

Consciousness and Knowing: What Can Be Known?

Mike Young PhD

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INTRODUCTION

Consciousness

- Consciousness is (1st person) **subjective experience**
- Nagel: “What is it like to be something”
- “fundamentally an organism has conscious mental states if and only if there is something that it is like to be that organism – something it is like for the organism”
- **Subjective character of experience**



What does a theory of consciousness have to account for?

- What is consciousness?
- Where does consciousness come from?
- What sorts of things have it?
- Do differences in consciousness vary in any systematic way across the entities that possess it?
- How does the concept of intelligence relate to the concept of consciousness?

Occam's Razor:

A scientific and philosophical rule that entities should not be multiplied unnecessarily which is interpreted as requiring that the **simplest of competing theories be preferred** to the more complex or that explanations of unknown phenomena be sought first in terms of known quantities

Merriam-Webster

Matter as Awareness

- I exist
- Subjectively I am aware of a world
- I am only composed of matter
- Therefore: Matter ~~can be~~ awareness

Occam's Razor: Matter is awareness

Energy ~~Matter~~ as Awareness

- I exist
- Subjectively I am aware of a world
- I am only composed of energy
- Therefore: Energy ~~can be~~ awareness

Occam's Razor: Energy is awareness

Energy is Knowing

- There is only one thing in the universe: Energy
- Matter and energy are different states of the same thing (i.e., $E = mc^2$ or $m = E/c^2$)
- All matter and energy is knowingness
- Knowingness is normally reserved for agents
- We argue that there can be knowingness, without an agent who knows
- Knowingness is non-conceptual knowledge

Configurations of Matter is Key

- The configuration of matter is critical
 - All cells except central nervous system (CNS) are replaced within 7 years
 - All matter is replaced every 7 years including CNS
- **Organisms** are not specific collections of matter, they are specific configurations of matter
- The most important configuration is the neuronal architecture which determines what you can consciously experience

Consciousness

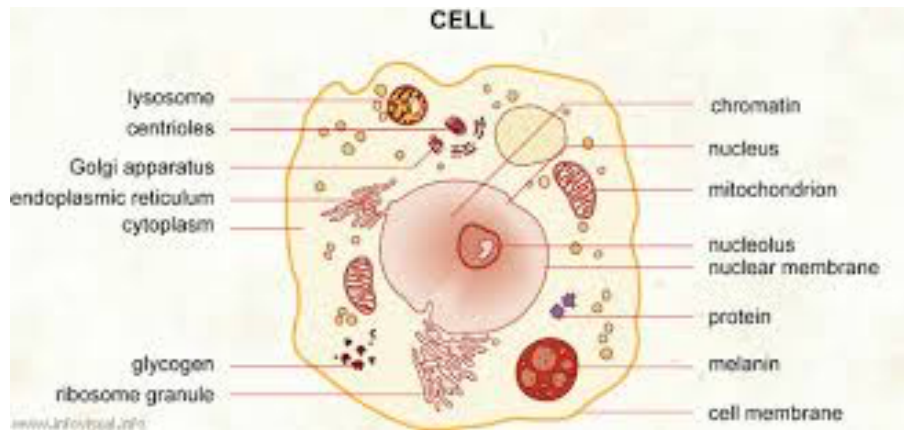
Dual Property Model

- Consciousness is an internal configuration of matter that embodies knowledge useful to an organism (i.e., it is a representation).
- Consciousness is the subjective experience of the (dynamic) representation
- Content of consciousness changes when a stimuli (i.e., energy from outside or inside the organism) triggers a change in this internal configuration
- Physical change is subjectively experienced as a change in the inner state of consciousness
- Consciousness is conceptual knowledge
- Only organisms possesses consciousness

Neuronal Architectures

- Neuronal architectures are biological information processing systems (i.e., nervous systems)
- They are species specific configurations of aggregate matter
- They define the range of consciousness you can potentially experience
- Neuronal architectures both differ across species, and in term of phylogenetic complexity
- More sophisticated architectures have more concepts and display more adaptable behavior

Consciousness: One Thing or Many?



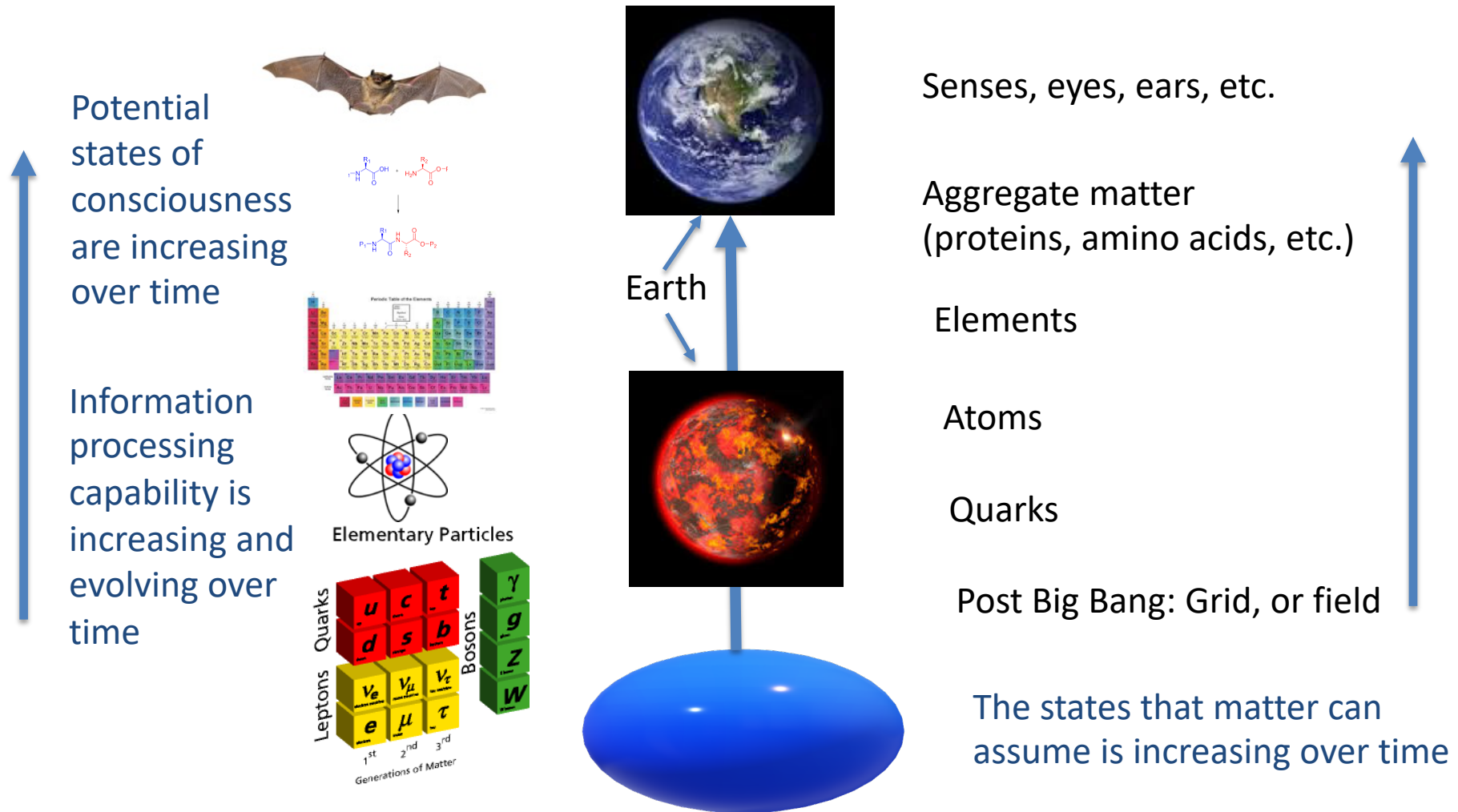
- We propose that separate pieces of matter-as-awareness merge when there is physical sharing of matter

AGGREGATED MATTER

Entropy

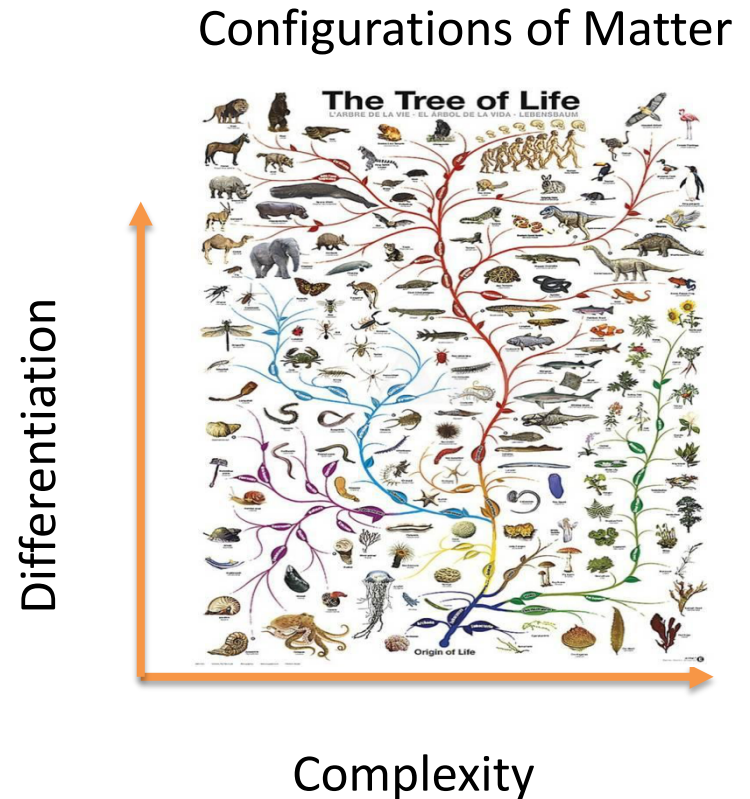
- PHYSICS
 1. a thermodynamic quantity representing the unavailability of a system's thermal energy for conversion into mechanical work, often interpreted as the degree of disorder or randomness in the system.
 2. lack of order or predictability; gradual decline into disorder.

Matter is Becoming More Complex Over Time



Aggregation

- Aggregate matter is physically more complex than elementary matter (e.g., proteins, amino acids, cells, etc.)
- When aggregate matter interacts with energy it often produces a more complex, cascading, physical reaction
- This is subjectively experienced as a richer experience of consciousness

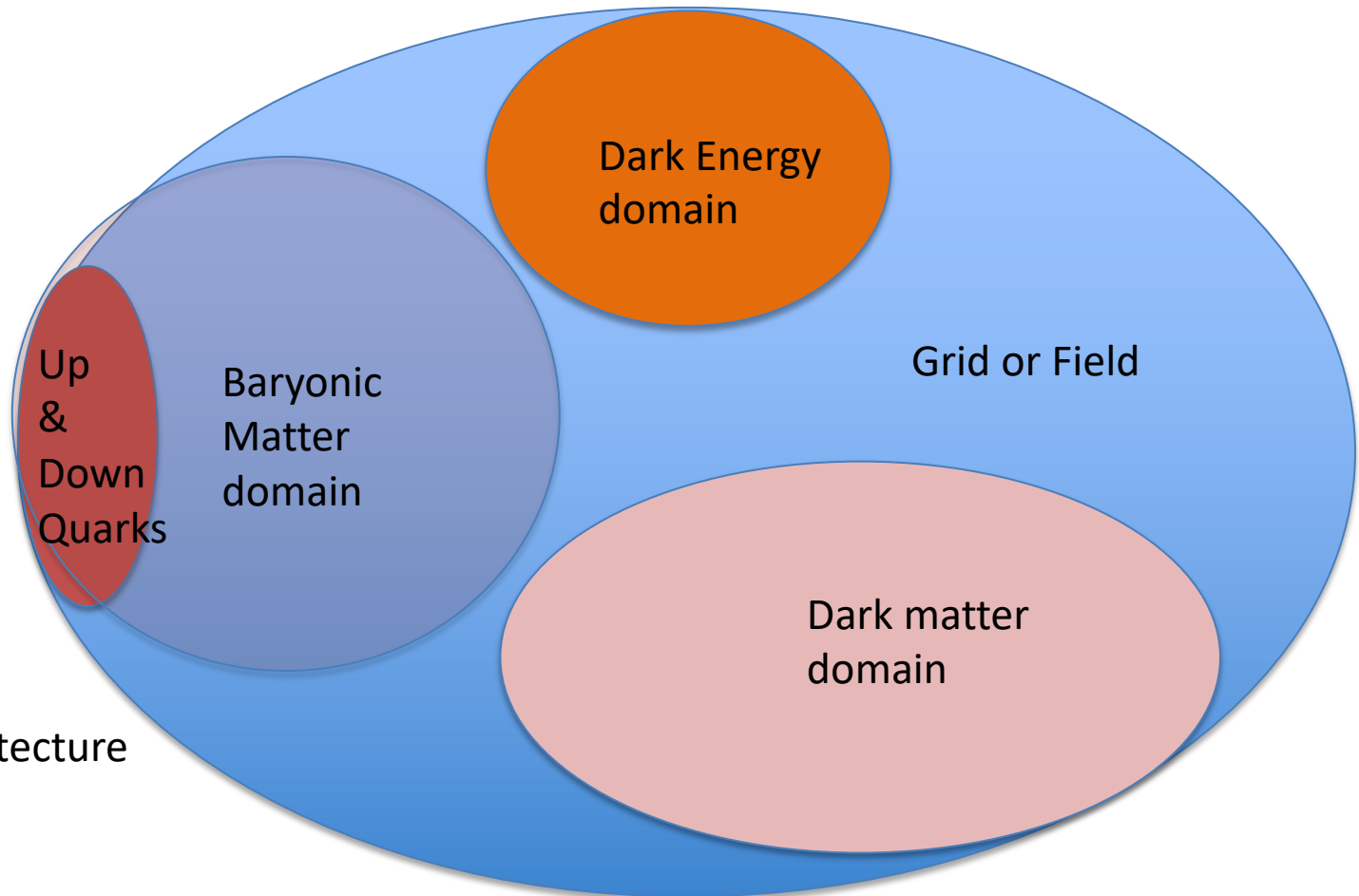


DIFFERENTIATION

Terminology

- Universe – All of the energy/matter of the universe, makes up or defines the *universe*.
- Domain – The type of matter you consist of defines your *domain*; it sets the limit of what you can be conscious of
- World – Your specific neuronal architecture defines your *world*; it sets the limit of what you can directly experience; it is species specific
- Reality – Your *reality* defines your specific state (compared to other conspecifics)

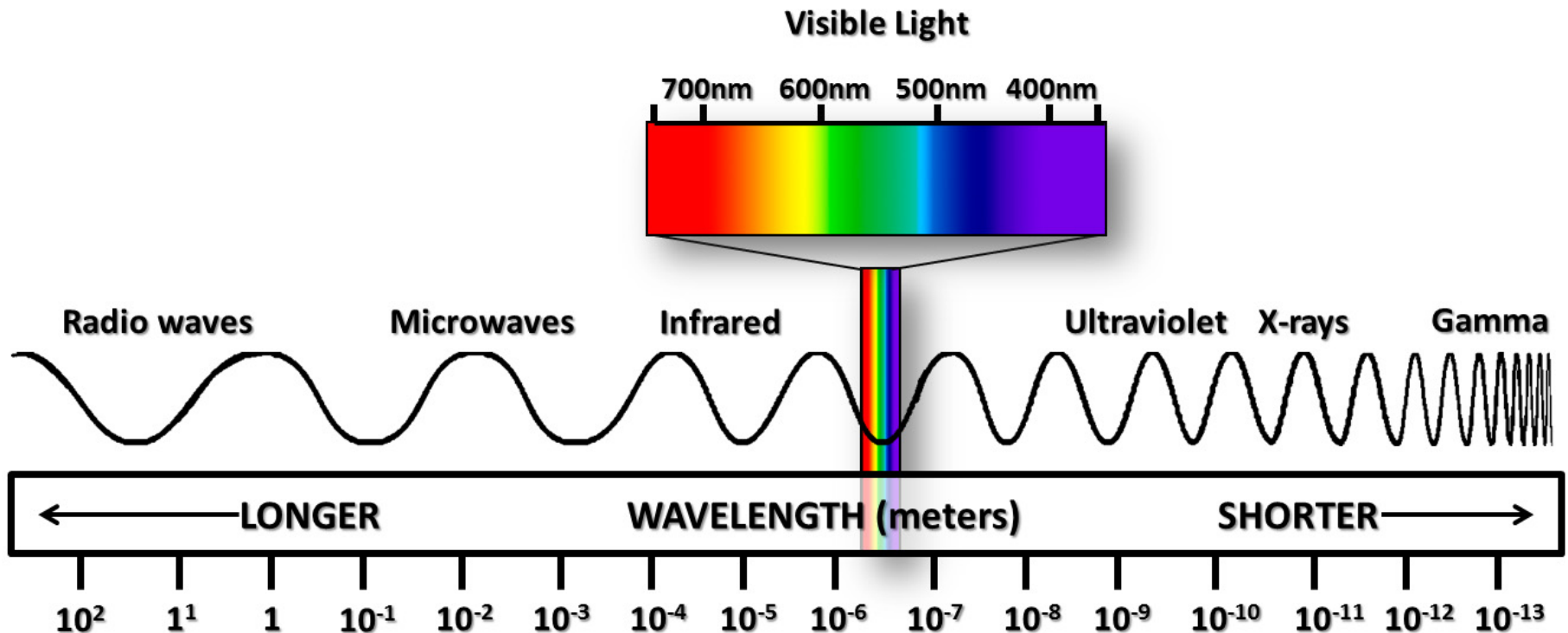
Energy and its Sub-Sets



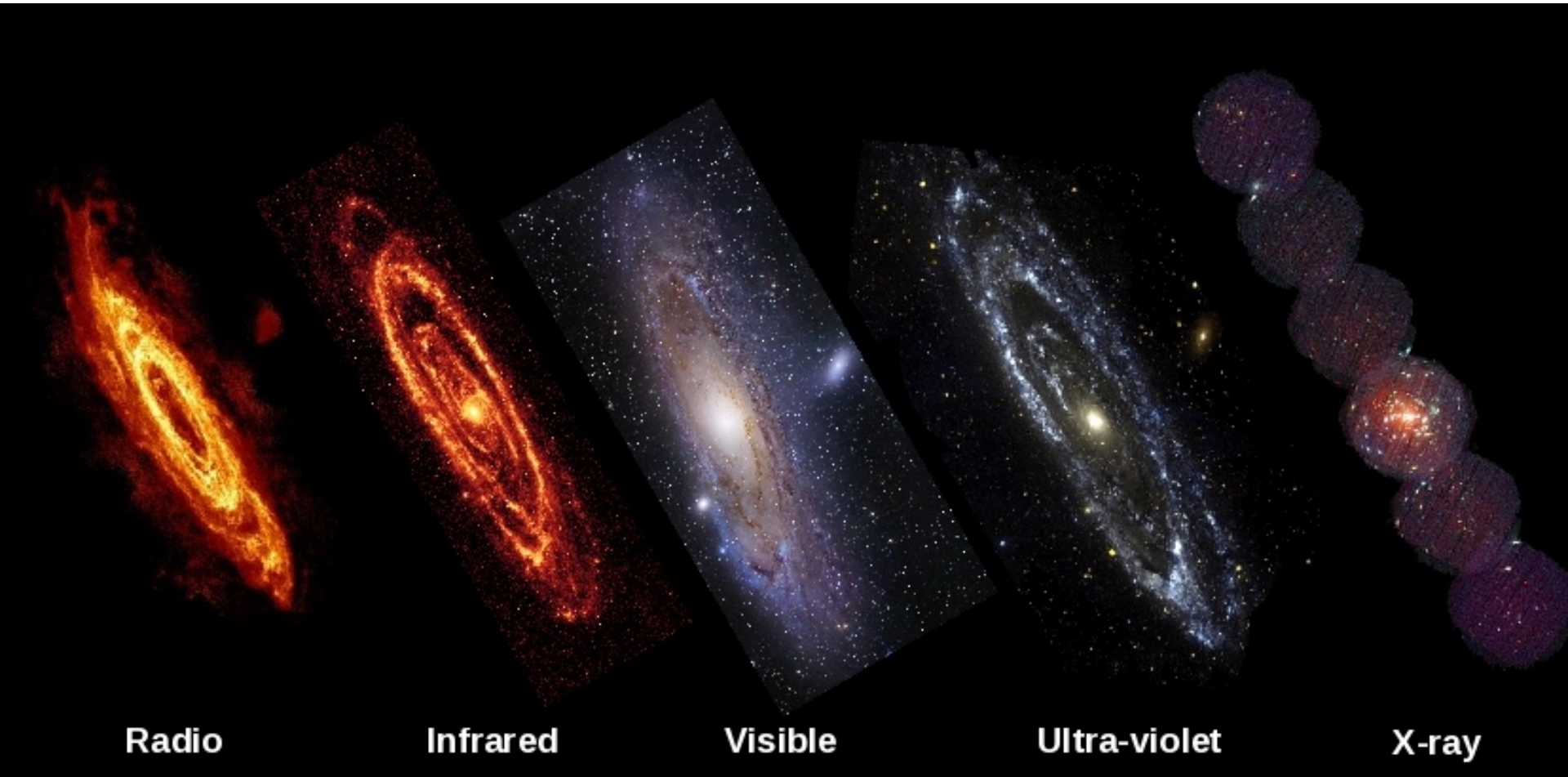
What can be Known?

- Neuronal architectures delimit worlds that can potentially be experienced
- They are species specific configurations of aggregate matter
 - Sensor systems
 - Central (or distributed) information processing
- They physically embody and subjectively create what Nagel called “something that it is like to be that organism”

Spectrum of “Light”



Sensing in a Realm

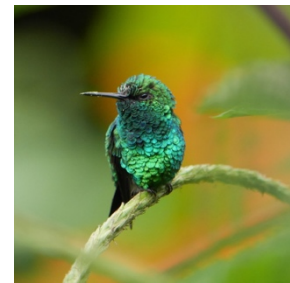


Human vision covers about 2% of the electromagnetic spectrum

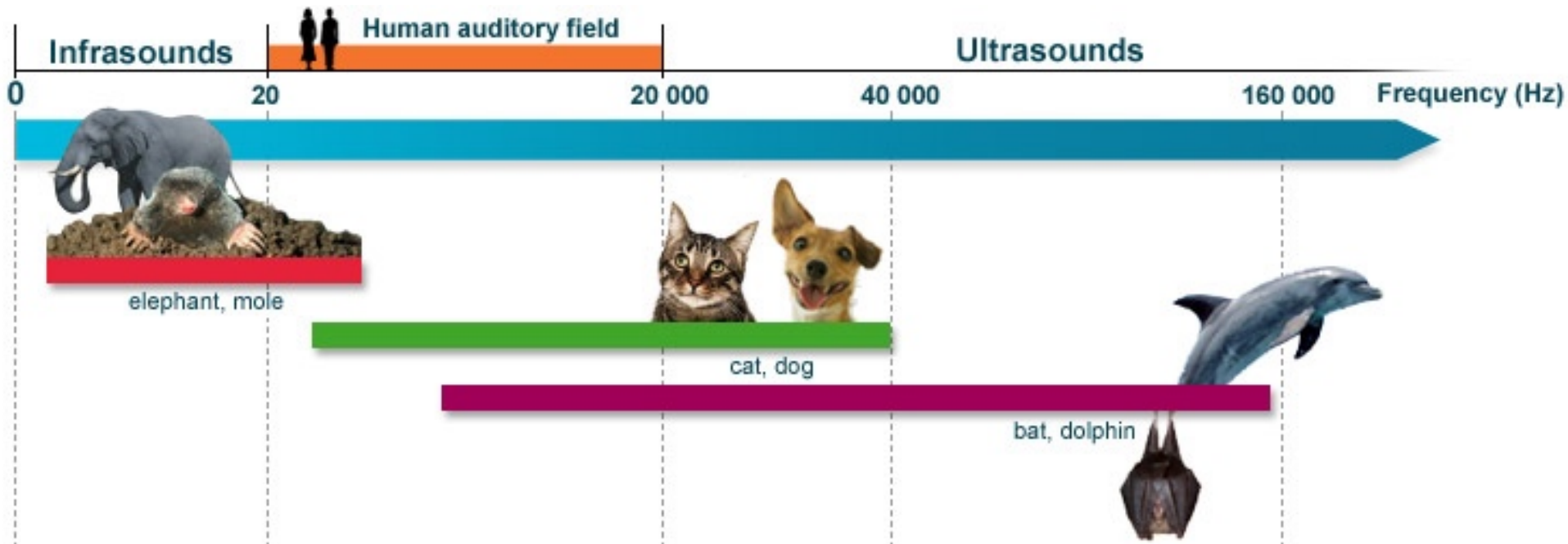
Two Worlds: Visible Light versus Ultraviolet Light Perception



Picture from: <https://morebees.com/blog/>



Phylogenetic Diversity



- Human hearing covers about 12% of sound frequencies
- What you hear (smell, feel, etc.) depends on your neuronal architecture

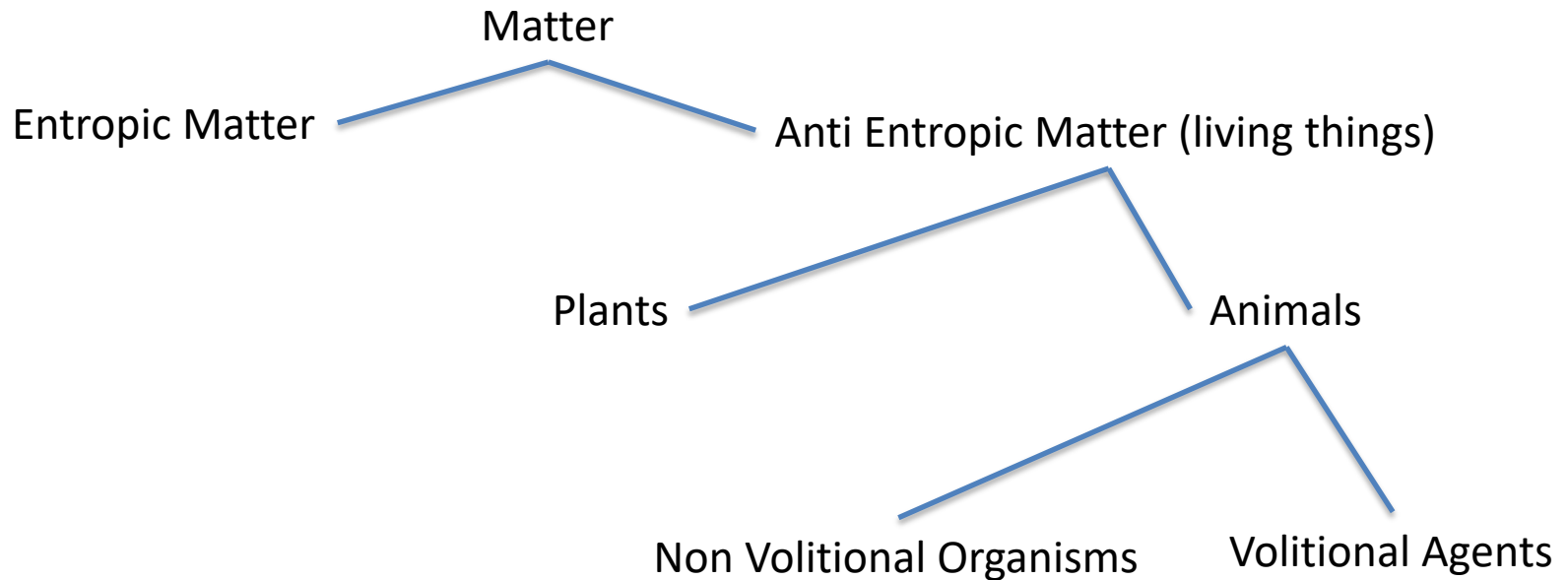
COMPLEXITY
(CLASSES OF MATTER)

Classes of Matter

- Entropic matter (e.g., elements, minerals, stones)
- Anti-entropic matter
 - Consist of aggregate matter
 - Builds internal structure that processes information
 - Flora have neuronal architectures
 - Fauna have neuronal architecture and are mobile
- Volitional Agents
 - Subclass of fauna
 - Can choose to ignore information



Phylogenesis



Entropic Matter



- Awareness, but no subject, no sensors, no effectors, no mind (no neuronal architecture)
- Changes in state of awareness due to physical environment
- Does not communicate independent of physical change
- Entropic matter does not discriminate
- Best characterized by hard sciences

Entropic matter is not conscious

Rocks all have what physics supplies them

- The uniqueness of one rock versus another is just the individual ‘experiences’ that change their respective internal states – one might be more susceptible to breaking apart versus another – but all of these individualized differences are driven by the **laws of physics**

(Jim Holt, Mind of a Rock, 2007)

I-ness separates Plants and Animals

- There can also be subjective experience (i.e., consciousness) without a subject (or with a subject)
- Flora possess consciousness but no sense of I, even though they sense and respond to the environment
- I-ness co-evolved with mobility in fauna
- I-ness is the central pillar of a “Mind”
- Animals have them, plants don’t

Anti-Entropic Matter: Organisms

- Living things engage in **self production**; they extract energy from environment, and use it to construct and maintain themselves
- No agreed upon set of factors define life: **self-organization**, emergence, autonomy, growth, development, reproduction, adaptation, responsiveness, and **metabolism**
- What interests us, is that organisms create “walls” that enable their **insides** to be different—**more complex**—than the **outside**

Plants



- Plants are alive, they use self-organization and metabolism to create and maintain complex dynamic structures
- Plant structures separate the plant from the rest of the universe
- Structures create an inner world of intelligence and meaning.
- **Plants can discriminate**
- This enables plants to **sense and respond to the environment**, and adapt their behavior accordingly
- Plants do not have a self that knows what they are doing and chooses specific behavior

Plants are conscious, but there is no subject

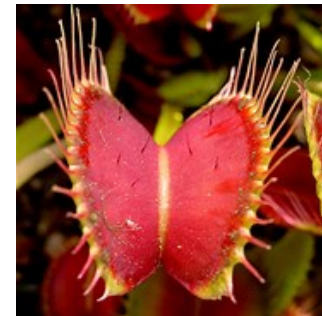
“Plants Cannot Think or Remember

- These borrowed terms do not accurately describe how plants function. However, like most organisms, plants can sense the world around them, process information from their environment, and respond to this information by altering their growth and development.
- In fact, plants respond to changes in their environment in ways that many would find surprisingly sophisticated, although botanists have known of these abilities for centuries.”

Plant Nervous System

- So if plants aren't using electrical signals in nervous systems like animals, **what do they do with the electrical impulses they produce?**
- In most cases, plant biologists don't know. "We've known about electrical signaling in plants for as long as we've known about it in animals," says Van Volkenburgh. “
- But **in most plants, what those signals are for is an open question.**"
 - The notable exceptions to this mystery are plants that rely on electric signals for rapid movement, like the carnivorous **Venus flytrap** or *Mimosa pudica*—a plant whose leaves fold up when brushed to discourage herbivores.

<http://blogs.scientificamerican.com/observations/plants-cannot-think-and-remember-but-theres-nothing-stupid-about-them-theyre-shockingly-sophisticated/>



Animals



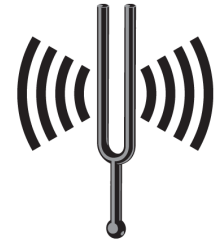
- Key factor separating plants and animals is mobility
- Mobility created huge phylogenetic opportunities
- Most important innovation: Sense of self or *I-ness*
- Animals discriminate and choose

Animals

- Mobility created opportunities for intelligence to greatly expand
 - Movement (motor systems; body, head, arms, etc.)
 - Sensation (diverse frequencies) and perception (categorization and associations)
 - Thinking and memory (planning, simulation; episodic, short, and long term memory)
- Radical expansion of information processing capability
 - Dedicated nervous system to include brain
 - Distal processing of information via electrical transmission
- Development of sense of I
 - Integrates information
 - Learns
- Sophisticated information processing and sense of I = Mind
 - Nothing magical or mysterious about it

Phylogenetic Diversity

- Mosquitoes respond to specific frequency even if it comes from a Tuning fork
- Frogs do not see objects
 - See patterns of light that behave in specific ways
- What a tree frog can hear is quite limited and always triggers a behavioral response
 - Co – Qui
 - <https://youtu.be/G2skl4qe5j0>



Context and Scripts

- Many species display context sensitive behavior
 - Hormonal influence
 - Environment influence
- Many behaviors are complex, and could be consider the execution of a script



Different Perspectives of a Bush

- Insect
 - No bush
 - Fixed action pattern (i.e., almost a reflex)
- Dog
 - Smell dominates, vision black and white
 - Small set of associations
- Human
 - Vision dominates, sees it as green
 - Range of associations
 - Can “choose” behavioral response



Volitional Agents

- Volitional agents are subclass of fauna that can ignore information
 - Ignoring information enables organism to overcome local maxima and defeat deception
 - Ability to “reprogram” themselves
 - Learn via observation (social learning theory)
 - Analyzing volitional agents requires an Intentional Stance or Theory of Mind approach
- Like all fauna they possess consciousness
- Sys2 systems (i.e., volitional agents) can ignore information, Sys1 systems cannot

Sophisticated Behavior

- Many species appear to be able to reason using internal knowledge.
- Non-human primates, advanced birds (e.g., crows, parrots), and invertebrates such as octopi appear able to think in a non-verbal fashion
- Standard way to explore non-verbal thinking is to use discrimination studies where an animal has to identify which two things are alike
- Example criteria include numbers (e.g. which two things have the same number of objects), melodies, weight, crooked versus straight, and many other dimensions.
- Hundreds of such studies indicate that many species have sophisticated non-verbal conceptual reasoning capabilities.
- Results indicate animals have stronger discriminatory capabilities when the required behavior is congruent with their natural behavior (and underlying neuronal architecture).

Adaptability

Koehler argues that the higher the evolutionary development of a species, the more adaptability they display in learning to refine and modify their fixed action patterns. Koehler relates adaptability to the progressive development of concepts in a species.

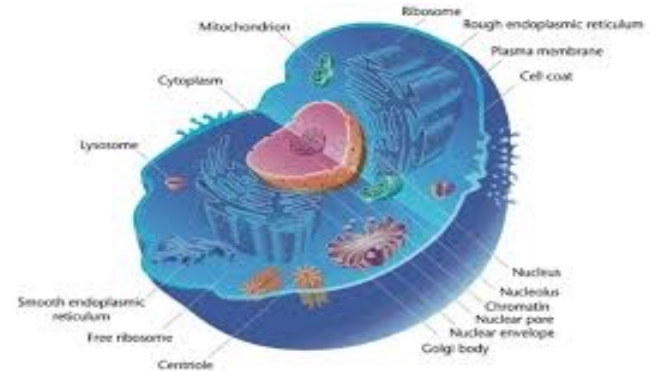
Cultural Transmission



- Many animals learn through **observational learning**
- Method to gather food are passed from one generation to the next this way
- Different monkey troops in the same area use different techniques

Are Machines Conscious?

- In a property dualism framework, the machine is matter-as-awareness
- However, we propose that separate pieces of matter-as-awareness merge when there is physical sharing of matter
- Machines do not share matter like organisms do; the parts of the machine do not share matter



Question of the day:

- Do cognitive neuroscientist study consciousness?
- Yes, they study the mechanisms that give rise to and control consciousness
- Two parts:
 - The computational substrate
 - The knowingness or subjective awareness
- Consciousness is not a unitary phenomena
- To make major progress you must study it in multiple species

Summary

- Energy as awareness is the “**baseline model**”
- Consciousness is the subjective experience of an internal state (even if there is no subject)
- Good models of consciousness are hard to develop because there is too much focus on “I” (I have a mind, I think,...)
- The **configuration of matter is the key variable**: it produces different information processing characteristics
- **Entropic matter cannot discriminate, anti-entropic matter can**
- Volitional agents can choose to ignore information
- **Aggregated matter enables more varied and complex consciousness**
- Mobility encouraged development of I-ness
- Volitional agency (I-ness, ability to ignore information, and self programming), not consciousness, is crucial to advanced cognition

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Thanks!

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