QuEST online trial lecture topic
situated representation tenets

March 2020

Cap

Air Force Research Laboratory

QuEST – Cognitive Exoskeleton

Kabrisky Memorial Lecture 2020

10 January 2020

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Integrity ★ Service ★ Excellence

QuEST for Consciousness
"What are the tenets for machine representations (artificial qualia?) that enable flexible behaviors?"

Some material from Nagel 1974

Notes by Capt Amerika from discussion with Special K

Edited April 2019 by cap

Post Ancient Mike consciousness presentation

In preparations of upcoming 'Walk with Marvin' MIT workshop

Intelligence & Artificial Intelligence

- Intelligence is the ability of an agent to gather observations, create knowledge, and appropriately apply that knowledge to accomplish tasks

- Artificial Intelligence (AI) is a machine that possesses intelligence

Autonomous Horizons v2: https://www.airuniversity.af.edu/AUPress/Display/Article/1787830/autonomous-horizons-the-way-forward/

Examples of Conscious Representation

There is something it is like to a human to be stabbed in the hand – or see the red or pink square or hear a chord or taste a pizza!

'perception' is subjectively acceptable
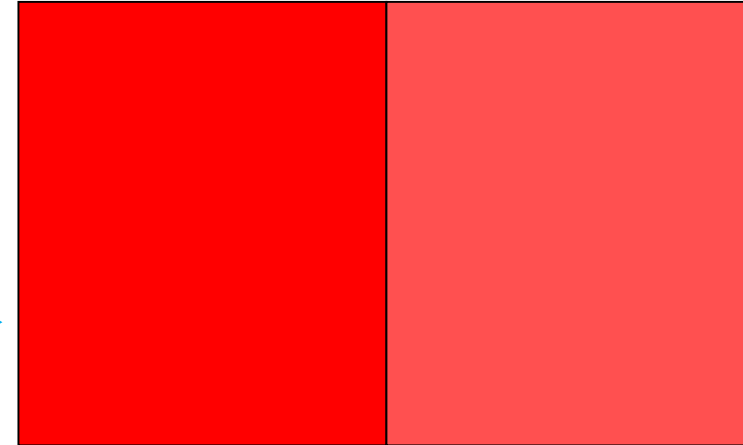
What it is like to undergo an experience?
Why do you 'feel' pain?
Individualized!

- Pheung – individualized basis **(SOUND)**
  - Chords a great example – what you hear is evoked in your mind it isn't just the notes! Headphones!

Why do you 'see' red?
Qualia Theory of Relativity.

- ***Pizza*** doesn't have a *taste* until you eat it.

Illusion of Cartesian Theater – What is a Quale?
## Working Memory (cognitive decoupled / simulation)

The 'subject' in the subjectively acceptable representation

Thoughts

Discernible aspects can be used internally to 'think' or communicated via language to an aligned agent -

Pretending to be in charge of things beyond its control – user illusion
Although claims to be making decisions – it isn't even there when the decision is made

www.jolyon.co.uk
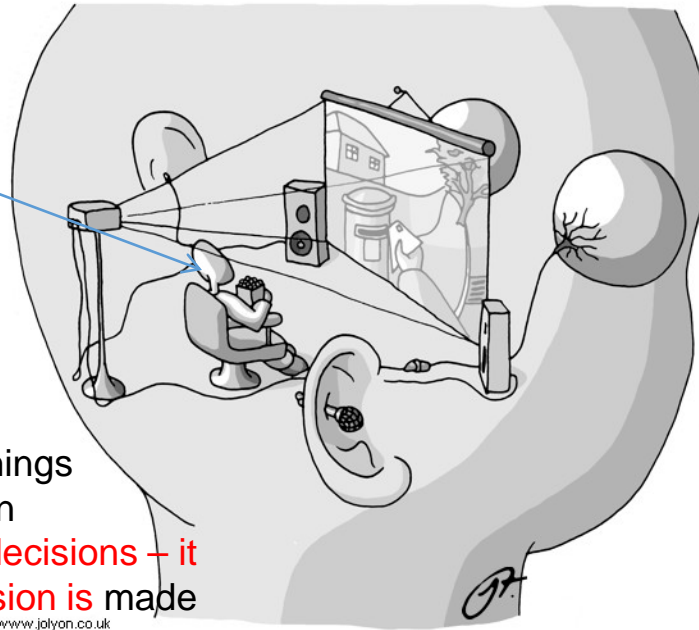
Qualia associated with representation of the physical environment and to represent the thoughts you are having all in a stable, consistent and useful way

Introspection

Discernible meant to capture that there is a difference between one state and the alternative (blue versus brown) and the fact that aspects are introspectively available

For the purpose of this presentation I will **define qualia** as **any discernible aspect of the illusory Cartesian theater** = any aspect of your world model that you are aware of (meaning you know is part of, meaning you experience that aspect) as being part of that world model, the fact you can 'see' the redness of a car means that red attribute of your world model is a quale red – any sound you hear (the attributes of the sound that evoked JND aspects to them are each a quale at that moment) – any thought you have at that moment you are thinking it is in your world model as a thought in your mind so there is a quale of thought associated with it AND thoughts in fact are composed of qualia (the primitives of all thought)

Model that suggest multiple representations: Dual process agent

- Dual-Process Theories of Higher Cognition: Advancing the Debate, Perspectives on Psychological Science 8(3) 223–241 © The Author(s) 2013
  - Evans and Stanovich

- Dual Process Theories,
  - Betram Gawronski, Laura A. Creighton, in D.E. Carlson (Ed.) (2013) the Oxford Handbook of Social Cognition, pp 282-312, Oxford University Press, Ny Ny

We posit that there are lessons in how nature creates its 'conscious' representation that are key to making autonomous systems that have flexible behaviours

Meaning will be the changes in both of these processes as a result of observation being processed with knowledge

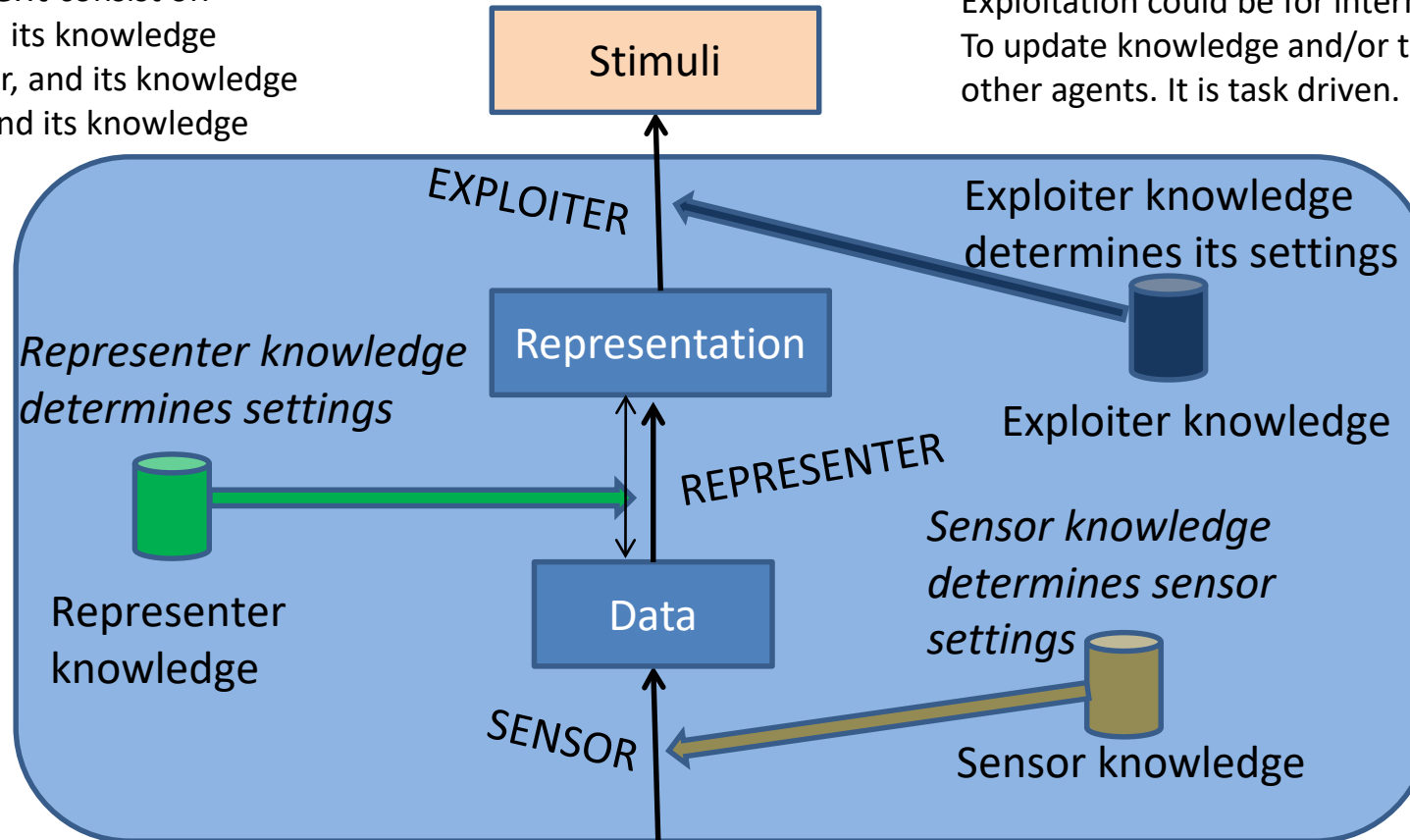**Work/interactions of Benjamin Libet initially led us here**

If you model the two systems as disparate agents – do they together exemplify the flexibilities – example Peer flexibility between sys1 / sys2

Atomic Agent, Stimuli, Data, Information, Knowledge and Query

Atomic Agent consist of:
- Sensor, and its knowledge
- Representer, and its knowledge
- Exploiter, and its knowledge

Exploitation could be for internal use
To update knowledge and/or to share with
other agents. It is task driven.

Stimuli

EXPLOITER

Exploiter knowledge
determines its settings

*Representer knowledge
determines settings*

Representation

Exploiter knowledge

REPRESENTER

*Sensor knowledge
determines sensor
settings*

Representer
knowledge
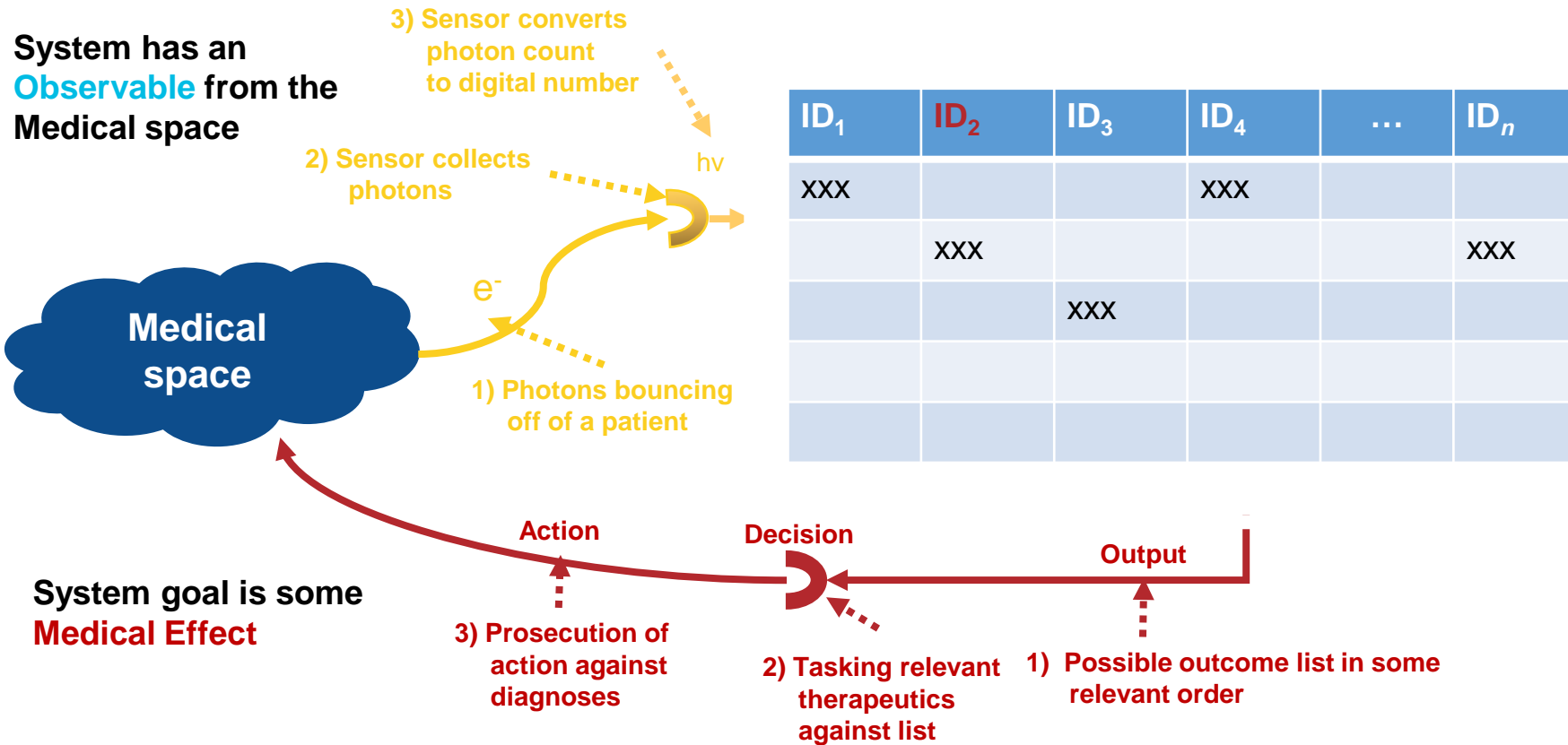
Data

SENSOR

Sensor knowledge

Atomic Agent = (S, K_S, R, K_R, X, K_X)

Stimuli

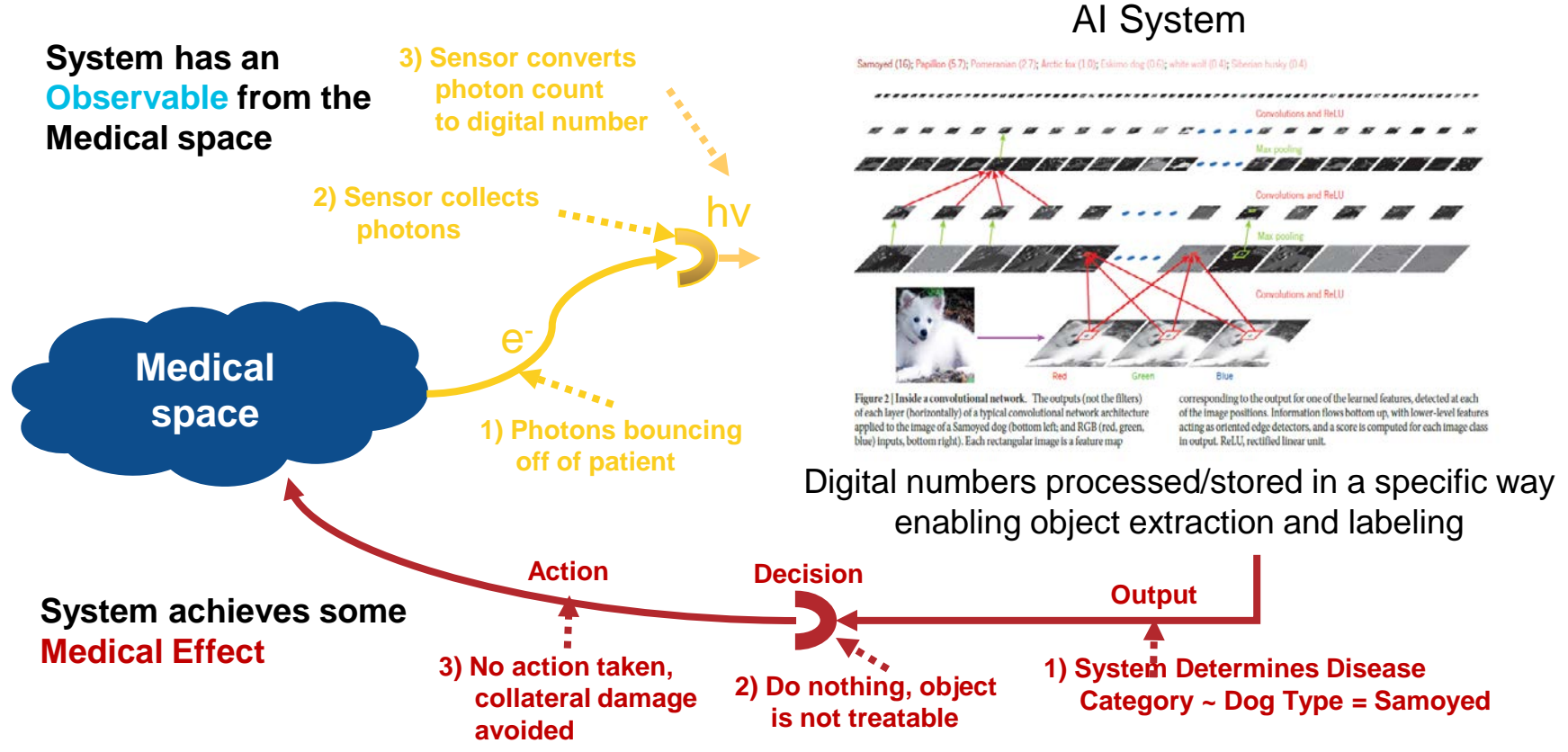A query is defined as **the act of a stimulus being provided to an agent and the agent responds.**

Example 2: Detection & Treatment

AI System

System has an Observable from the Medical space

3) Sensor converts photon count to digital number

2) Sensor collects photons

$h\nu$

e^-

Medical space

1) Photons bouncing off of patient

Figure 2 | Inside a convolutional network. The outputs (not the filters) of each layer (horizontally) of a typical convolutional network architecture applied to the image of a Samoyed dog (bottom left; and RGB (red, green, blue) inputs, bottom right). Each rectangular image is a feature map corresponding to the output for one of the learned features, detected at each of the image positions. Information flows bottom up, with lower-level features acting as oriented edge detectors, and a score is computed for each image class in output. ReLU, rectified linear unit.

Digital numbers processed/stored in a specific way enabling object extraction and labeling

System achieves some Medical Effect

Action

Decision

Output

3) No action taken, collateral damage avoided

2) Do nothing, object is not treatable

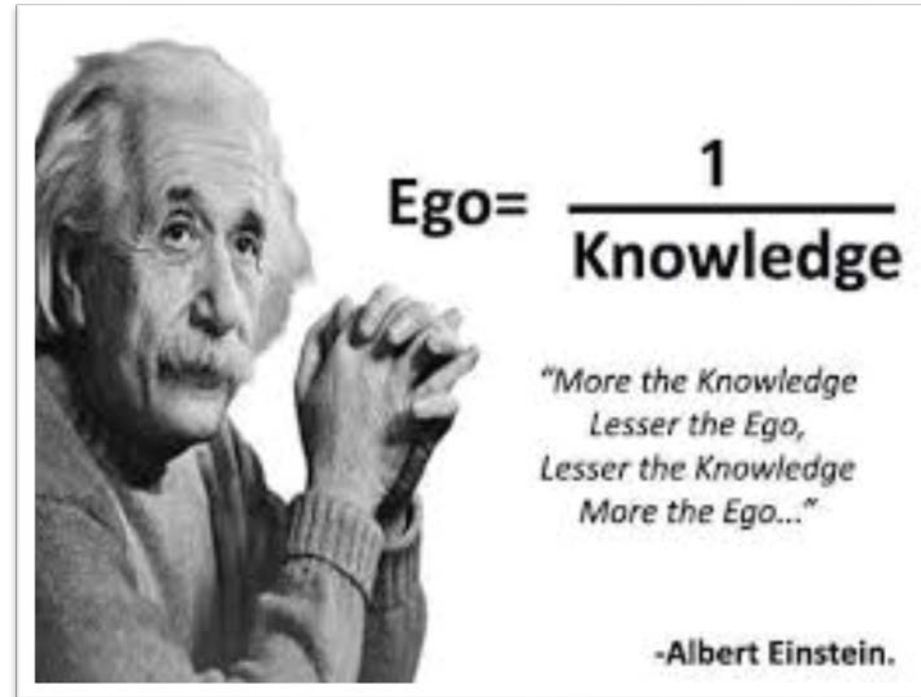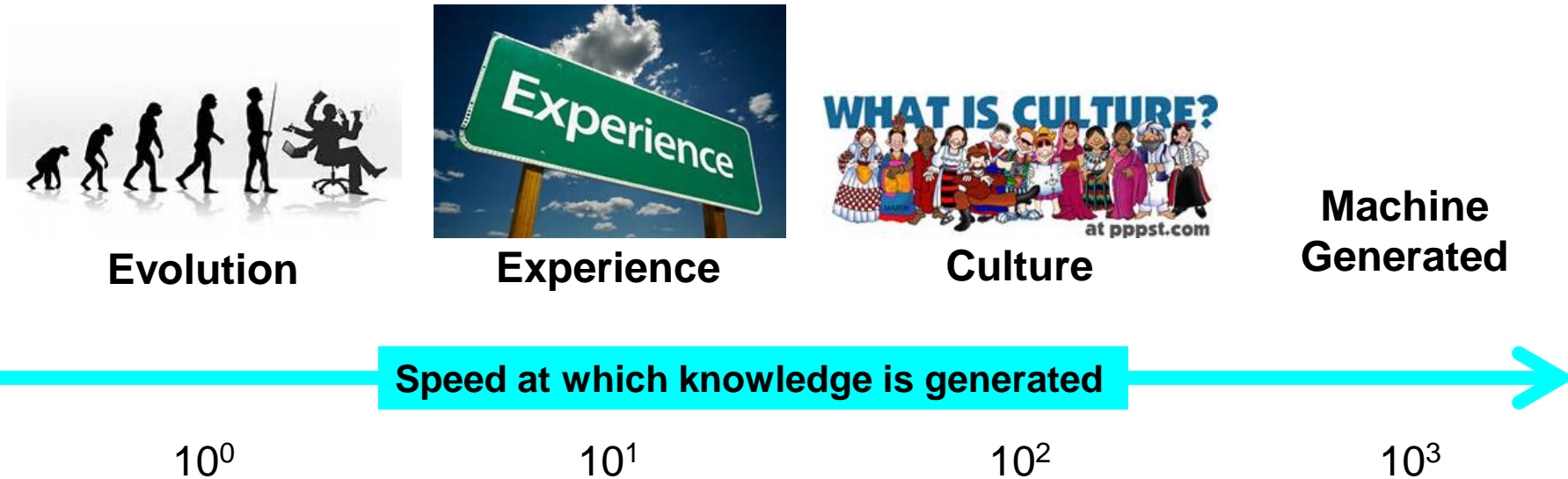**1) System Determines Disease Category ~ Dog Type = Samoyed**

Representation and knowledge

- Representation is how an agent structures its knowledge

- Knowledge is what an agent uses to generate meaning (knowledge includes the representation and the processes of how to generate that meaning using that representation)

- Example: we have experienced a probabilistic characterization of the occurrence of a particular event – that is knowledge – we decide to represent that knowledge in a PDF (probability density function) and then use a particular instantiation inside the computer based on relative frequency - maybe some parzen windows for a representation of that knowledge.

- Example2: we have experienced seeing lots of pictures with labels 'cat', there exists in that set of pictures what could be used by an agent as knowledge about 'what is a cat' – the agent has to create the knowledge it will use to decide if a picture is of a cat from that data and how it will represent that knowledge and what processes will be used to generate subsequent meaning of pictures

What is knowledge?

Knowledge is what is used to generate the meaning of the observable

Where does Knowledge come from?

Evolution

Experience

Culture

Machine Generated

Speed at which knowledge is generated ⟶
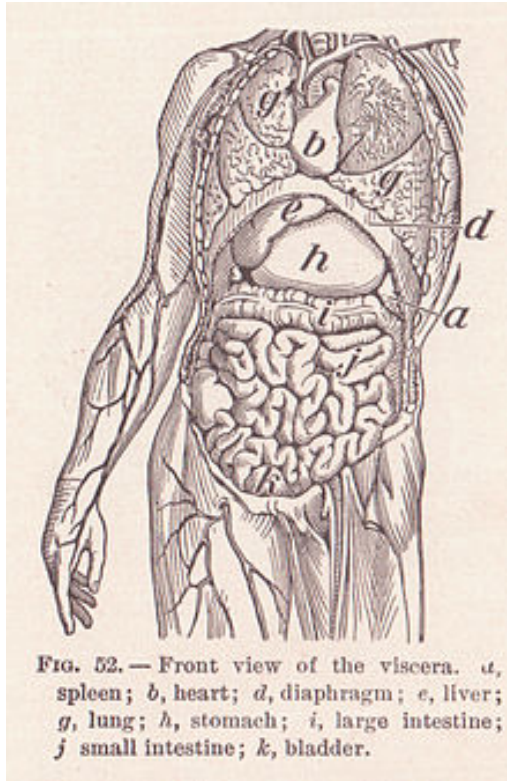
10^0 10^1 10^2 10^3

- Each source of knowledge is an order of magnitude quicker than the previous

- Most future knowledge on Earth will come from machines extracting it from the environment –machine generation of knowledge key for the future of Medicine

Pedro Domingos book: The Master Algorithm

There is more to your internal representation than what you are conscious of – Type 1

'What is done by what is called myself is, I feel, done by something greater than myself in me' – James Clerk Maxwell on his deathbed, 1879 (user illusion)

FIG. 52. — Front view of the viscera. *a*, spleen; *b*, heart; *d*, diaphragm; *e*, liver; *g*, lung; *h*, stomach; *i*, large intestine; *j* small intestine; *k*, bladder.

Defining gut (intuition or hunch) feelings:
Appears quickly in consciousness (we would say the results of the calculation gets posted to consciousness)
Whose **underlying reasons** we are not fully conscious of - Is strong enough to **act** upon

John Rollwagen, a colleague for many years, tells the story of a French scientist who visited Cray's home in Chippewa Falls. Asked what were the secrets of his success, Cray said "Well, we have elves here, and they help me". Cray subsequently showed his visitor a tunnel he had built under his house, explaining that when he reached an impasse in his computer design, he would retire to the tunnel to dig. "While I'm digging in the tunnel, the elves will often come to me with solutions to my problem", he said.

Below the level of consciousness does NOT imply lack of importance to the system's solution! Should Cognitive Engineering Design include type 1 information?

Benjamin Libet – Harvard University Press

Theory of Consciousness

- **THE ULTIMATE GOAL of a theory of consciousness is a simple and elegant set of fundamental laws, analogous to the fundamental laws of physics.**

- We provide the QuEST tenets – they <u>are unlikely to be the right answer to this challenge</u>.

  - **Structural Coherence (interaction to ensure stable, consistent and useful representation)**

  - **Situation based processing (situations as variables) – fundamental unit of conscious cognition (narratives)**

  - **Conscious representation of situations are done via simulation (cognitively decoupled – imagined past, present and future in the form of a cohesive narrative)**

Consciousness is **Stable, consistent and useful ALL SOURCE situated simulation that is structurally coherent**

Consciousness Tenets Summary

1. **Structural Coherence**

    1. Interaction – enough fidelity with reality (bits of awareness info) facilitate conscious driven interaction (situations are learned via interactions)

    2. There is a similarity measure applicable for the conscious representation – (color wheel example) – the similarity measure is between situations/qualia/chunks

2. **Situation** based processing (situations as variables) – fundamental unit of conscious cognition

    1. Links (types of links, possibly capture similarity, meaning as what links are evoked – source of exformation – entities (situations) are defined based on how they are situated that is their meaning)

    2. Gists as key part of representation–low bandwidth representation –what is situated/simulated

    3. Multimodal – integrates multiple sensors representation into common framework – part of situated

    4. One quale at a time – for any aspect of the illusory cartesean theater (example invertible illusions)

    5. Qualia Theory of Relativity – only value (meaning) is in the relationships between (dictionary)

    6. Narrative based representation–situated in time/space/multiple modalities (plausible narratives compete) Stream of consciousness is a cohesive narrative

    7. TD/BU – means to do context - rapid high level first –

    8. Types of Qualia types of situations - time as a quale, Affect as a quale, types of speech, ToM – (Evolving not static), aha and negative aha (means to know what is known and what is NOT known by the agent)

        1. Self – special type of qualia/situation (qualia self interacts with Continuity, unity, embodiment, sense of free will, reflection)

3. Conscious representation of situations are done via **simulation** (cognitively decoupled)

    1. simulation is an organized body of knowledge that _produces_ specific _simulations of a situation's instances_

    2. Imagined past, imagined present, imagined future – cognitively decoupled

    3. Exformation (pattern completion inferring mechanism)

    4. Compression (infinite number of stimuli into a single quale, low bandwidth 50 bits/sec)

    5.) Ability to generate meaning / situated simulation of a new concept – the unexpected query

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situations

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Jared definition situation ~ qualia ~ chunk – and 'perception'

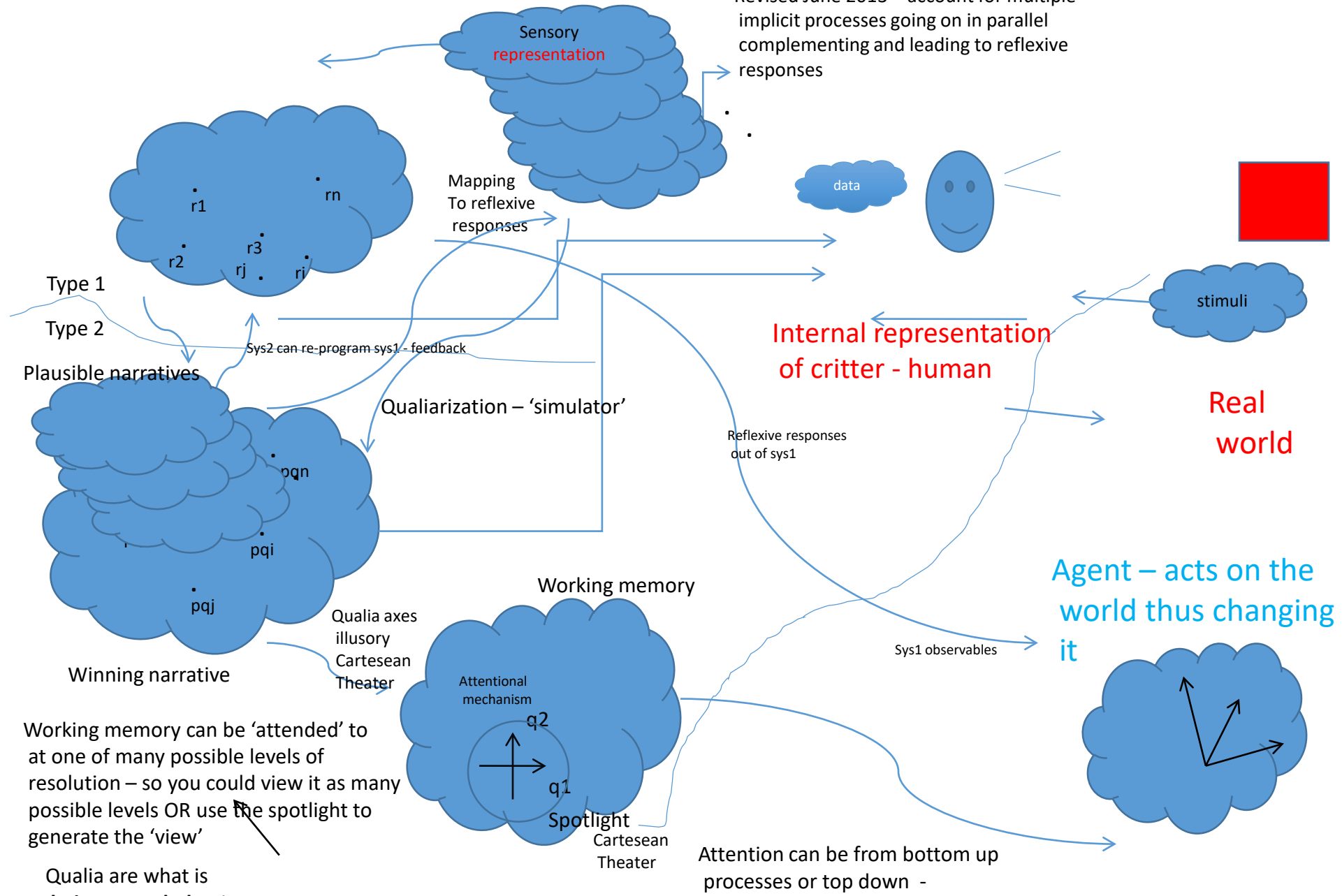Walk away point – situations are structurally coherent – relationships / interactions

- **A *situation* is any part of the *agent centric* internal representation which can be understood as a whole by that agent** meaning that agent **expected to be able to do the tasks of *defining how that situation interacts* with or *is related* to other parts (situations) of the representation in that agent.**
  - By defining the task of how the situation interacts or is related to other situations for example via linking (and types of links) we can use the word 'understood' properly.
  - **interacting** with other situations in the representation we mean that the **situations have properties or relate to other situations**." *** *we would say can and must be linked to other 'situations' = 'other qualila' = other chunks***

Completely consistent with our definition of an entity – can be an event and/or an object

What is a Quale?

- By a quale, then, we mean a part of working memory (result of Type 2 processes – quale only associated with critters) that is can be experienced as a whole in its own right – meaning has distinct interactions / relationships with other situations in the representation of that critter
  - The **experience has characteristics** associated with how this experience ***interacts with or is related to other conscious experiences (other qualia) – and those characteristics include (structural coherence, situation based, cognitively decoupled- simulated)***.
  - By interacting with other qualia we mean that they (qualia) have properties (tenets next) or relate to other qualia (via tenets next slides).

Sensory **representation**

Revised June 2013 – account for multiple implicit processes going on in parallel complementing and leading to reflexive responses

data

stimuli

Mapping To reflexive responses

r1   rn
r3
r2   rj   ri

Type 1

Type 2

Sys2 can re-program sys1 - feedback

Internal representation of critter - human

Real world

Plausible narratives

Qualiarization – 'simulator'

Reflexive responses out of sys1

pqn

pqi

pqj

Agent – acts on the world thus changing it

Winning narrative

Qualia axes illusory Cartesean Theater

Working memory

Sys1 observables

Working memory can be 'attended' to at one of many possible levels of resolution – so you could view it as many possible levels OR use the spotlight to generate the 'view'

Attentional mechanism

q2

q1

Spotlight
Cartesean Theater

Attention can be from bottom up processes or top down -

Qualia are what is **being attended** to in WM the vocabulary of the illusory Cartesean Theater - the axes are concepts – qualia - situations

Chomsky view of breakthrough by humans

- While reviewing some of our late colleague Patrick Winston material I fixated on a quote he attributed to Norm Chomsky-
  - "the cognitive breakthrough for humans was the ability to take concepts and combine them into a new concept without destroying the original concepts and to do so in an unlimited manner" –
- this is what we are asking of our colony of ACE bots - retain their atomic functionality but combine together when the resulting joint functionality is worthy of their use –
- and when that demonstrates value form a new bot whose mission is to call upon them to replicate that new functionality as a service it offers to the corral

The Great Move – representation for flexible behaviors!

- A representational system must be sufficiently flexible to **predict the effects of all the distinct external situations and transformations that are important to the organism**.

- **Newell argues that as the diversity of the knowledge that an organism must represent and manipulate increases (required for autonomy), it becomes increasingly difficult to find specialized representational systems to provide appropriate encodings.**

- In what Newell terms **"the Great Move," evolution developed a representational system that enables more complex representations to be composed from simpler ones. ** recall composition is one way to think of peer flexibility – key ACT3 technical challenge****

This has been the QuEST position on Qualia – a representational approach to allow the simulation of complex situations (potentially new qualia composed of simpler situations (existing qualia))

Newell, A. 1990. Unified Theories of Cognition.
Cambridge, MA: Harvard Univ. Press

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narratives

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Daniel Kahneman

- Two selves
- Experiencing self and the remembering self
- Turns out the remembering self doesn't actually recall the experience – and if have to choose people often choose the memories are more important than experiencing
- To recall some event you create a narrative – you want a story – when you return from a trip you tell a story -

When experiencing a painful event – even one of long duration – it is the onset and ending that stick out – a good dentist / physician will ensure you experience a pleasant 'end to the visit' – dramatic reduction in malpractice suits

One means to situate is to embed in a Narrative

- Any **account of connected <u>events,</u>** presented to a reader or listener in a **<u>sequence of written or spoken words,</u>** or in a sequence of (moving) pictures.

Meaningful work – urban blight

- To achieve meaningful work requires collaboration- the social sharing is critical to the memory of the day and the satisfaction of the endeavor - exformation has to be a key piece - there is so much more information in a Shannon sense that is evoked versus in the channel

- It is the story versus the actual meaningfulness of the work - the story are social based - ask someone about their day immediately goes to social interactions

- Want to construct memories versus experiences - they are not the same - we live our lives for creating the memories versus the experiences - the meaningfulness of the day is directly tied to the 'stories' one can relate to others about events that occurred –

- How do we create jobs that result in 'stories' that one would associate with 'meaningfulness'- tied to co-workers / customers

QuEST definition of narratives

- Based on the last two weeks of discussions **we will define narratives** as any account of connected situations created with a sequence of qualia (recall qualia are the vocabulary of consciousness and are situations that are represented with specific engineered constraints of being situated / structurally coherent / simulated).

- **Events are defined** as <u>situations that an agent deems need to be acted upon</u> (action could just be to update the representation) <u>and/or communicated</u> to other agents.

- **Situations** are the fundamental unit of cognition – and capture the idea of any aspect of the representation that can be understood as a whole (where understanding is respect to the task of establishing the relationship with other situations and how this situation can interact with other situations).

Propensity to create narratives exploited by magicians and movies

- The plot twist relies on you creating a false narrative to explain plausibly what is going on – you accept without questioning then when it turns out not to be true you are surprised by twist
  - Sixth Sense – in beginning of movie you see Bruce Willis get shot – then you see him walk around – you fill in he must have recovered …
- Also exploited by magicians – they toss the coin into a hand and squ...

Consciousness Tenets Summary
TD/BU and Types of Qualia

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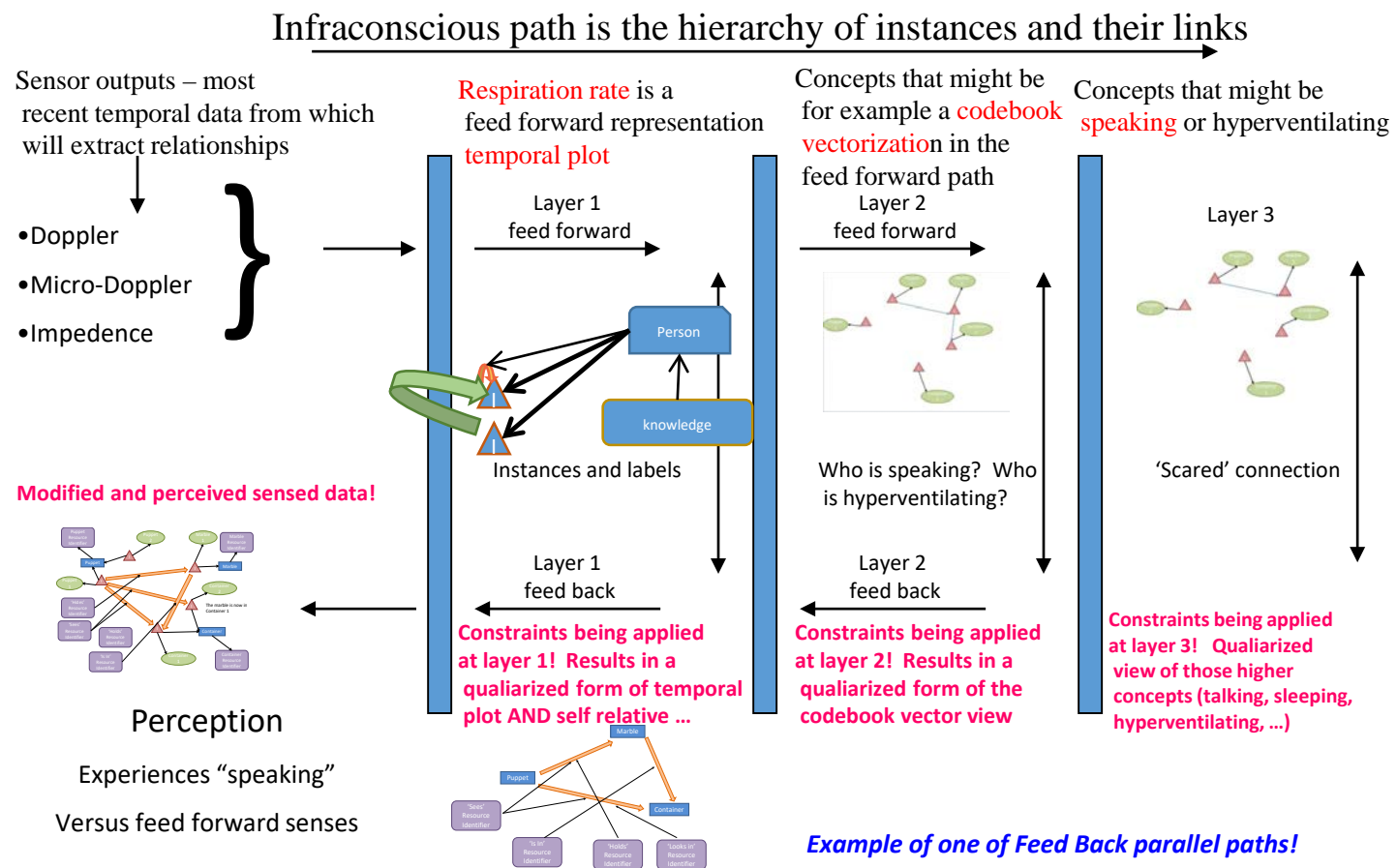
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Hierarchical Quest Architecture
'Chunking' for complex problems

Infraconscious path is the hierarchy of instances and their links

Sensor outputs – most recent temporal data from which will extract relationships

- Doppler
- Micro-Doppler
- Impedence

Respiration rate is a feed forward representation temporal plot

Concepts that might be for example a codebook vectorization in the feed forward path

Concepts that might be speaking or hyperventilating

Layer 1 feed forward

Layer 2 feed forward

Layer 3

Person

knowledge

Instances and labels

Who is speaking? Who is hyperventilating?

'Scared' connection

Modified and perceived sensed data!

Layer 1 feed back

Layer 2 feed back

Constraints being applied at layer 1! Results in a qualiarized form of temporal plot AND self relative …

Constraints being applied at layer 2! Results in a qualiarized form of the codebook vector view

Constraints being applied at layer 3! Qualiarized view of those higher concepts (talking, sleeping, hyperventilating, …)

Perception

Experiences "speaking"

Versus feed forward senses

Example of one of Feed Back parallel paths!

From 2009 Kabrisky Lecture

Consciousness as context engine

- Goal for use of context is to *generate more useful meaning of a stimuli for example* in object or situation recognition (correct assignment of object / situation labels requires consideration of other objects / prior-future situations / other sensory information, model seems to fit if the *context is used to disambiguate between multiple competing alternatives / narratives*)
  - Attempting to generate semantic meta-data bottom up only is ill-posed

Context agents as post process

- Common to think of context use as a post process to max agreement between parallel processes
  - In this sense you might imagine <u>Context Agents</u> – possibly all artificially conscious agents that generate Qualia are these Context Agents - where their sensors are capturing aspects of the representation of a set of agents looking to maximize the agreement between the parallel computations from those agents – a means to choose the most plausible narrative!

Source of context and why use context

- Sources of context
  - Learning from training (**co-occurrence** – can be from other agents)
  - **Pre-programmed** in (Google sets examples – since retired)
  - ***Derived information (includes agent's current and prior informational states includes***
    - Environment (city, weather, location, orientation, proximity, change of proximity, time)
    - User's own activity User's own physiological states*)*
- One reason context can be important to consider is the statement:
  - ***Total reliance on sensor data is metaphorically equivalent to trying to solve a set of equations when there exist more unknowns than equations***
- *If our goal is the automated generation of semantic meta-data then it will require some means to incorporate context*

Context provides the means to 'situate' new sensory representations

- Context and Big Data – are current approaches to Big Data looking to account for just one aspect of Context – co-occurrence?
  - If so can we look as another value added path for QuEST to provide a path to incorporate other aspects of Context (like relevant domain knowledge, other sensory paths)?
  - Our colleague George's recent interest in combining 1st and 2nd wave AI – could be means to bring in context
- Another topic is the relationship of current proposed means to use context and compliance with QuEST tenets –
  - **Context provides the means to 'situate' new sensory representations** – it is all the other stuff in the representation that is being experienced – thus situating a representation is a big step towards QuEST compliance –

Context: AGENT CENTRIC 'SUBJECTIVE'

"Everything is of one substance. It is **custom, not reason, that sets the temple apart from the house**, mutton from human flesh for the table, bread from vegetable, vegetable from meat. "

Diogenes of Sinope (fl. 412-323BC)

Diogenes of Sinope (412–323 BC), the philosopher, better known as *Diogenes the Cynic* or simply *Diogenes*

The stories told of Diogenes illustrate the logical consistency of his character. He inured himself to the weather by living in a jar[4] belonging to the temple of Cybele.[16] He destroyed the single wooden bowl he possessed on seeing a peasant boy drink from the hollow of his hands.[17] It was contrary to Athenian customs to eat within the marketplace, and still he would eat, for, as he explained when rebuked, it was during the time he was in the marketplace that he felt hungry. He used to stroll about in full daylight with a lamp; when asked what he was doing, he would answer, **"I am just looking for an honest man."**[18] Diogenes looked for a human being but reputedly found nothing but rascals and scoundrels.[19]

http://en.wikipedia.org/wiki/Diogenes_of_Sinope

Context Walk-away points

Perception = qualia = your sys2 in our vocabulary – thus only in context are situations perceived – context requires a Sys2 as we have defined it -

- Consciousness – we've suggested is for the integration thus may be the *framework for the use of context*

- Situation Awareness is the perception of the elements in the environment within a volume of time and space ***and spectra and logical adjacency*** , the comprehension of their meaning, and the projection of their status in the near future. (Endsley)

  - Awareness (mutual information with reality) implies being able to draw conclusions – inferences **not all information comes from observations** - thus tie to context discussion - Projection implies the ability to anticipate future events

  - Need situation consciousness – with minimally acceptable awareness – we don't care about reality – we care about stability / consistency and usefulness!

    To be conscious means you have access to its presence in your representation – to be aware we will use to represent the fidelity with reality – the mutual information

Context integration/use require consciousness!

- We can propose only to use the word context when we are talking about the common framework for multi-int integration – the working memory – the conscious representation –

- For **something to be 'experienced' as a quale it has to be 'in-context'** – it has to be stable consistent and useful – thus requires all relevant information to be 'experienced' – the consistent idea makes things 'in-context' – this is the **act of 'situating' representation**

- **Context provides the means to 'situate' new sensory representations** – it is all the other stuff in the representation that is being experienced
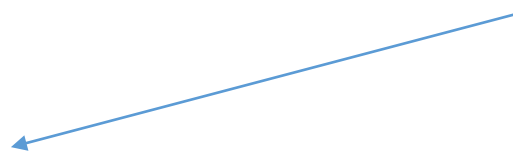
Be a little careful with my broad conclusion here – all I'm suggesting that OSL means to do the context solution is to have Context QuEST agents – the way we've defined them – they generate a hypothetical representation that is cognitive decoupled but is a common framework for the integration – **but since context SITUATES it begins to satisfy tenets**

QuEST and Context

- I would contend what we are discussing in this presentation is a means to generate the h**ypothetical** aspects of the conscious representation – **the pattern inference completion mechanism**

- A major difference between what we are suggesting and the SAIC work (toward greater consciousness in data fusion …) is that we also allow the hypothetical to change the sensory data and thus make it hypothetical whereas conventional 'context' engines just look to complement the sensor measurements with other domain knowledge – and our pattern completion inference mechanism

QuEST Situations - context

Recent modification

- "By a situation, then, we mean an agent's representation of a part of reality that can be comprehended as a whole in its own right - one that *interacts with other things (situations).*

- By interacting with other things we mean that they have properties or relate to other things (situations)." *** *we would say can and must be linked to other 'situations'* ***

    Does this mean an object is a situation? Is this our answer to drive together a representation that can be both for object based production and activity based intelligence

My biggest issue on this is I want to define subjective situations – they only exists in the representation (certainly sys2 and probably sys1) of the agent – the same world can generate
 different situations to different agents or even in one agent at different times -

        *** *we might suggest situation is subjective – not reality – it is not necessarily what is*
         real – it is what is real in an agent's representation of the world = a part of the representation
          that can be comprehended as a whole – interacts with other aspects of representation ***

Types of qualia – all qualia are 'thoughts'

- **Thoughts** – term that captures those aspects of *qualia generation, manipulation or maintenance* that are introspectively available (introspection is not mysterious – it is what it feels like to the agent that is manipulating its conscious representation – it is the quale created to capture that the thoughts (manipulation) is ongoing inside the agent having the thoughts)

  - **Sensations** – sensations are thoughts –the introspectively available internal representation (conscious *mental counter parts*) of the sensory data (note that it is only a quale when it is being attended to – when you are aware of its presence in the world model) (note: not all sensory data makes it to qualia – example the visceral sensors that control low level bodily functions like heart rate or body temperature) (note: the quale associated with sensation can change without a change in the sensory data -> there is a TD process involved also – Necker cube) – plausible explanation of sensory data – includes *body sensations* like (hunger, pain, dizzy, …) – using current qualia vocabulary to construct a representation of the sensor data within an acceptable narrative

The 'mental-ease' of conscious thoughts are qualia – the vocabulary of conscious thoughts.

Conclusion on sensation

- Data driven concept extraction ***isn't just at the label*** level – it is at the perception level = quale (note <u>*wide variation in hue same quale*</u>) – <u>**this is an example of data -> concepts**</u>
  - Wide range of wavelengths = same perception = same quale = same concept (***same data vary context changes perception – example Land Mondrian experiments)***
  - Even wider range mapped to same label (red)
- Perception is subjective – the color is in your mind <u>***not***</u> coming off an object
  - (I really should say I have no way of knowing what is coming off the object but we do know that the red you 'see' is generated by your mind)

The color I 'see' is my <u>***internal representation of a concept***</u> that captures the wavelength aspect of some part of my environment - *'we experience not the raw sensory data but a simulation of them. The simulation of our sensory experiences is a hypothesis about reality. The simulation is what we experience. We do not experience things themselves. We sense them. We do not experience the sensor data. We experience the simulation of the data.' – user illusion. – **headphones! – the simulation is more stable, consistent and useful than the raw data!***

Land Mondrian experiment – example of context

- http://www.vislab.ucl.ac.uk/land_mondrian_experiment.php
- If a multicoloured scene is illuminated with three projectors (natural condition), the brain compares the light coming from all the patches in the scene in order in order to assign colors to the patches. If you illuminate only one patch, leaving the others dark (known as the void condition), then the result of the comparison (between the patch and nothing else) will be different, leading to a different perception of the color of the patch. To convince yourself that the actual emission of the patch is remaining constant between the two conditions, cut a hole in a piece of black card and hold over the screen whilst you press the
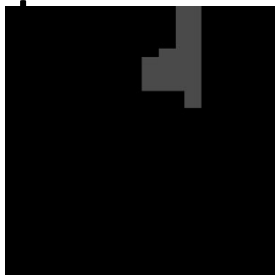
The Land-Mondrian Experiment. If a **multicoloured scene is illuminated with three projectors** (this is known as the NATURAL condition), the brain compares the light coming from all the patches in the scene in order to assign colours to the patches
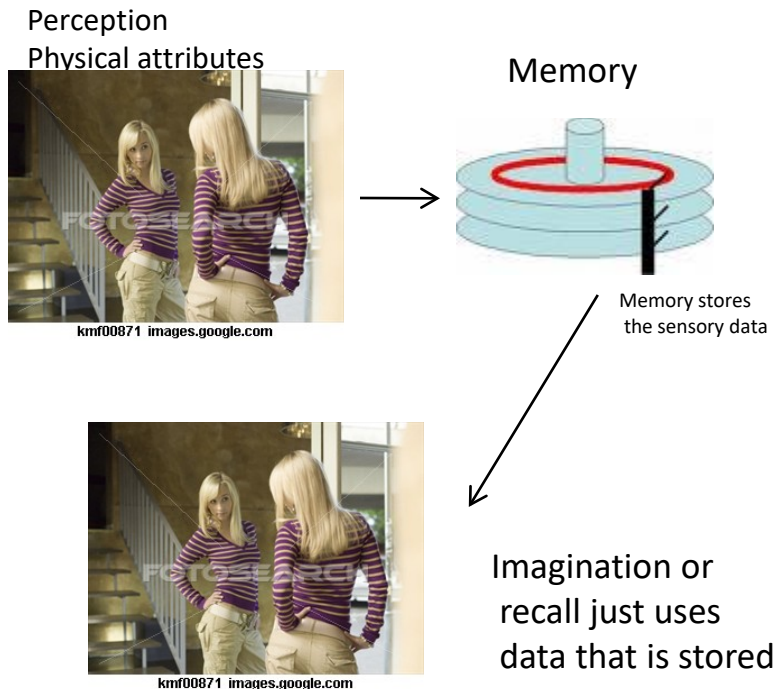
continued

- **Imagination** – thoughts associated with combination of qualia that might occur (note how imagined pain doesn't 'hurt' the same) – similar process used in the generation of plausible narratives (the attended to narrative is the Cartesean Theater), ToM!, memory
- **Self** – thoughts associated with the existence of the entity creating the qualia (may be levels here – dogs don't commit suicide?), a set of processes (coming slide) – a quale that captures the source of the thought
- **Dreams** – thoughts probably associated with the reorganization of the qualia memories to allow more efficient use of them – since they 'feel' different than other imagined thoughts they are a different type of quale – they 'feel' real versus 'feeling' imaginary
- **Memory** – thoughts associated with possible explanations for prior experiences – (*combination of qualia that might have occurred but using current qualia to generate plausible reconstruction*) plausible narrative explanation for prior experiences (not what happened – but what you imagine might have happened but tainted by experiences since the experience being recalled!)

Memory, Perception and Imagination – *'time'* is a quale

The idea that the architecture that requires plausible narratives requires that past (memory), present (perception) and predicted future (imagination) be tied together – thus a quest solution imagines the set of processes that accomplish these tasks be the same – this is in contradiction to the conventional approaches to perception, memory, prediction

Current Approaches to Memory, Perception and Imagination Representation

Perception
Physical attributes

kmf00871 images.google.com

Memory

Memory stores the sensory data

kmf00871 images.google.com

Imagination or recall just uses data that is stored

QUEST Approach to Memory, Perception and Imagination Representation

Perception
Qualia attributes

Memory

STM

Consolidation – not a bit level sensor storage approach – constantly changing basis projection storage

LTM

'See' what you believe – vivid dream

Reconsolidation

Imagination or recall changes the memory – the waiter idea 'Blink'

c'est de quelle manière tu te perçois!
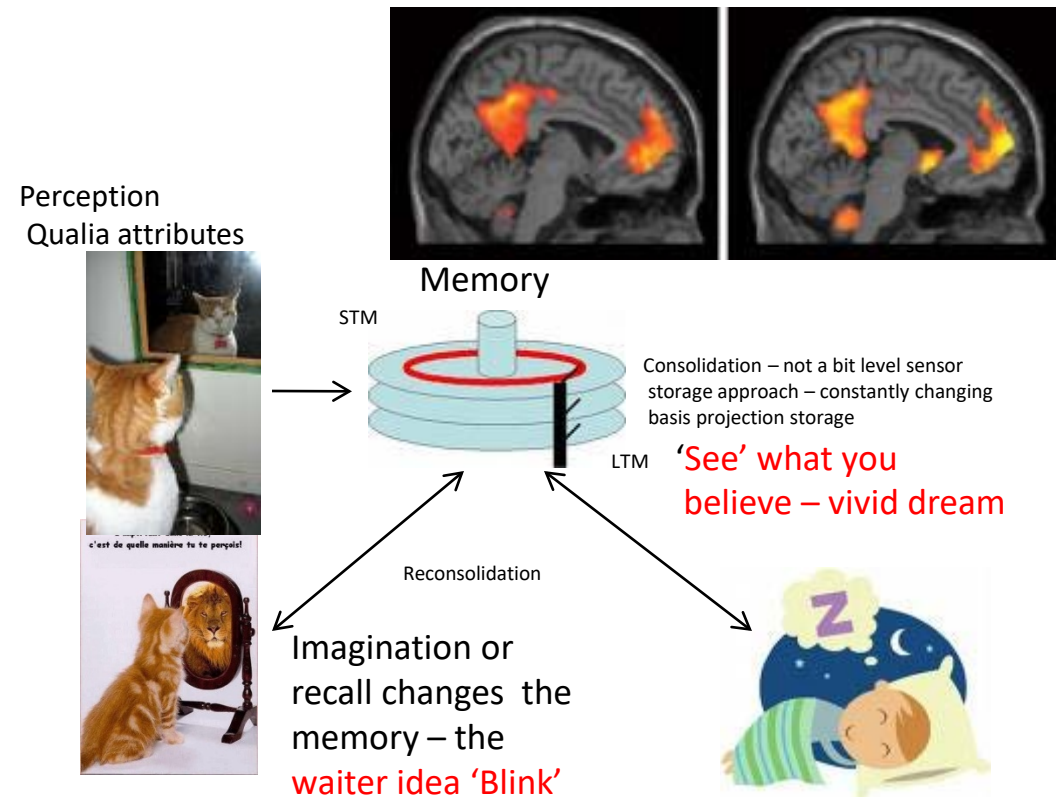
Diagram: perception = memory = imagination ('time is a quale)

Sensory data

Schizophrenia could be the lost of the quale tags that allow the world model to put the WMM in proper perspective

World model

World Model Modification Process **"THINKING"**

New World model

Conscious Thoughts – generation, manipulation, maintenance of qualia

Thoughts

There is only one process – attention controls what dominates the world model modification!
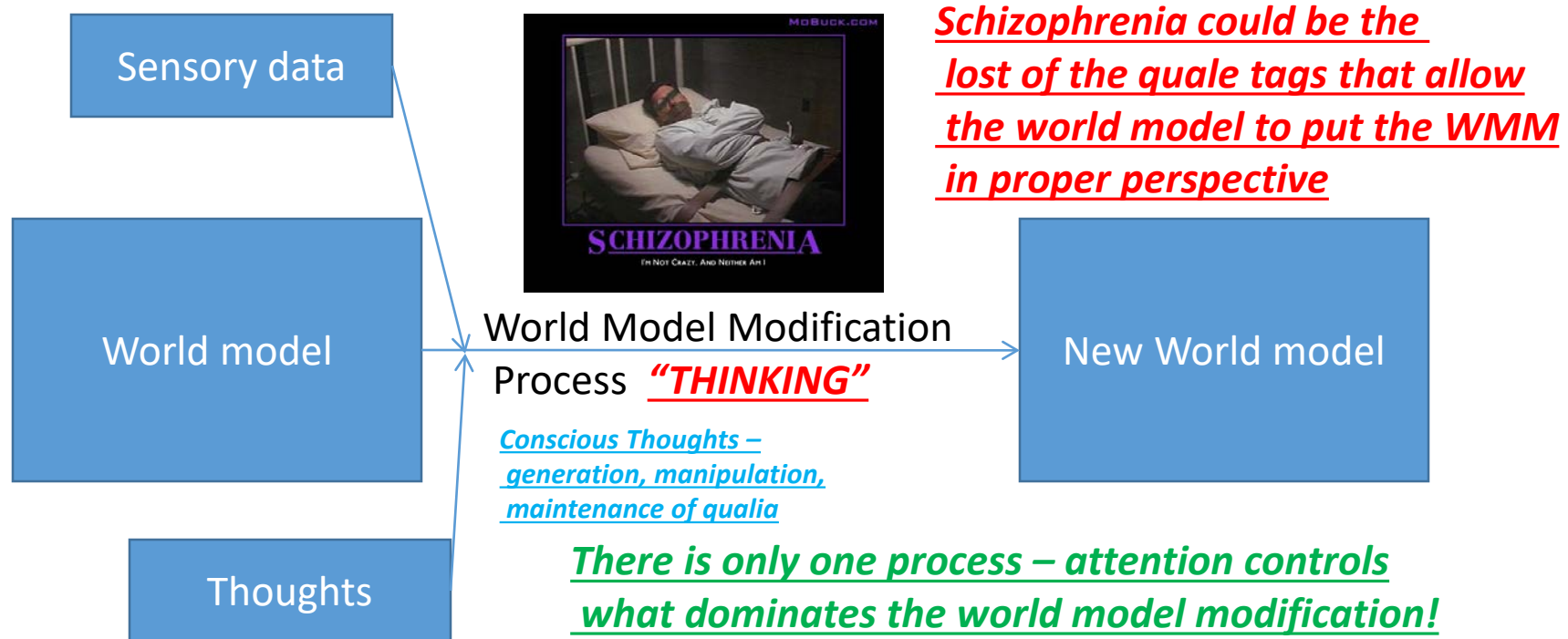
In one case this WMM achieves perception when the process is being dominated by sensory data, it achieves memory when the process is dominated by thoughts of recalling some prior experience and achieves imagination when the process is dominated by thoughts associated with some possible future – ATTENTION drives what becomes QUALIA – and specifically its 'time' quale that it associates with the WMM

If thinking = cognition = manipulation/modification of world model then perception requires thinking as does imagination and memory as does orienting as does acting! No OODA!

- Cognition is how an AS processes thought/experience/sensory inputs, generates _knowledge_ and _understanding_ so it can carry out its role in the organization

The great illusion of self
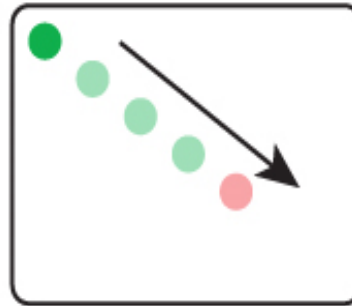
Notes by Cap

May 2019

"beta phenomenon"

Spotted trick

©NewScientist

If two dots are flashed on a screen in quick succession, the brain creates the illusion of a phantom dot moving between - and if the colours of the dots are different, the result is even stranger

When two coloured dots are flashed in quick succession...

...some people report a ghost dot moving between them that changes colour abruptly along the way
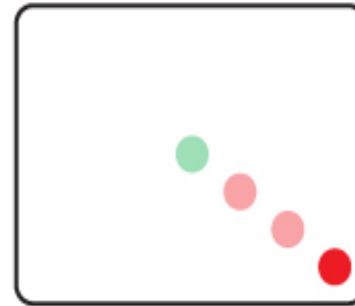
The weird thing is, people report seeing the colour change to red BEFORE the red dot has even appeared

Self

- Experiencing of the representation requires the illusion of something to undergo the experience = self (note doesn't say it requires the critter to create the ability to reflect on the existence of itself – but never the less it does say it {self} has to exist to experience the qualia) –
  - ex) a *set of processes* that judge the usefulness of alternative plausible narratives that thinking generates – this suggest it is the 'self' that decides what becomes conscious.
    - One thing this allows is a flexibility on the output of that is the response of the qualia system to a given class of input.
    - The usefulness is computed from a consistency within a plausible narrative from a consistent perspective = self (continuity, unity, embodiment, reflection, 'free will')

Van gough 'self' portrait example

Characteristics of Self

Can we hope to replicate some of these processes in a QUEST soln?

- Continuity – unbroken thread (with 'feeling' of past, present and future) – cohesive narrative (non-causal – time is a quale)

- Unity – diversity of sensory data BUT 'experiences', memories, beliefs and thoughts are experienced as one person – as a unity

- Embodiment – mind is embodied and body is embedded, 'feel' anchored in our body (idea that you can't model a priori all that will be encountered and form sensory experiences will take)

- Sense of free will – 'feel' in charge of our actions, I can wiggle my finger (recently thinking link sets may offset a lot of what appears to be free will – **although clearly not present when deciding**!)

- Reflection – 'aware' of itself (places 'self' in world model)

All of these characteristics can be differentially disturbed by brain lesions – Self is not one thing it is a ***set of processes*** all acting together! (self is a 'feeling' = a quale associated with these processes {qualia}). Even when multiple personalities only one at a time is experienced – as is all 'one quale at a time'.   Stick your tongue out at the baby and they stick their tongue back out at you – that is really cool – they have to have made a model of you and map that to what that would feel like if he stuck out his tongue – mirror neurons! Autistic kids may have deficient mirror neuron system. (Ramachandran)

Conscious = generates quale = aware of that attribute of the internal representation

Unity characteristic

- The world model (qualia) also has a **unity** about it in that everything is from the one perspective of the qualia system generating the world model.
  - All Gists that are generated are taken from the qualiarization system's sensors that are unique to that system and to that system's embedding.
  - That world model is **embodied** within a system that is equipped with sensors to observe the world and it is embedded within the world it is modeling.
- The world model (qualia) are a useful and consistent representation of the world from the perspective of the qualiarization system (example – visual aspects of the representation are as 'seen' from the qualiarization system angle of its visual sensors)

Perspective:
Draw a letter on the palm facing away from you, then make the same drawing on the palm facing towards you – note the same sensory input is perceived differently based on perspective. RECENT BODY SWAP ILLUSIONS based here!

Unity

All information from user's perspective – ex) recent movie Vantage point

Body Swap Illusion

The body associated with your mind can be swapped so you perceive the mannequin as your body – this shows the power of UNITY in qualia – even the rubber hand idea – all make your world model accept the inplausible narrative that something is part of you when it clearly isn't

Rubber hand illusion

- They say that in certain situations, the experience of owning a nonhumanoid body is more convincing than that of owning a humanoid body. And this result paves the way for virtual body ownership to play a greater role in applications such as training, education, and of course video-gaming, where the potential is significant.

- First some background.

  - The rubber hand illusion begins by covering a person's real hand and placing a rubber hand next to it. The subject can see the rubber hand but not their real hand. The illusionist then lightly touches or strokes both hands in the same place and in the same way.

    https://www.technologyreview.com/s/613976/a-vr-illusion-that-makes-us-think-we-have-a-spiders-body-could-change-gaming/

Rubber Hand

Great Demonstration of the importance of the prediction path in all
Qualia processing! Great example of demonstrating you experience
the prediction versus the sensory inputs. Expectation driven sensing!
Anbar Province solution comes from this analysis.

New approach – don't attempt to understand traffic jams by studying engines

- ***reciprocal interaction,*** especially as cancers grow and become more advanced.
  - ***The*** **surrounding cells might let cancers start,** but once they do, cancers appear to change the surrounding cells to help fuel the cancers' growth. ****** this is the environment problem and the reason that the awakening councils worked so well in Anbar *...***
  - ***Cancer is no more a disease of cells than a traffic jam is a disease of cars,***" Dr. Smithers wrote.
    - "*A lifetime of study of the internal-combustion engine would not help anyone understand our traffic problems...*