

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 technologies 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.

Mental health techniques are required in order to develop a mitigation plan for the alleviation of pain which is of both mental as well as physical. This paper addresses the requirements for the mitigation of mental pain. Specifically anxiety and depression are the most common problems, with around 1 in 10 people affected at any one time. How do mental health problems affect people? Anxiety and depression can be severe and long-lasting and have a big impact on people's ability to get 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.

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Overview

Cause and Effect



<https://media1.tenor.com/images/dad2c576db235144699941a18c7900b9/tenor.gif?itemid=17537593>

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 (Line Of Sight) vector and the Albus/Mystel EOTB (Eye Of The Beholder) of **Figures 3 and 4**.

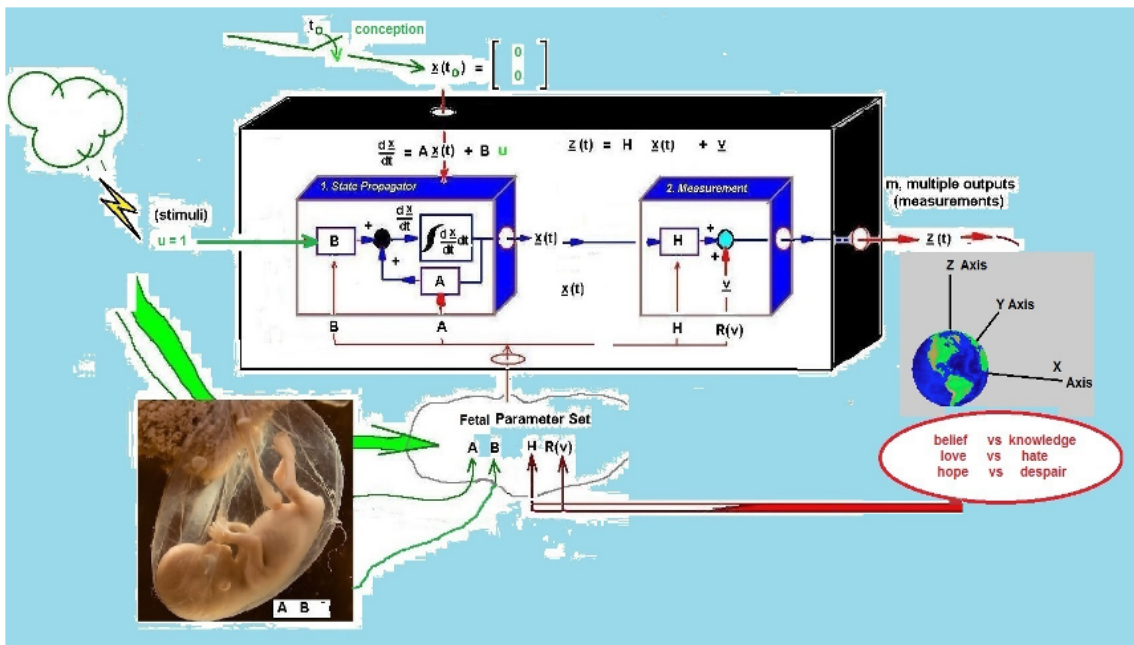


Figure 1. The Variables of Spiritual and Secular Space

$$\text{Error} = \left\{ \begin{array}{l} \text{Signal Processing} - \text{Design} \\ \text{Design} - \text{Signal Processing} \end{array} \right.$$

$\underbrace{\hspace{10em}}_{\text{BRAIN (left)}} \quad \text{vs} \quad \underbrace{\hspace{10em}}_{\text{LOS (right)}}$

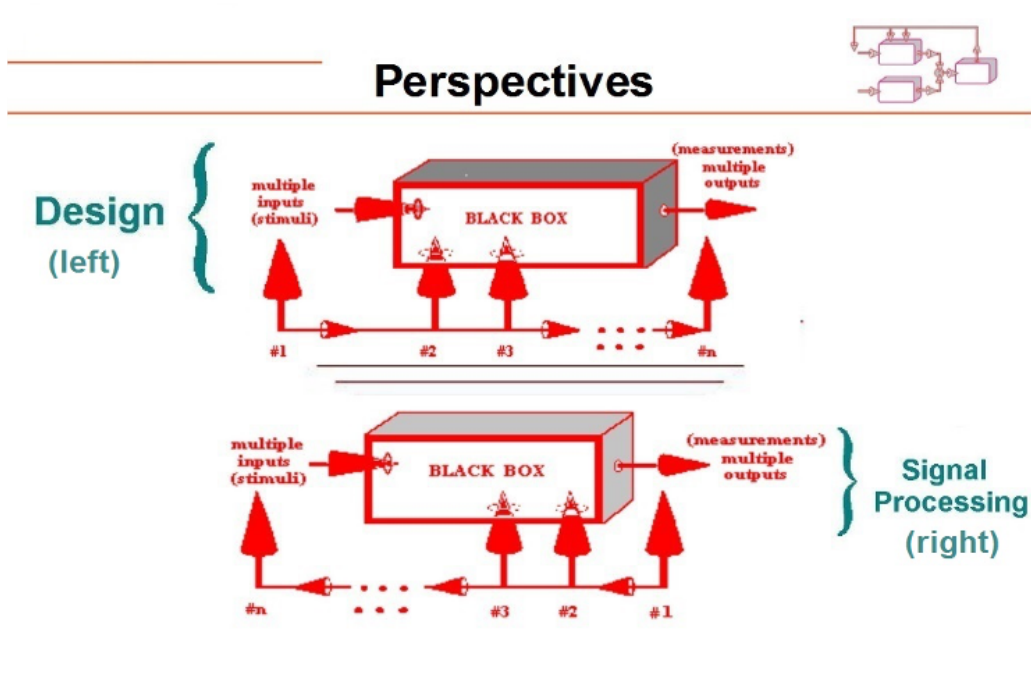
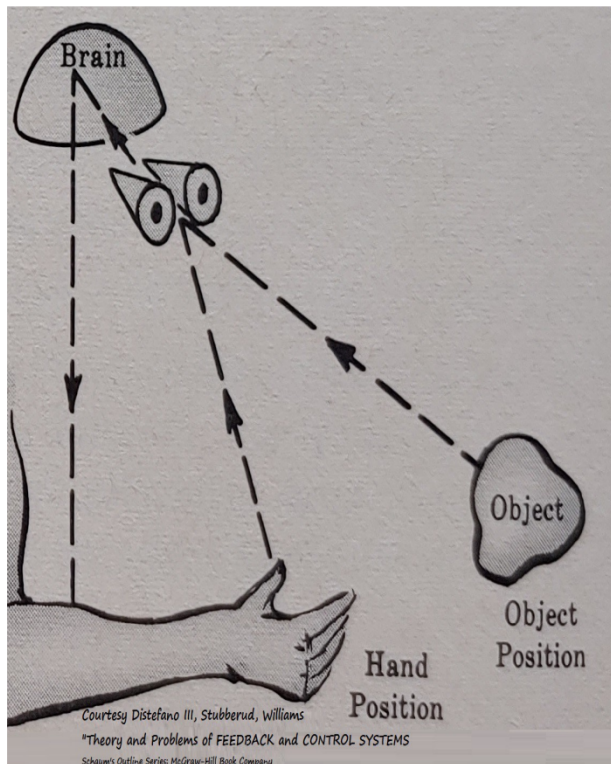


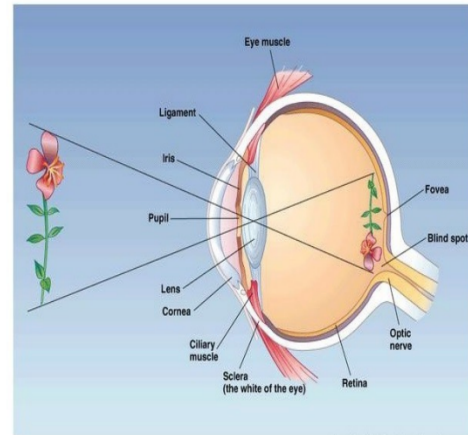
Figure 2. Ontological Engineering Perspectives

Stakeholders, practitioners, 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 requires understanding of the correlation of Ethics, Economics and Education as measured from the *m* observer's¹ the LOS (Line Of Sight)^[1] as illustrated in:

- Figure 3,
- the output of Figure 1, and
- Figure 4 - *life's EOTB homeostatis design*^[2]



► Section of the Human Eye



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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 function 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

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

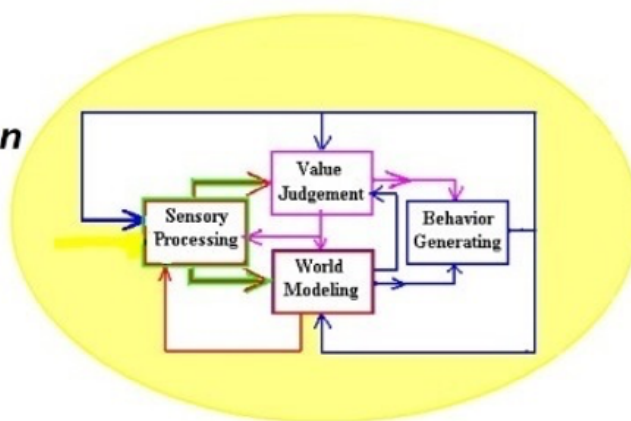


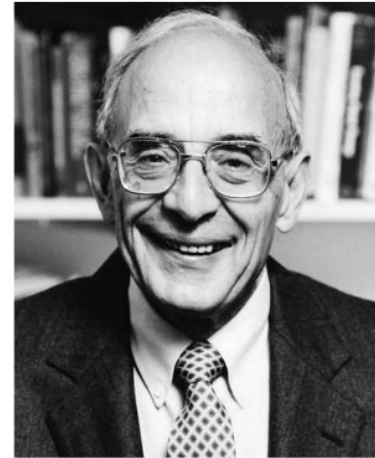
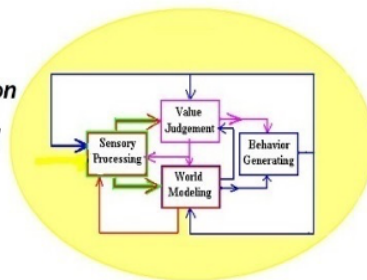
Figure 4. Albus/Mystel EOTB Homeostasis Architecture
(Feedforward and Feedback Signal Flow)

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 controlled 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.

Albus/Mystel EOTB

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



Chris Argyris
James Bryant Conant Professor
Harvard Business School

"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."^[3] Hence in order to mitigate of mental health problems it's stakeholders, practitioners, 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 Accessed²:

- - *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 illustrated in the simplified diagram of **Figure 5**.

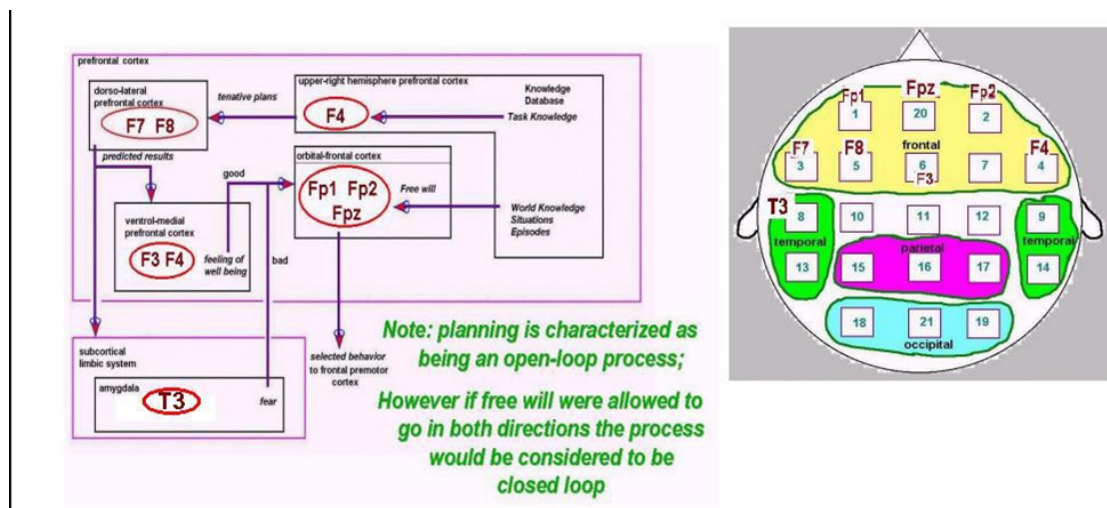
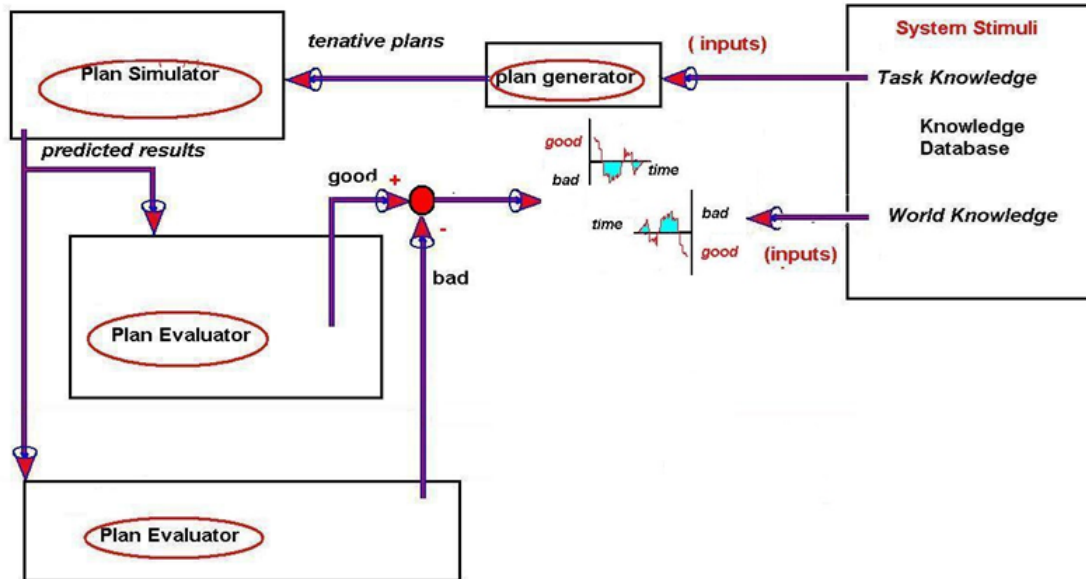


Figure 5. A Simplified Flow Diagram Of The Brain And It's Measured EEG High-level Planning System

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 incorporate error feedback (Figure 7) by employment of - *Closed-Loop-Control*

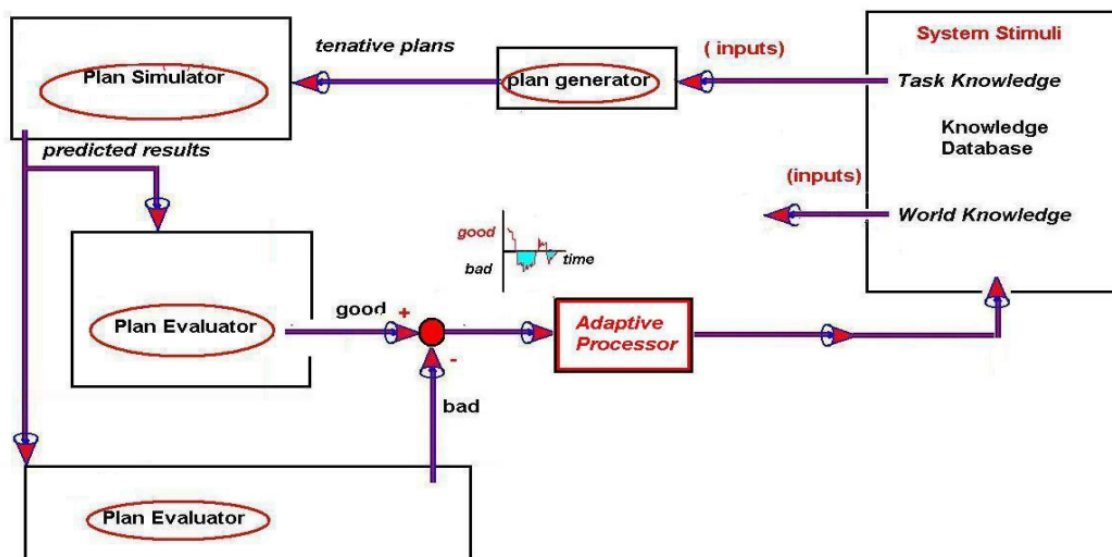


Figure 7. Closed-Loop-Control via the Adaptive Processor Yielding Systematic Homeostasis Stability - see Figure 6

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

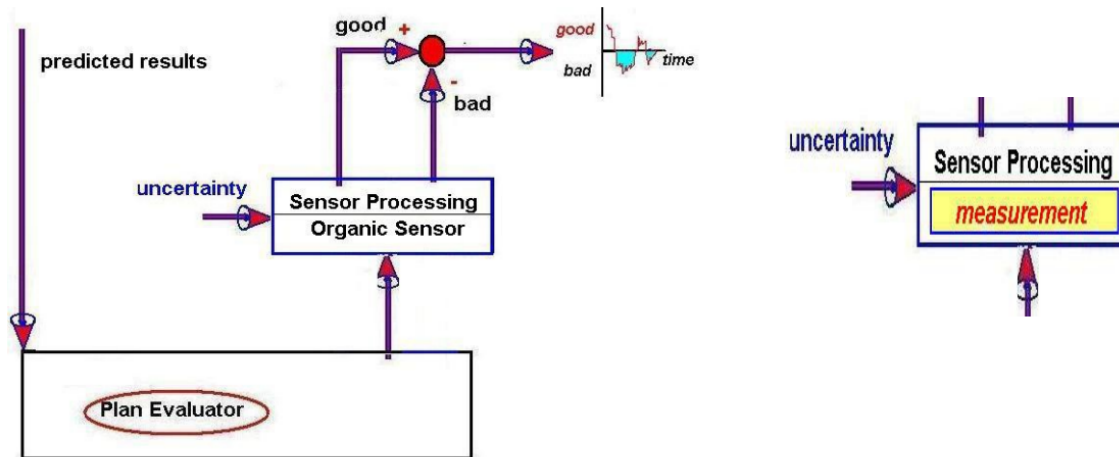


Figure 8. OLM Organic Sensor Signal Processing

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

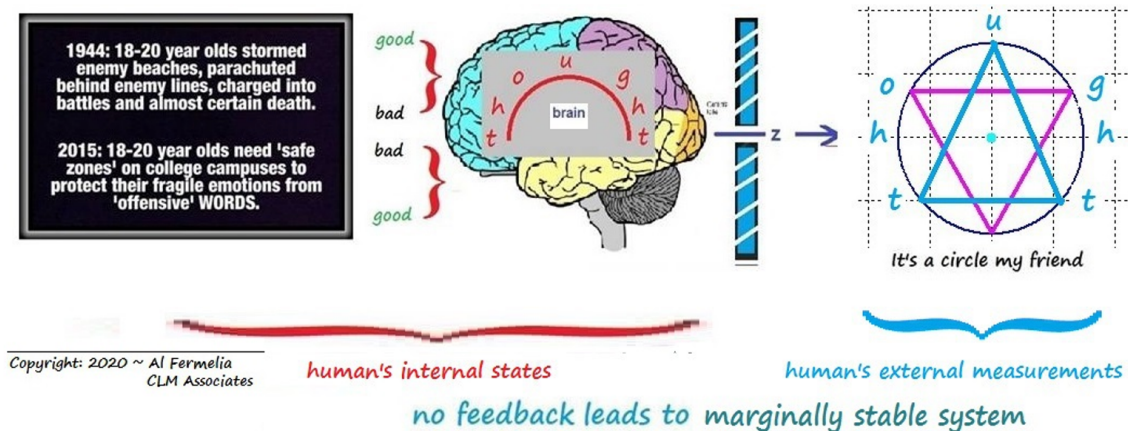


Figure 9. OLM Organic Sensor Changing Thought

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 affect people? Anxiety and depression can be severe and long-lasting and have a big impact on people's ability to get

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.

For example: Consider Figure 10 which illustrates the thought process of the brain producing good and bad thoughts from the "Sensor Processing" of a scene as produced

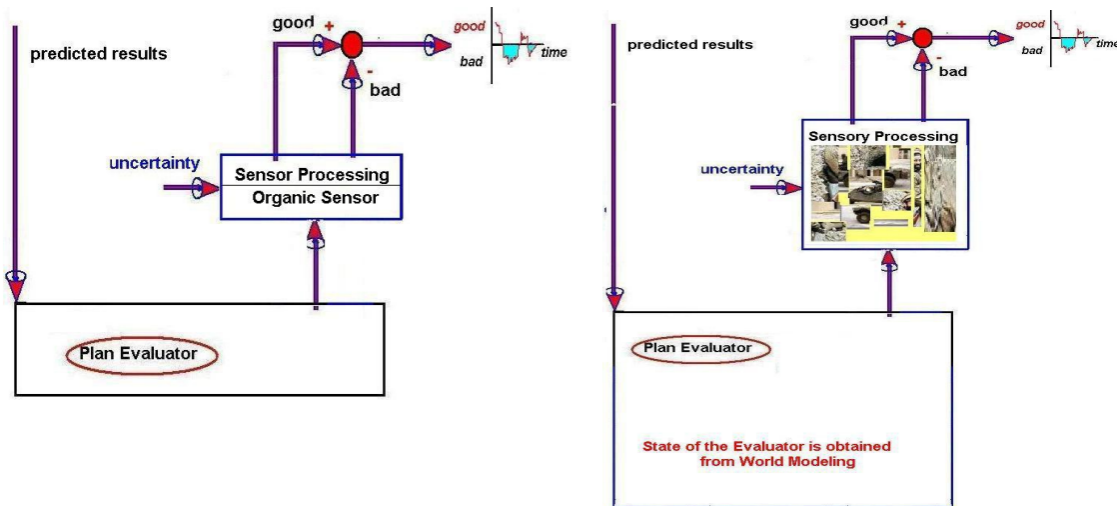


Figure 10. Measurement Of Thought

Is it good or bad?

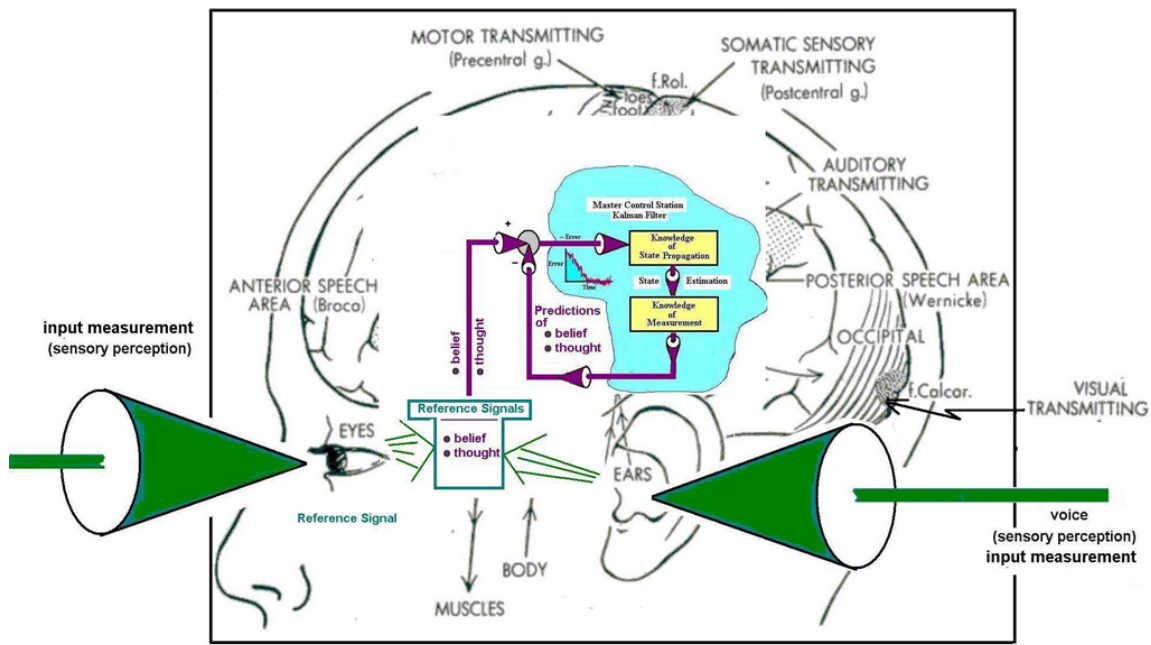


Figure 11. The Brain Has a Mind of It's Own Referenced On Its Measurement Systems Of Belief and Thought Errors Utilizing the WKDB

from Figure 11. A 2nd example is the “anxiety” which may be simulated via the current Corona epidemic as illustrated by Figure 12

Example 2: ~ Is it or Isn't it? ~

Corona Virus

Question: What is the Primary Problem?

Answer: Measurement of Anxiety !

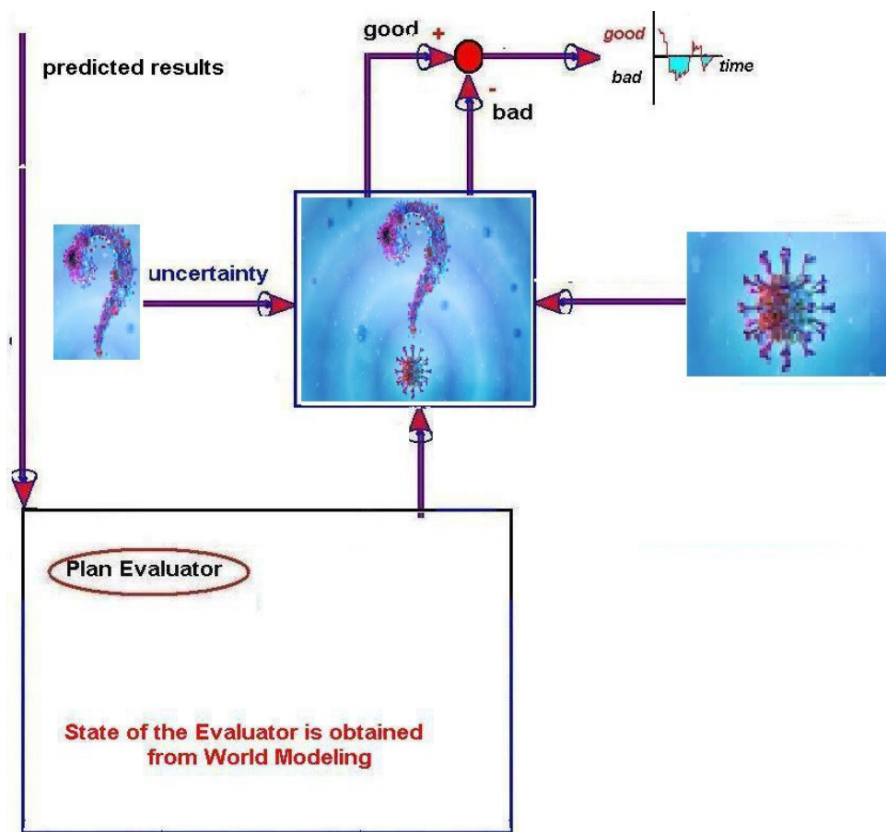


Figure 12. Anxiety Example

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

Validation of the *Adaptive Processor Design* requires the integration of *Behavior Generation*, *Sensor Processing*, *World Modeling*, and *Value Judgement* as illustrated by Figure 13.

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

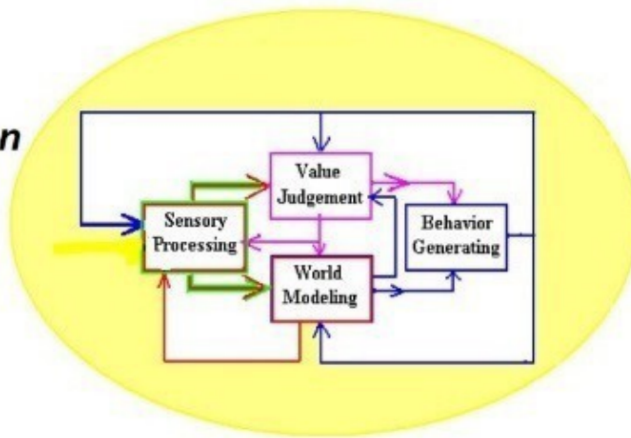


Figure 13. Reference model architecture subsystem functional elements

Upon validating the adaptive processor design via the application of ontological engineering design the pain (referred to on page 9) associated with many health problems may be mitigated. For example: The Coronal Virus of Figure 14.

*“Good Bye Rosie, Queen of
Corona Down by the School
Yard”*

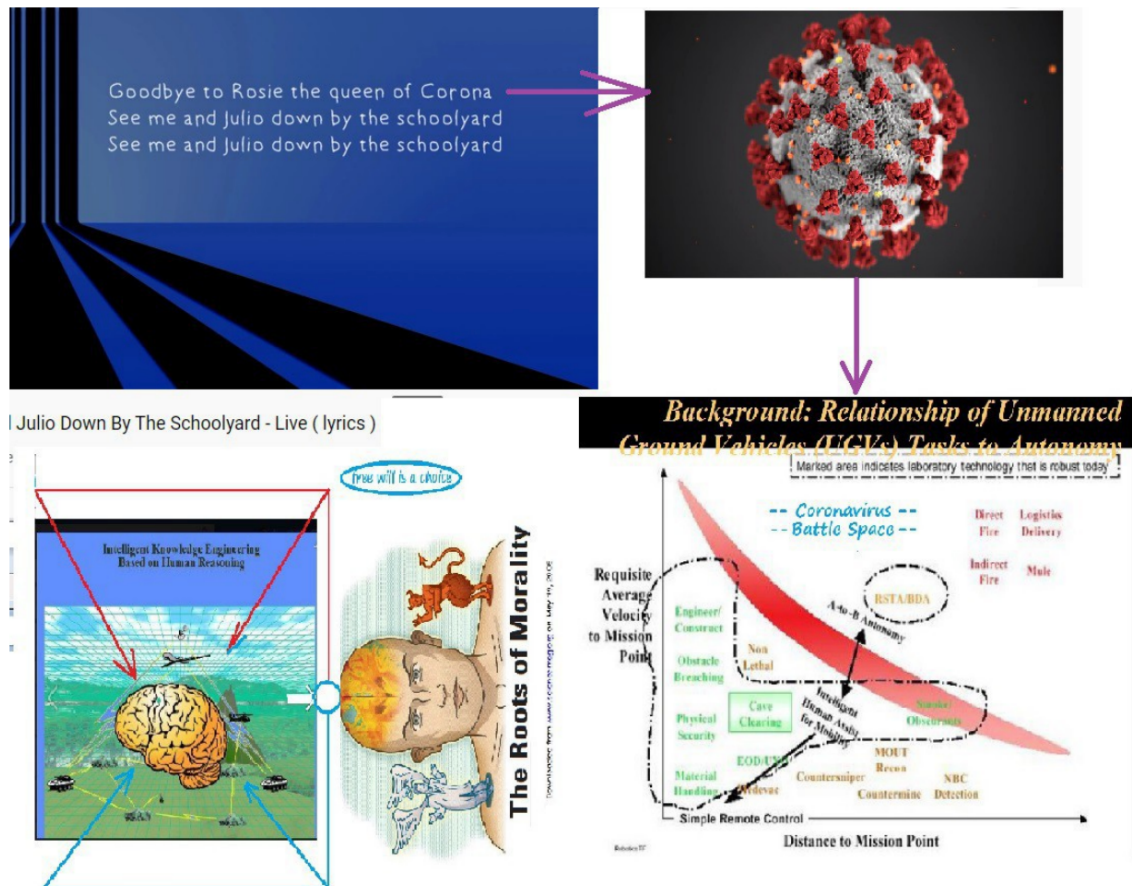


Figure 14: Ontological Engineering Applications via CLM

Ontological Engineering Applications via CLM



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Footnotes

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

² Toolboxes highlighted in red are discussed in this paper.

³ The brain is the organic sensor of Figure 10.

References

1. [^]Ternyik, S., Fermelia, A., QMH VIA ONTOLOGICAL ENGINEERING WITH A BIAS TOWARDS IT'S MOOD SCIENCE, Lambert Academic Publishing, 2019 ISBN: 978-620-0-24402-4
2. [^]Albus, J., Mystel, A., ENGINEERING OF MIND, John Wiley & Sons, INC, 2001
3. [^]National Alliance on Mental Illness, "Ripple Effect-NAMI <https://www.nami.org/mhstats>

Supplementary data: available at <https://doi.org/10.32388/37C74M.2>

Declarations

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