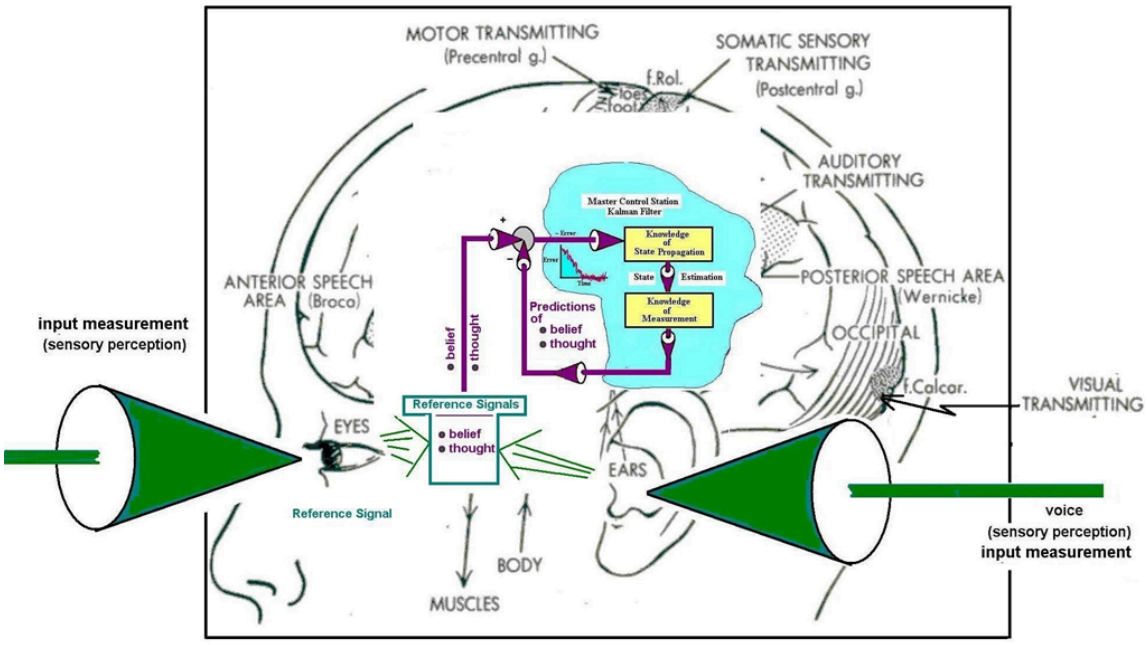

Figure 11. The Brain Has a Mind of It's Own Referenced On Its Measurement Systems Of Belief and Thought Errors Utilizing the WKDB

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Example: ~ Is it or Isn't it? ~

Corona Virus

Question: What is the Primary Problem?

Answer: Measurement of Anxiety !

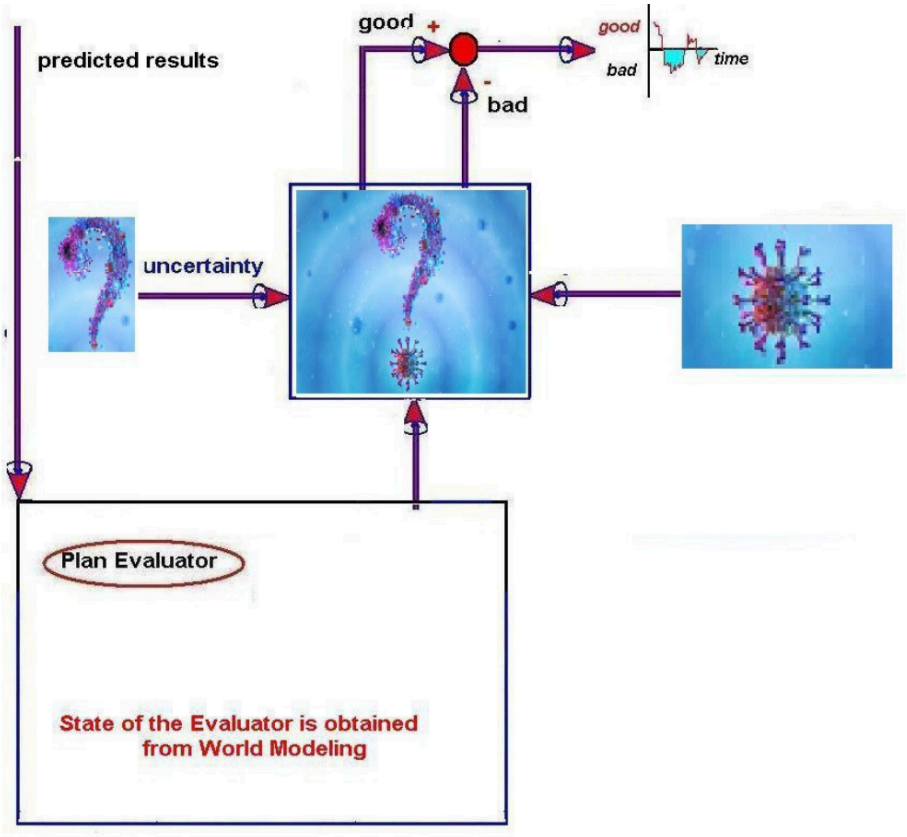


Figure 12. Anxiety Example

Question: How Can Anxiety Be Mitigated?

Answer: By Implementation Of

Adaptive Processor Design

- Design is predicated on the answer to the following questions:

  (1) What variables in the Knowledge Database does the

  Adaptive Processor modify ?

  (2) Does it add variables that do not exist?

(3) What is the mechanism for adapting the Knowledge Database

(4) What is the Knowledge Database comprised of?

Insight to the answer to these questions will be obtained by detailing the properties of a reference model architecture for an intelligent system

Properties of a reference model architecture for an intelligent system

- **Defines the function elements, interfaces, and information flow within and between intelligent systems**
- **Specifies the informational units and data models for both static (longterm) and dynamic (short-term) representations of knowledge necessary to describe the environment and intelligent systems operating within it.**
- **Specifies processes by which goals are selected, plans are generated, tasks are decomposed, subtasks are scheduled, and feedback is incorporated into control so that both deliberative and reactive behaviors can be combined and coordinated into a single integrated system.**
- **Specifies processes by which signals from sensors are transformed into knowledge of situations and relationships.**
- **Specifies symbolic and iconic representations for knowledge of objects, events, relationships, and situations in space and time, including semantic, pragmatic, and causal relationships in data structures that can support reasoning, decision making, and control.**
- **Specifies how knowledge can be acquired (learned), stored (remembered), and retrieved (recalled).**
- **Specifies how values can be represented and used to compute cost, benefit, risk, and uncertainty for evaluating plans for the future and assessing results of past behavioral choices**

- **Specifies the timing of processes and temporal relationships between functional elements**

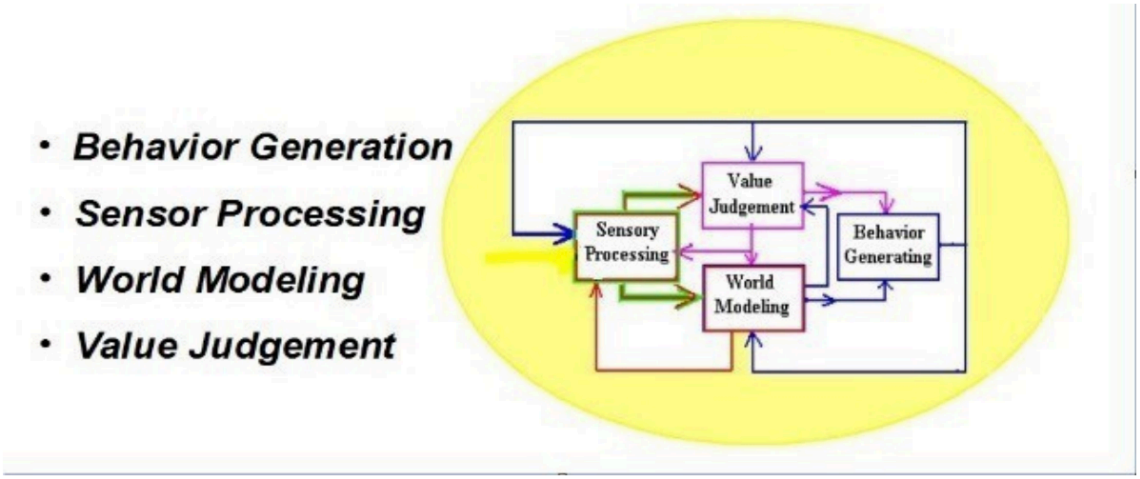
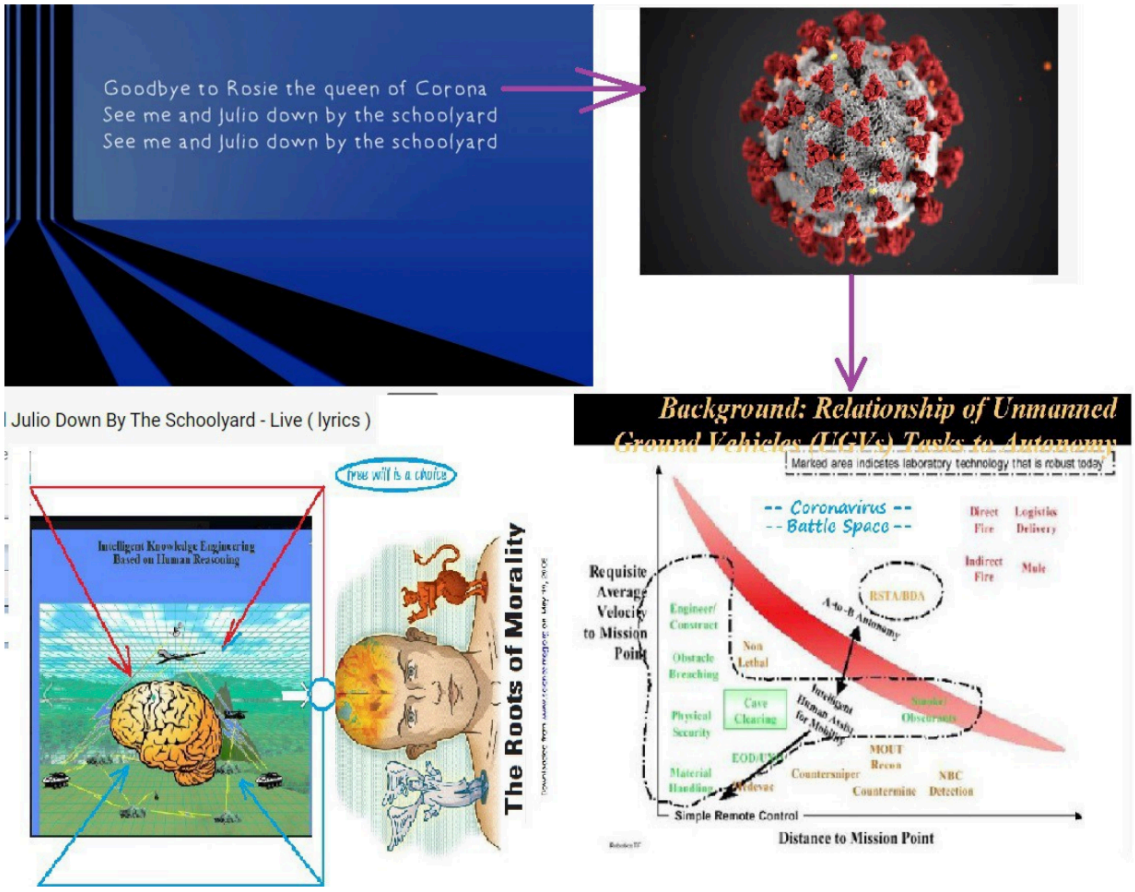


Figure 13. Reference model architecture subsystem functional elements

"Good Bye Rosie, Queen of

Corona Down by the School

Yard"



Ontological Engineering Applications via CLM

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Footnotes

[1] The 3 observer's in this case are the independent stakeholders, practioners, and designers measurements of Belief-Knowledge, Love-Hate, and Hope-Despair.

[2] Toolboxes highligted in red are discussed in this paper.

References

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4. ^*National Alliance on Mental Illness,"Ripple Effect-NAMI https://www.nami.org/mhstats*

Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.