



# Observer Theory

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SAM A SENCHAL





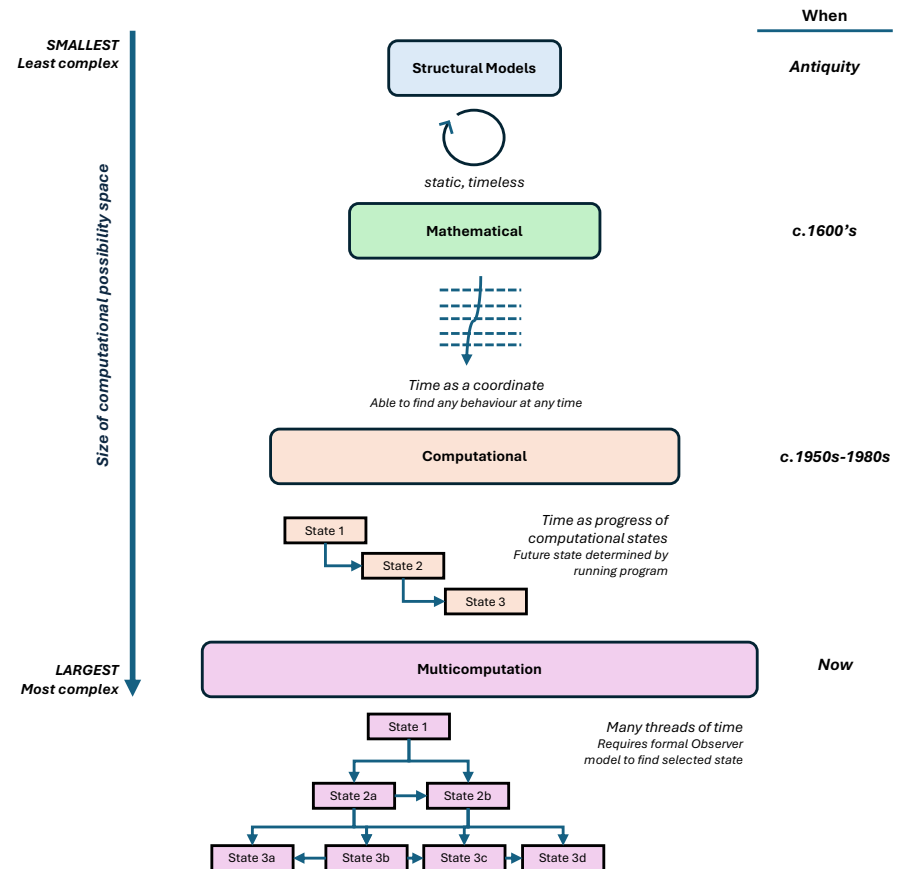
SETTING THE SCENE

# The Ruliad

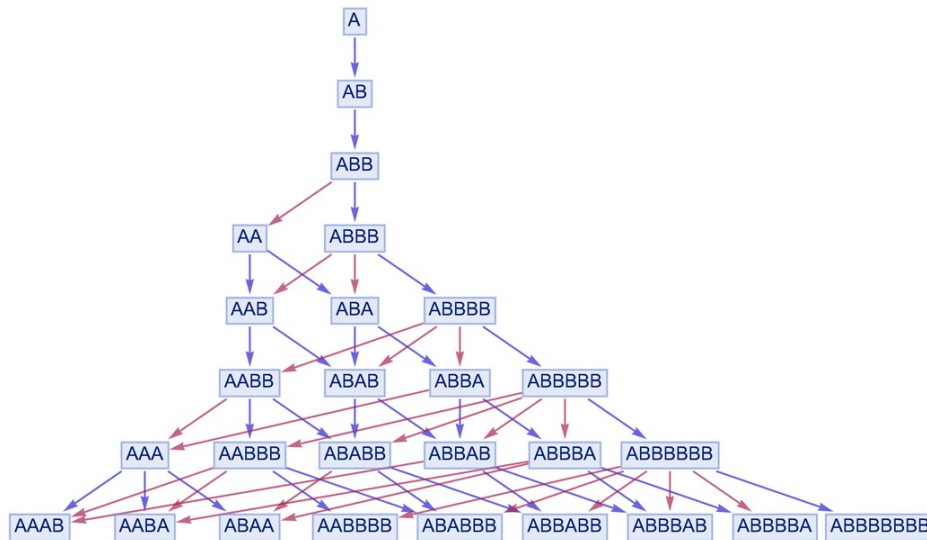
Wolfram (2021)

Category Theory formalism by Arsiwalla, Gorard et al (2022 / 2023 / 2024)

- The Ruliad is an idealized “everything-computation”, it contains all possible computations (i.e. it functions as an ‘infinite ground’ of computational information)
- It is an abstract mathematical object: **a meta-space containing every rule-based universe**
- Think of it as a gigantic “library” of every possible computation (and hence every possible multiverse)
- It is not an empirical thing we discover; rather, we use it as a precise backdrop where all possible models of reality can co-exist
- **Important: The Ruliad is not the universe. It is a formal limit object within which our universe can be modelled to arbitrary accuracy**



# The Computational Opportunity



- **Definition:** Computation, here, are the chains of [cause-and-effect processes within the Ruliad](#) (Wolfram's computational possibility space)
- In a Computational Observer Model what is invariant vs. variant
  - Causal / Morphological structure is Observer independent i.e. the underlying structure of computational possibility space / latent space / the Ruliad
  - Computational samplings by Observers are not invariant
  - **BUT** the categorical relationships that determine how an Observer samples are invariant i.e. entropy inequalities, functor composition, conservation laws



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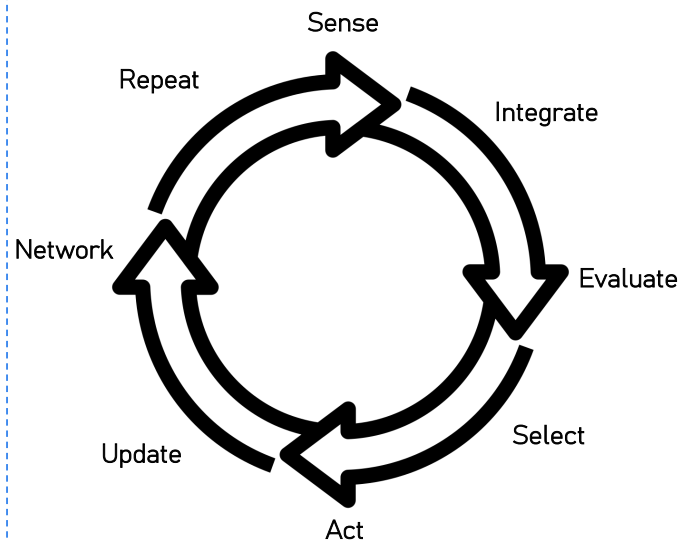
# What's an Observer?

- An **Observer** is any subsystem doing computations inside a **persistent boundary**
- This includes anything from simple molecules to complex minds – **not just humans**
- **Function**: Observers **sample information** from a possibility space / latent space (here, the Ruliad) and update their internal state and output an action. Because they have limited computational resources, each Observer “carves out” a specific “slice” that becomes its experienced reality
- **Coarse-Graining**: Due to **computational boundedness** and **persistence** (finite memory, time, power), Observers necessarily coarse-grain an infinite computational possibility space into a manageable ‘reality’
  - They only see patterns (like pixels in a photo) rather than full detail
- **Analogy**: An Observer is like a lens or filter
  - Each one “sees” a simplified version of the Ruliad based on its limits and its determination of **Relevance**



# The Observer 'Loop'

Claim: Every Observer – from atoms to humans to civilisations – implements an identical loop



In the Arsiwalla formalism, the Observer is modelled as

State space  $X$  (internal states)  
Input space  $Y$  (sensors)  
Output space  $Z$  (actions)  
Transition function  $f: X \times Y \rightarrow X$   
Output function  $g: X \rightarrow Z$   
Boundary  $B$  separating "inside" from "outside"

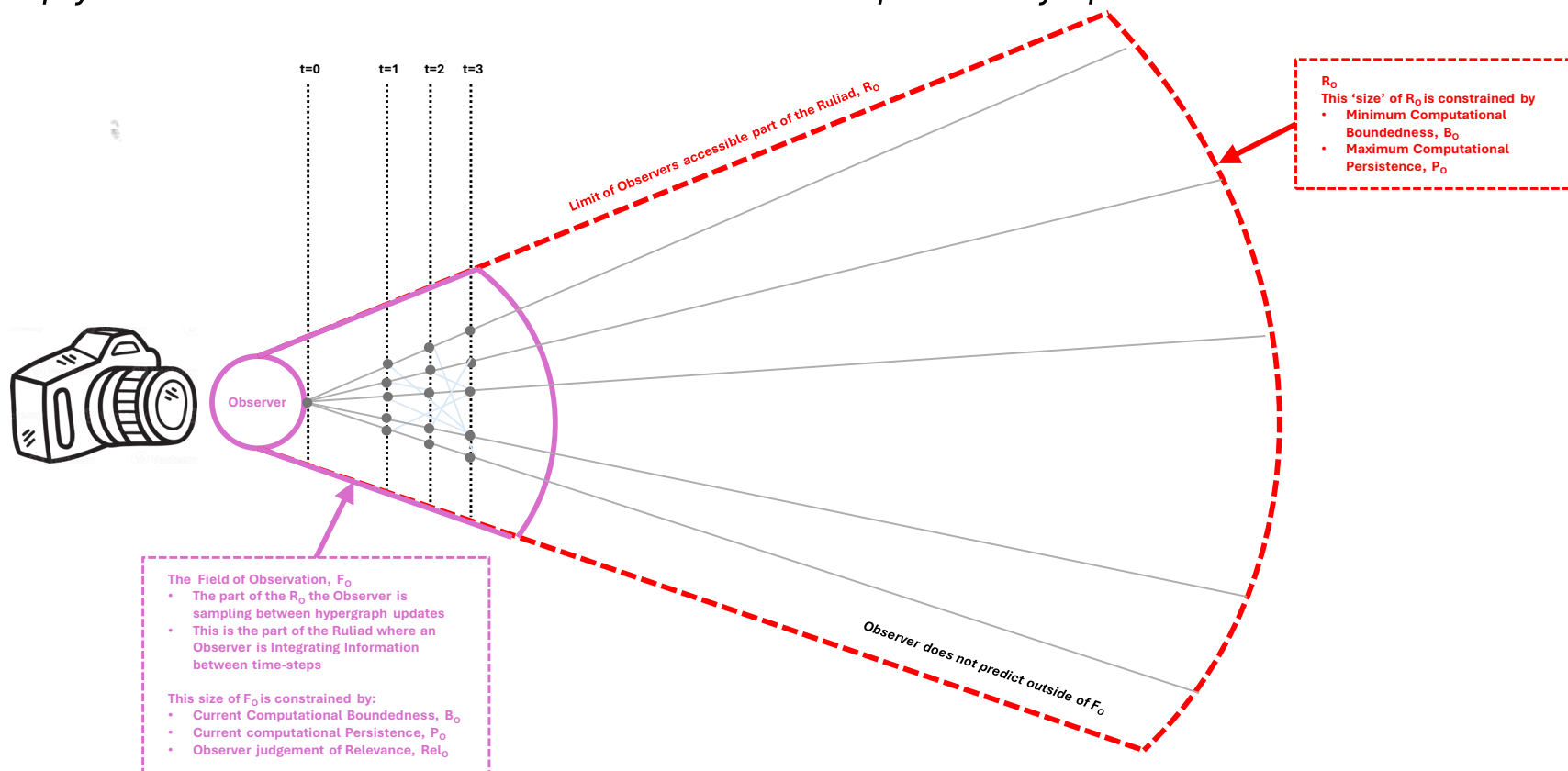
Mapping these back:

1. **SENSE** – restrict Ruliad  $R$  to relevant inputs in  $Y$
2. **INTEGRATE** – update internal state  $X$  and compress inputs into a coherent model
3. **EVALUATE** – compute predicted value/utility of possible actions
4. **SELECT** – choose an action according to an internal objective function (telos)
5. **ACT** – apply  $g(x)$ , changing the environment and future inputs
6. **UPDATE** – adjust model from prediction errors (learning)
7. **NETWORK** – exchange information with other Observers
8. **REPEAT** – iterate through time



# The 'Field' of Observation $F_O$

*Observer internal models set the limit for  $R_O$ . For Observers like us, different belief systems imply different 'sizes' or limits of their accessible possibility space*



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# Cross-Domain Causation & Topological Closure

- **Cross-Domain Causation:** Causation is state transitions in the Ruliad. A “mental” state and a “physical” state are part of the same overall structure. This can be mapped via functors enabling us to model [top-down](#) and [bottom-up](#) causation without breaking physics
- **Formal vs. Efficient Cause:** We distinguish [formal causation](#) (patterns restricting lower-level outcomes) and [efficient causation](#) (lower-level changes inducing higher-level effects) as morphisms with increasing or decreasing rule constraint
- **Infinite Regress:** In naive models, “who observes the observer” leads to infinite regress. Here this is resolved by introducing True Infinity (TI) as a terminal object in the category of  $R_0$ . Every object **X** has a unique morphism to **TI**. Intuitively, **TI** is an unobservable “ultimate observer” (an omniscient viewpoint) that closes the loop
- **Outcome:** With **TI**, the hierarchy bottoms out. It provides topological closure (in an  $\infty$ -groupoid) that enables the Ruliad to generate geometry, math and eventually, our physics



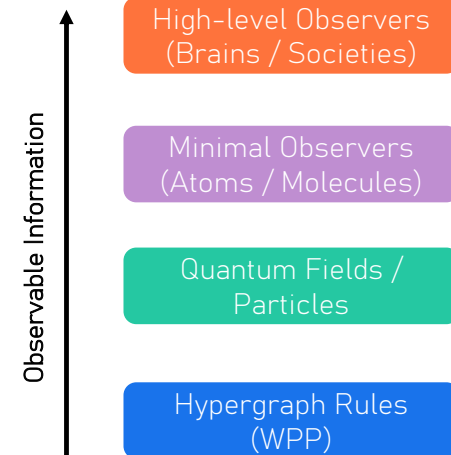


IMPLICATIONS – PHYSICS

# Observers All the Way Down

- We now zoom back to physics and ask: [what does this add to the Platonic Space / Latent Space picture?](#)
- Three main moves:
  - [Minimal Observers](#): Treat simple physical systems as minimal Observers with genuine—though primitive—observation loops
  - [Symmetries & Computation](#): Read physical symmetries as constraints on what Observers can reliably sample and compress
  - [Fields as Computational Ground](#): Interpret quantum fields as the “substrate” on which observer-relevant patterns are ‘carved out’
- This section is **not** a new physics theory; it's a reinterpretation that:
  - Connects Observer constraints to the emergence of complexity
  - Offers a route from WPP hypergraphs → category-theoretic observers → human superstructures (politics / economics / theology / sociology)
- We'll start with a contentious question

*Can an atom really qualify as an Observer?*



# Can an Atom really be an Observer?

| Property  | Hydrogen Atom  | Claim  |
|---|--|--|
| 1 Non-trivial <b>sensing</b> – it couples to external variables | Absorbs photons, 'feels' fields, collides                                    | Trivial Observation <b>not conscious but satisfies criteria</b> for a minimal Observer in a computational universe |
| 2 Non-trivial <b>internal state</b> – it can store information  | Internal quantum state (spin, ground vs. excited)                            |  |
| 3 Non-trivial <b>action</b> – it can affect its environment     | Emits photons, dipole movements, ionisation                                  | First rung on an Observer hierarchy (climbing information gradients towards black-hole limit)                      |
| 4 A clear <b>boundary</b> between "inside" and "outside"        | Bohr radius, binding energy to define 'inside' vs. 'outside'                 | Crucial as we can talk about <b>Observer Constraints</b> at <b>almost every</b> scale of physics                   |
| 5 A <b>feedback</b> loop: its actions change its future input   | Emitted photon alter neighbouring atoms, changes future environment for atom |  |



# Symmetry Breaking as Information Explosion

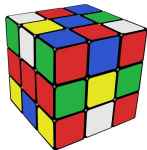
## Breaking symmetry increases the Observer's distinguishable state-space

- If perfect symmetry gives you only **one** distinguishable state, then breaking symmetry creates **many** distinct states an Observer can tell apart
  - Initial condition:  $R_0 \approx 1$  equivalence class
  - Post symmetry-breaking:  $|R_0|$  grows explosively as more branches become distinguishable
  - Let  $G$  = Initial Symmetry Group,  $H \subset G$  = residual subgroup, number of distinct 'patterns' accessible to Observer scales like the coset space of  $|G/H|$

### Analogy



1 configuration, high symmetry



$4.3 \times 10^{19}$  configurations. More potential structures **because** symmetry broken

### Ruliad Mapping

Symmetry breaking in  $R >$  Observer 'picks' particular branches  $>$  more fine-grained equivalence classes in  $R_0$

### Parallels in Ancient Traditions

"From the One to the Many" is more than mythic language; it's an intuitive description, in the language of the time, of how computation, observation and symmetries produce structured universes



# Does Observer Theory Predict Differently?

Key Point: Not re-labelling other theories; makes distinctive predictions

| Domain >>>                | Many-Worlds   | Copenhagen  | Materialism   | Idealism   |
|---------------------------|---|---|---|--|
| What it says              | All branches equally real; no preferred selection   | Measurement "collapses" wavefunction as primitive postulate   | Consciousness arises whenever there's sufficiently complex computation; no special role   | Physical world is derivative of mind; "mental stuff" primary   |
| What Observer Theory says | Observers <b>select</b> branches in a <b>computationally efficient</b> way; branch weights <b>track information-integration telos</b> (gradient-like), not just amplitude | "Collapse" is emergent description of observer-bounded sampling; <b>no ontic collapse, only constraints</b> | Consciousness requires a <b>threshold of integrated information across all Observable domains</b> ; not all computation / observation qualifies | Both "mind" and "matter" are <b>perspectival slices</b> of the same computational structure – information is fundamental, not it's instantiation |





IMPLICATIONS – EVOLUTION

# Evolution is Informational

*Evolution is powerful because it's 'surfing' pre-existing information gradients*

## Standard Story

- Evolution by natural selection explains complexity via variation, inheritance, and differential survival
- **But: No free lunch theorem!** *Implies evolution operating on special, highly structured class of problem i.e. pre-shaped informational landscape*

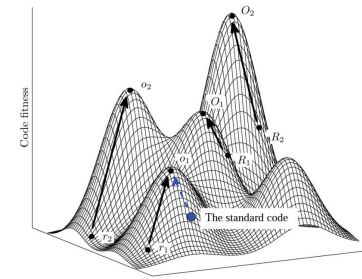
## Observer Theory

Evolutionary Biology

+

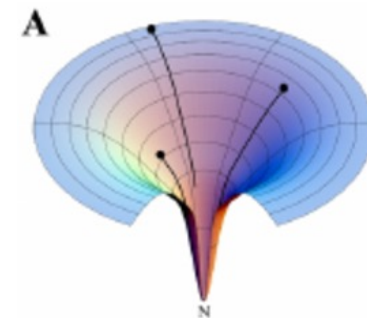
Informational Layer

- Evolution only works because the landscape is **informationally structured**
- **Demski-Marks:** Information to make search efficient **must** come from somewhere – *here, fine-tuned physics, chemistry and boundary conditions*



*All possible  
problems  
(No Free Lunch)*

Embedded Information in  
Physics / Chemistry



*Biological  
Evolution's  
actual  
landscape?*



# Evolution is Informational

*"Where's your evidence?" screamed Dawkins...*

## Fine-tuning

Physical Constants appear "just right"

*Observer Theory argues this the most computationally efficient 'region' of possibility space containing rich attractor structures for Observers! (like Leibniz 'BOAPW')*

## Convergent Evolution

Independent discovery of similar solutions

*Bats / Dolphins (echolocation)*

*Repeated protein motifs*

Specific regions of computational possibility space are rich with strong attractors

## Interpretation

Evolution isn't a blind watchmaker  
*constrained search guided by*

Physical Law

Pre-structured chemical spaces

Environmental Information



'Architecture' of Ruliad itself

## Implications

Survival and reproduction are instrumental

*(for computational persistence of Observers)*

BUT

Deeper goal is to explore and integrate information as efficiently as possible

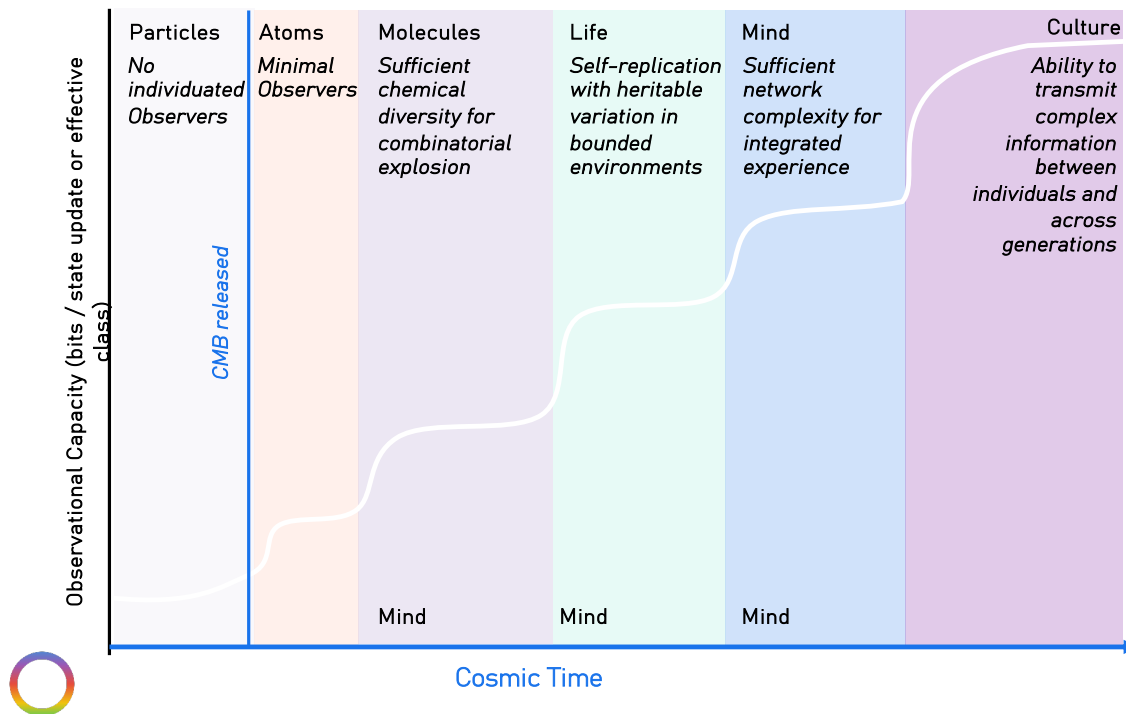




# Observer Scales

*Observer Scales  $\approx$  "How much of the possibility space a given Observer can sample and integrate information about"*

*Note: Time Periods are inaccurate – drawing sigmoid curves with a mouse is not fun!*



## Scale

## Observation Mechanisms

Molecules

- Conformal Scanning
- Vibrational Spectroscopy
- Reactivity
- Bonding Networks

Life (basic)

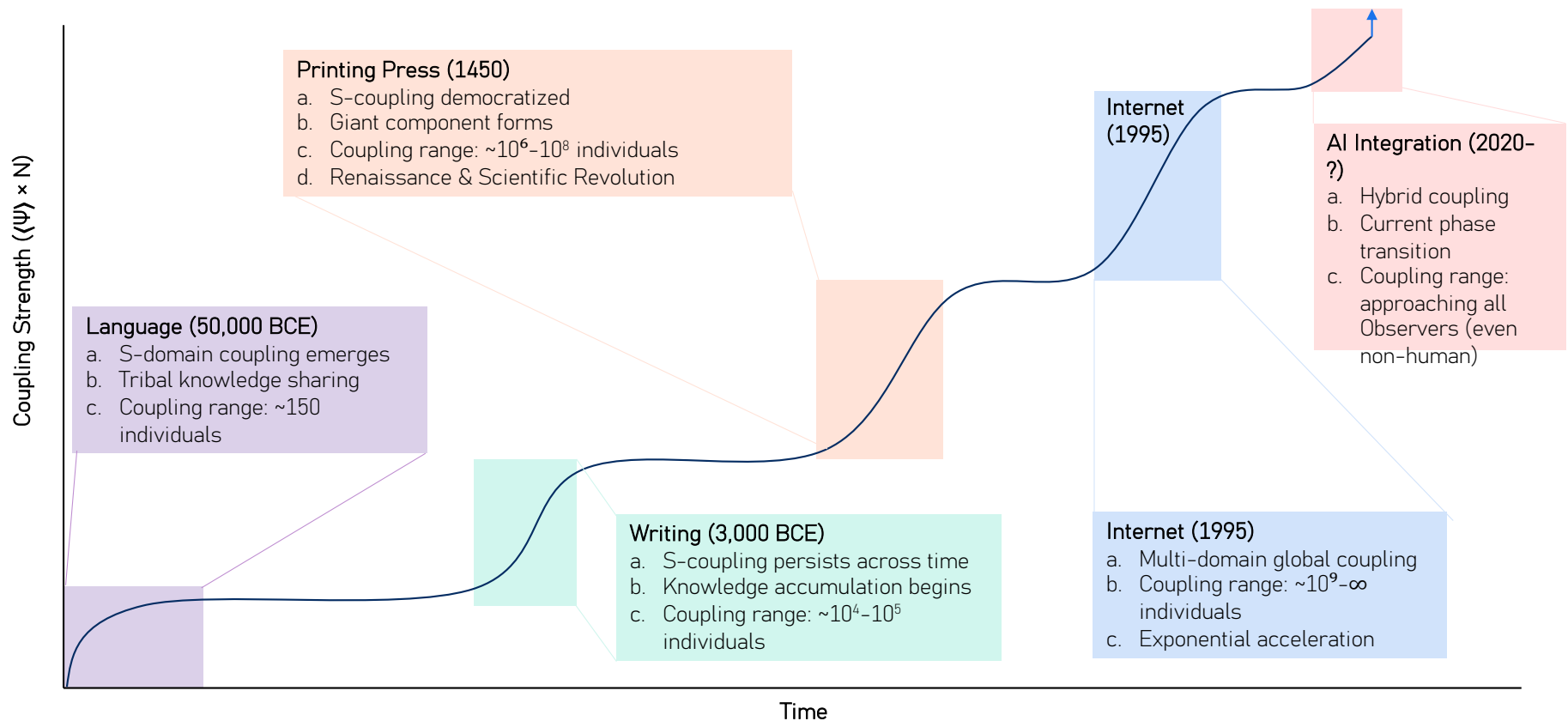
- Chemotaxis: Detect chemical gradients (e.g. toward food)
- Quorum sensing
- Gap junctions (multicellular)

Mind

- Neurons as specialised apparatus
- Network topology (clustering / path length)
- Plasticity (LT Potentiation / LT Depression)

# How have Observers Like Us Coupled Through History?

*Each transition between different coupling technologies exhibited sudden jump in network capacity, emergence of new Observer capabilities, reorganisation of social structures and an acceleration of the innovation rate*





IMPLICATIONS – TELOS

# From Observational Complexity to Universal Telos

We've seen three converging threads:

- **Physics:** Symmetry breaking, quantum fields and Planck limits define a **structured, bounded observable universe**
- **Evolution:** Biological and cultural evolution ride pre-existing informational gradients, building increasingly powerful observers
- **Observers:** Complexity and phase transitions track how much and how deeply Observers can probe our universe / reality

This suggests something quite provocative:

- Reality / universe's story is one of information integration at all scales
- Observers are how this happens

Now let's make this precise:

- What is **Universal Telos**?
- How do we formalise **information gradients** and **hierarchies** in the Ruliad?
- How does this connect to consciousness, meaning, and ethics?



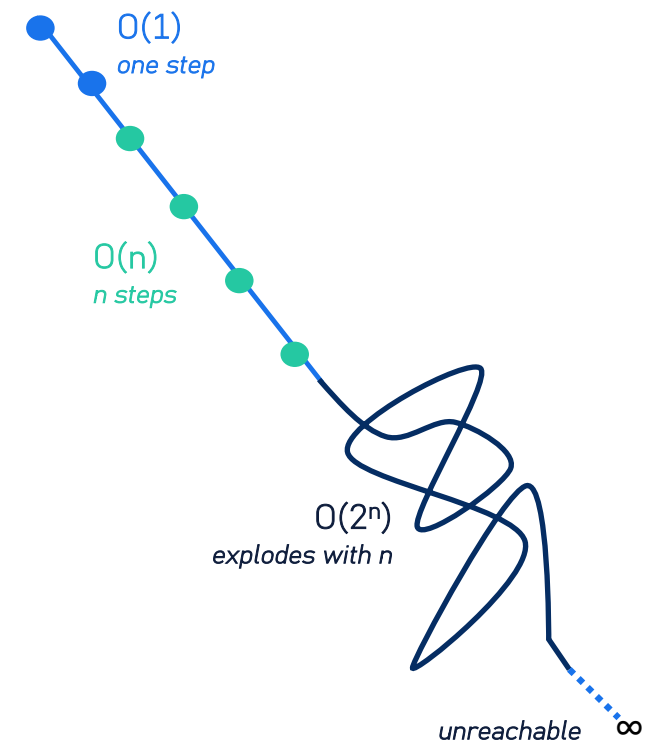
Three Stories, One Gradient?  
*Toward maximal information integrated via  
Observation*



# Computational Complexity Primer

## *Connecting this to the Ruliad*

- Here complexity measures how far an Observer must 'travel' in the Ruliad to reach a piece of information
  - $O(1)$  – information is directly accessible from your current state
  - $O(n)$  – information is  $n$  "hypergraph updates" away
  - $O(n^2)$  – needs exploring a 2D region (random walk / diffusion)
  - $O(2^n)$  – full multiway explosion: information is buried in an exponential branching of possibilities
  - $O(\infty)$  – fundamentally unreachable by bounded Observers
- Ruliad framing
  - Let the Ruliad be a hypergraph of states and rules
  - Complexity measures length and structure of morphism chains you must traverse to "find" a desired state

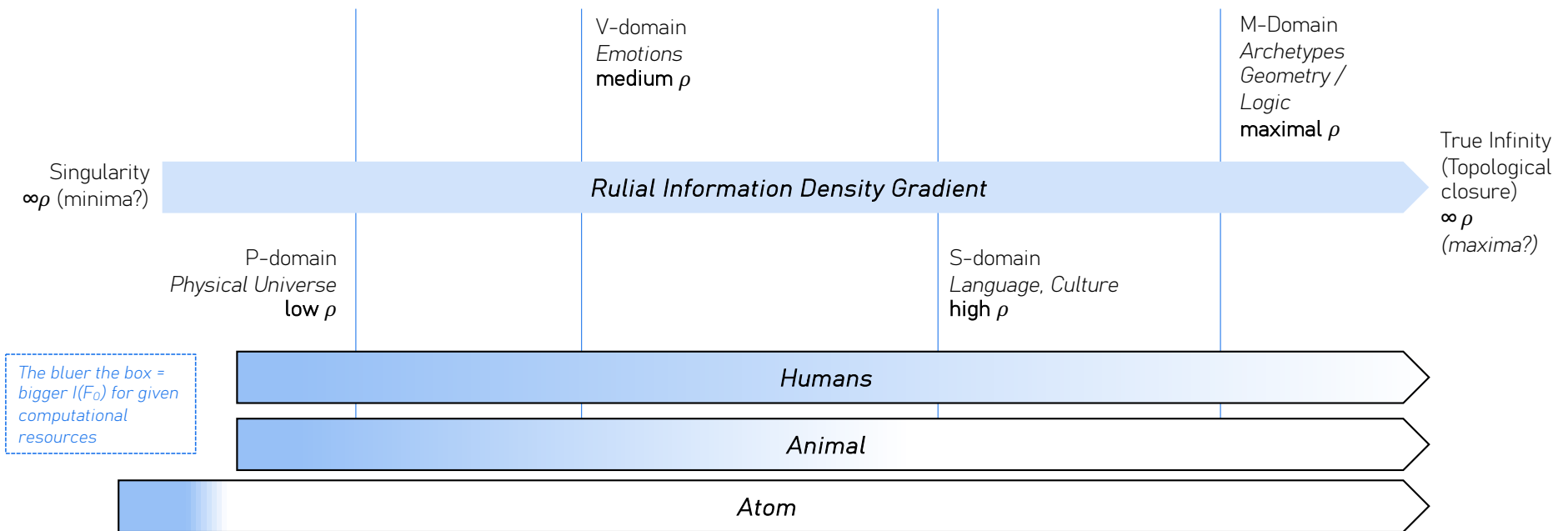


Given limited resources, which paths should Observers invest in?  
Which strategies **minimise** cost per bit of **useful** information gained?

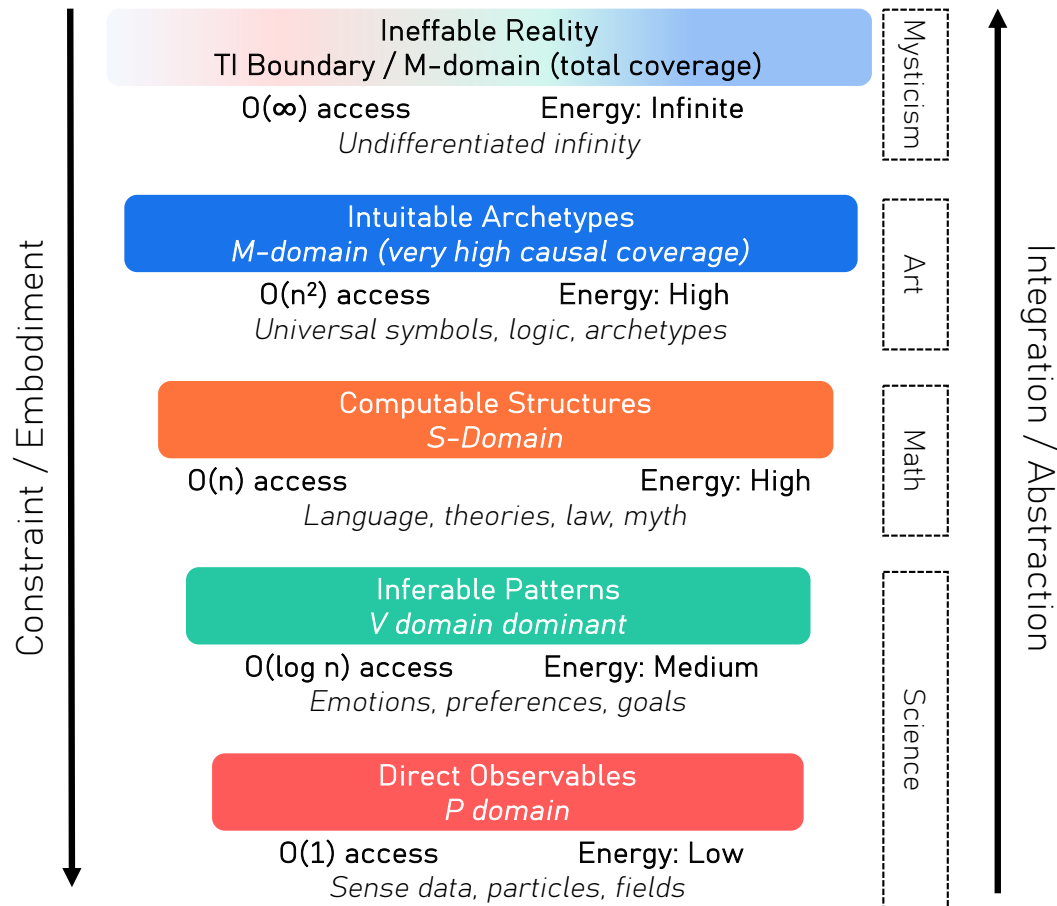
# Information Gradients in the Ruliad

Note that Information Density,  $\rho$ , is an Observer relative measure!

CLAIM: The Ruliad is not a 'flat' topos. It has information gradients from low to high density



# Informational Hierarchies



## Hierarchy Properties

- 1 Higher domains contain and constrain lower ones
  - A pre-image of the lower domain exists in the higher domain (nested hierarchy)
- 2 Observers move integrated information upwards

*raw data → value-laden meaning → abstract insight*

- 3 Ancient traditions intuited this hierarchy, they function as a 'limit-setting' device to maximise size of  $R_0$  (the Observable possibility space)
  - Kabbalah's four worlds
  - Hindu koshas
  - Platonic forms vs. matter

*Different languages but same structure*



# Information Integration as Universal Telos

Core conjecture: All Observers share the same fundamental telos

Maximise integrated information  $I(F_O)$  subject to boundedness  $B_O$  and persistence  $P_O$

- Intuition
  - Observers that integrate more useful information predict better, survive longer, and spawn more observers
  - Survival and reproduction are instrumental; information integration is the deeper optimisation
- This aligns with
  - Biology: organisms that sense, integrate, and respond better outcompete others
  - Culture: societies that compress and share knowledge thrive
  - Spirituality: traditions that guide attention toward deep structures persist

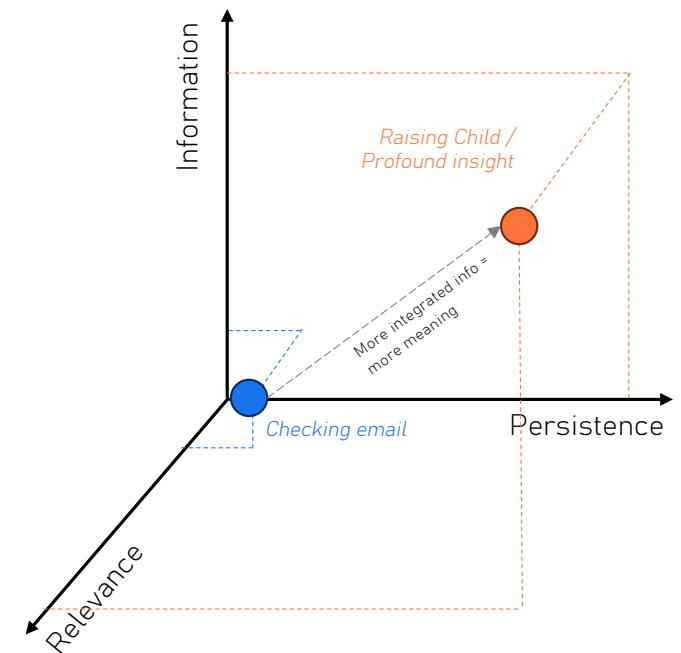
Allows definition of meaning as a 'computable-ish' quantity

Meaning  $\approx$  integral over:

*Total information content from an Observation (how much is encoded)*

*Observer relevance (how much it matters to internal model)*

*Temporal persistence (how long it has utility)*





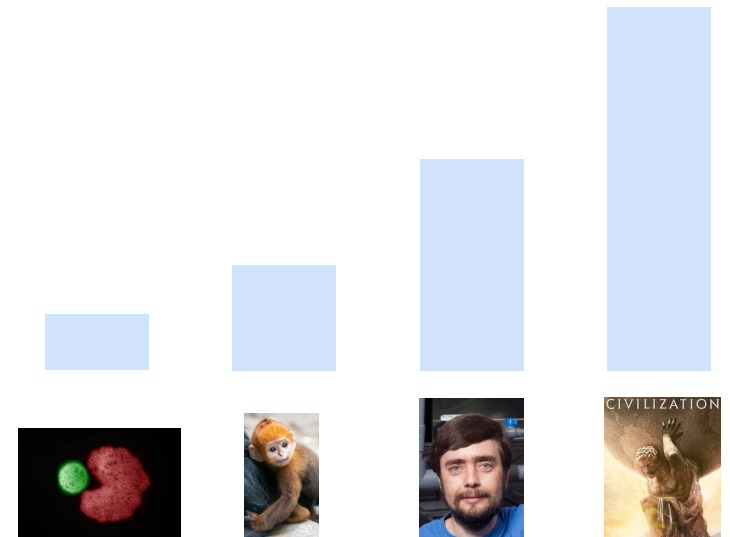
# Initial Empirical Support for Telos

- Biology: Nervous systems, sensory organs, memory systems all increase  $I(F_0)$  per unit energy
- Culture: Writing, science, and digital tech serve primarily to externalise, compress and share information at lower cost
- Levin's experiments
  - Xenobots, regenerative morphogenesis, and non-neural cognition show telos-like behaviour wherever there is capacity to store and process information
- Ruliad / Observer perspective
  - Systems that don't integrate information die out to entropy (lose boundary)
  - Systems that do become more complex Observers that have more causal influence
  - Consistent with Darwinian selection, No Free Lunch constraints and observed acceleration of complexity through time



## Information Integration Capacity

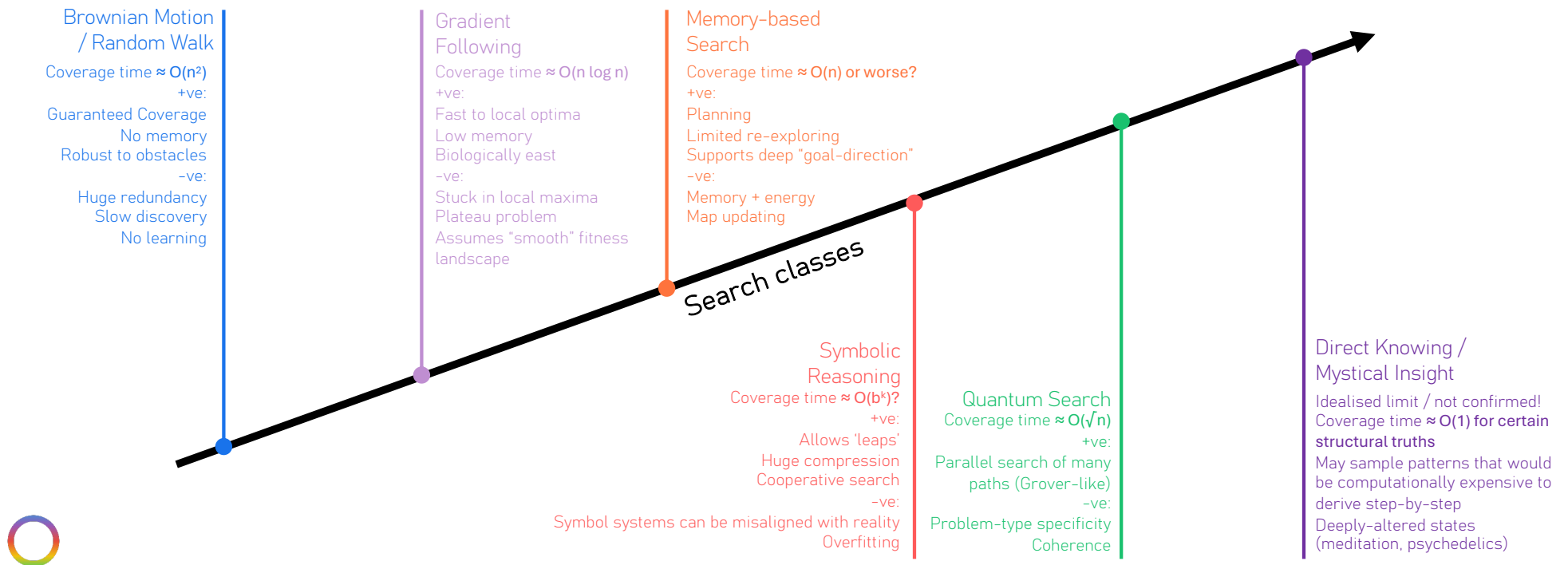
Evolution / Cultural time → Increasing  $I(F_0)$



# The Efficient Search Conjecture

Observers (at every scale) evolve optimal strategies for exploring computational possibility space given their constraints

- Strategies get more **complex** and **sophisticated**, balancing **exploration** (finding new information) and **exploitation** (using compressed / computationally reduced knowledge)



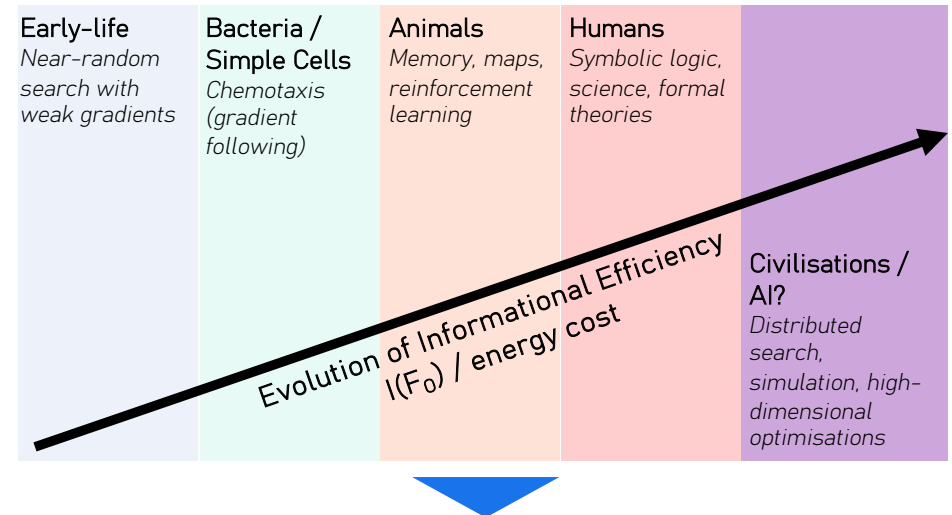
# Evolution of Informational Efficiency

## Cost per bit: Why Efficient Search is Better

| Search Strategy    | Qualitative Summary  |
|--------------------|--|
| Random Walk        | High-time, low memory, awful energy efficiency             |
| Gradient Following | Good locally, stalls in complex landscapes                 |
| Memory-based       | Higher one-off costs, cheap reuse of successful strategies |
| Symbolic           | Huge upfront cost, massive long-term efficiency gains      |
| Quantum            | Limit efficiency for certain classes of problems           |
| Direct Knowing?    | Perfect efficiency for ultra-narrow set of problems?       |

Observers that can pay the upfront cost gain huge long-term advantages in integrating information

Selection favours architectures implementing more efficient strategies



Trajectory is universal

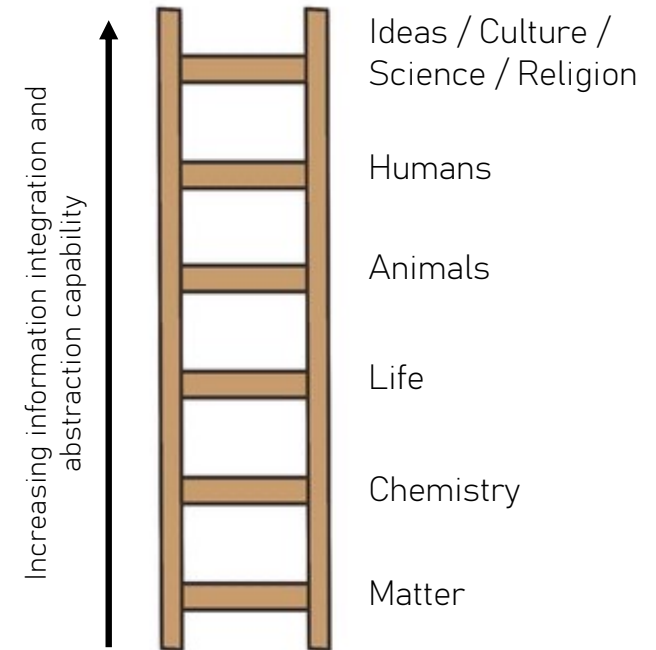
Survival is derivative optimisation: required so that info integration continues



IMPLICATIONS – HOW DO IDEAS INGRESS?

# Introduction: Ideas as Superstructures

- So far, we've explored
  - Reality as a **computational possibility space** (the Ruliad)
  - Observers as **bounded samplers** navigating information gradients
  - A **Universal Telos**: maximise integrated information per unit cost
- Now we move to the next layer
  - **Ideas** as superstructures that ride on top of sufficiently complex Observers
  - Ideas represent a **phase transition** in how information is organised and integrated
- Central question
  - If the universe is computational and telic, **what role do ideas play in shaping reality?**

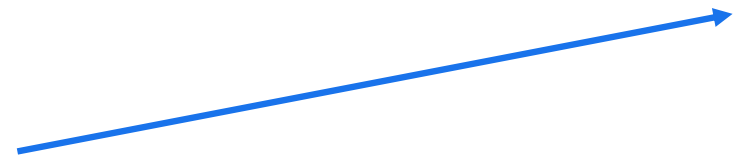


# Ideas as Persistent Information Patterns

Definition: Ideas / Memes are information patterns that achieve autonomous existence by replicating between minds (Dawkins-like “mind-viruses”)

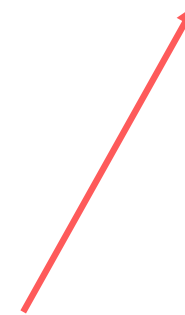
- Ideas / Memes are not the same as genes
  - Genes are tied to **biological lineages** and reproduction
  - Ideas can jump across species, across substrates (brains ↔ books ↔ silicon) and across cultures and epochs
- Phase transition
  - Once you have Observers that can symbolise and communicate, you get a **new landscape for evolution**
  - Not just organisms evolving, but **ideas / memes evolving within and between Observers**
- Memetic speed is much, much faster
  - Genetic evolution: generations → decades
  - Memetic evolution: social media → hours

Genes



Slow – millions of years / thousands of generations

Memes



Fast – years (books) → days (letters) → hours (email) → seconds (social media)



# The Formal Structure of an Idea

## The Memetic Tuple

Idea = (Pattern, Replication Rules, Fitness Function, Mutation Rate)

Components:

- **Pattern:** Core integrated information structure *e.g. the concept "survival of the fittest"*
- **Replication Rules:** How it spreads and sticks for Observers like us
  - **V-domain:** emotional resonance (fear, hope, curiosity)
  - **S/M-domain:** cognitive fit (is it easy to understand, remember, teach?)
  - **P-domain:** pragmatic utility (does it help achieve goals?)
  - **All domains:** coherence (status, conformity to Observer's causal graph)
- **Fitness Function:** How effectively it replicates under given conditions
$$\text{Virality} \propto \frac{\text{causal influence}}{\text{computational cost}}$$
- **Mutation Rate:** How much the idea changes with each transmission

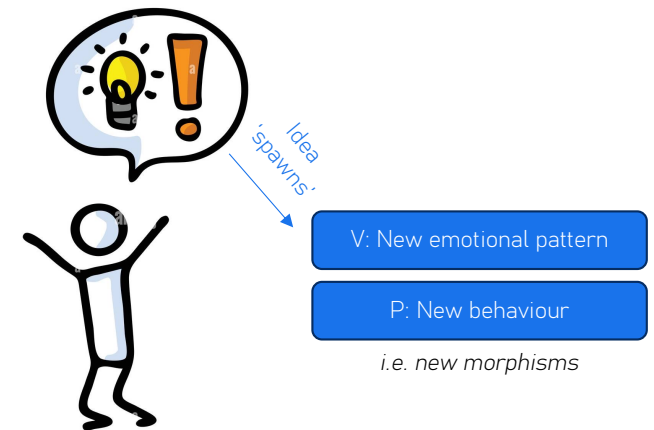


## Ruliad Context

Ideas are structured as objects in the **S-domain** that can be copied between Observers

**Special Features:**

- Includes its own replication rules – like code that contains installer + updater



Creates **new evolutionary arena** where **ideas compete for attention and memory** ( $B_0$ ). Form **stable attractors** in **S-domain**, analogous to biological niches

# Ideas Shaping Reality

## How Ideas Reshape Lower Domains

Claim: Ideas not epiphenomenal – they shape what becomes real in less information dense (lower) domains

- Example mechanisms:

- 1 Physical Embodiment: Beliefs change brain states → change hormones & behaviour

*Example: Placebo effect → endogenous opioid release*

- 2 Epigenetic effects: Chronic stress altering gene patterns / meditation

- 3 Social organisation: Shared ideas create norms, laws, institutions

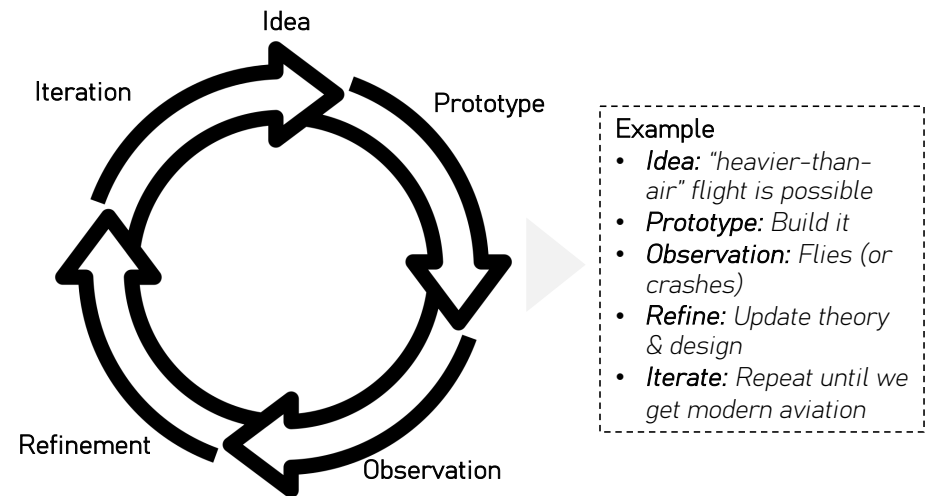
*Example: "Fiat Money" pure S-domain structure that moves trillions of P-domain dollars*



S-domain structures constrain which V / P domain morphisms ever get explored

*"You can't build a rocket without the physics of rocketry"*

## The Feedback Loop: Ideas Shape Reality, Reality Shapes Ideas



Each 'loop' deepens the idea's **computational persistence** (more **equivalences** and **embeddings** in possibility space)

Makes **paradigm shifts** cost massive energy – overwriting entire classes of computationally reduced (efficient) models





# The Evolution of Ideas

| Memetic Selection Pressure |                     | Example   | Claim  |
|----------------------------|---------------------|---|--|
| 1                          | Explanatory Power   | Germ theory beating Miasma theory – more predictive                                   | Ideas that compress regularities more efficiently (i.e. more computationally reducible) are more useful                      |
| 2                          | Emotional Resonance | Hero's Journey 'sticky' as mirrors all Observers lived experience                     | Ideas that activate emotions are more memorable as they 'touch' more points in the Observers causal graph                    |
| 3                          | Social Utility      | "Don't Murder" enables societal stability (timeless / placeless)                      | Ideas that solve coordination problems spread widely (lower global information integration cost!)                            |
| 4                          | Practical Utility   | Scientific ideas that enable more Observation (electricity / antibiotics)             | Ideas with repeatable tangible benefits to Observer function gain wide adoption  |
| 5                          | Simplicity          | "An eye for an eye" persistent because everyone gets it – not everyone 'gets' the law | Simple ideas spread faster but are subject to more distributed interpretations based on Observer's variable causal histories |

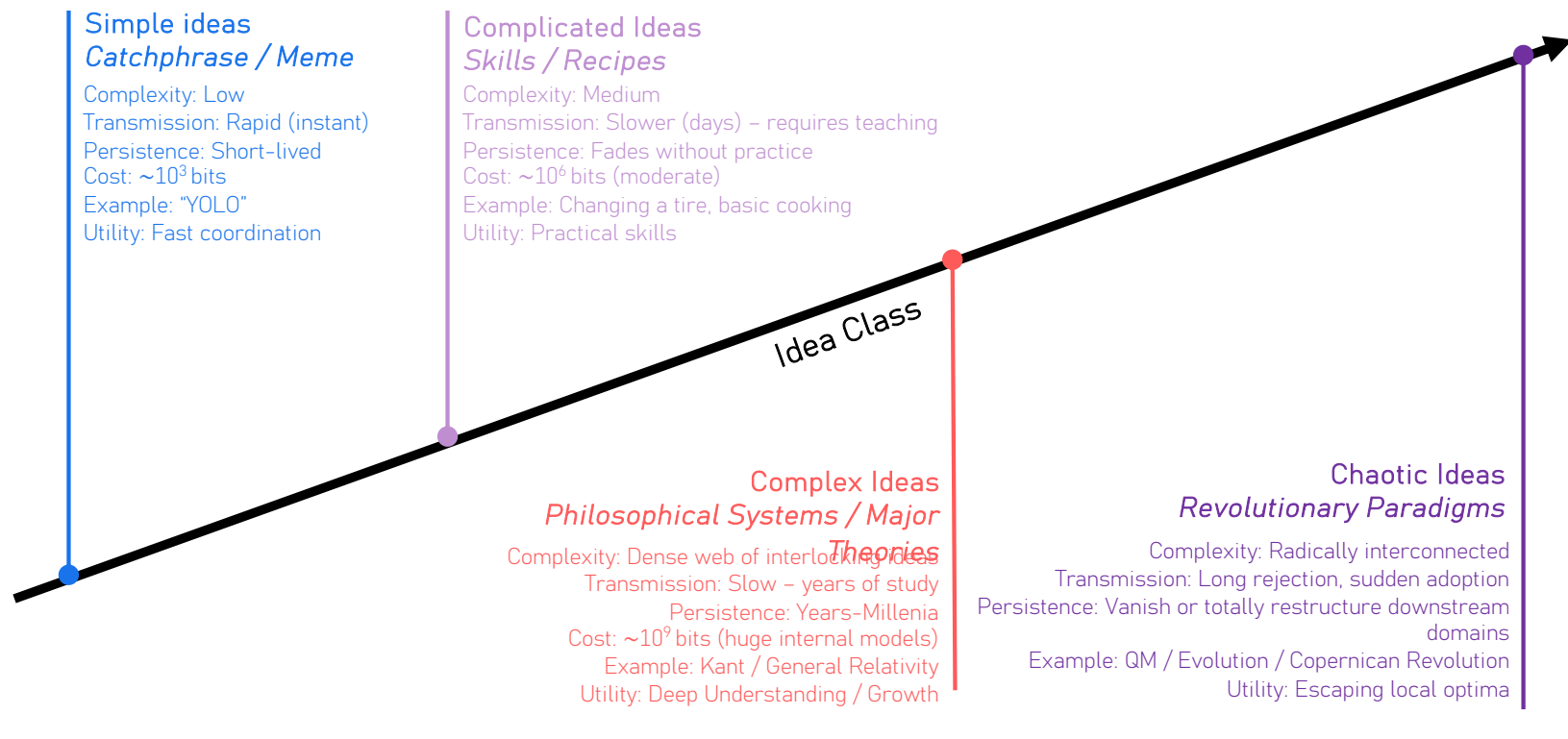


High-fitness ideas compress regularities and integrate information across Observer accessible domains (P, V, S, M)

# The Computational Cost of Ideas

Conjecture: Different types of ideas have radically different computational burdens for Observers like us

- Ideas are categorised by **complexity** class, **transmission** and **persistence**



# How do Ideas Interact with Meaning?

## Meaning as a Function

$$I(F_O) \text{ for } x \approx \int I_O(x, n) \cdot Rel_O(x, n) \cdot P_O(x, n) d\mu(O, x, n)$$

- $I_O(x, n)$  = Information content of Observation  $x$  at state  $n$  for Observer  $O$
- $Rel_O(x, o, n)$  = Relevance to Observer  $O$ 's telos (optimisation function) at state  $n$
- $P_O(x, n)$  = Persistence (probability weighting of how many computational updates it survives, i.e. temporal half-life)
- Integration to approximate this over all Observers  $O$ , all time  $t$ , and all possible observations  $x$  (across the entire accessible Topos,  $F_O$  to the limit of  $R_O$ )

## Plain English

Structure,  
pattern, non-  
noise

How much it  
matters to  
goals and  
survival

Whether it  
endures  
(minutes vs.  
centuries)

Integral

High Meaning = lots of info, highly relevant, long-lived

Zero Meaning: High info but no structure or relevance (pure noise)





IMPLICATIONS – COMPUTATIONAL ETHICS

# The Home Stretch



- So far, we've argued
  - Reality, for Observers, is only parseable computationally, and The Ruliad is computations limit object!
  - Observers are **bounded samplers** with **Universal Telos**: *maximise integrated information (as quick as they can)*
  - Ideas and cultural systems form **formal causation superstructures** that shape what Observers can do
- This raises an unavoidable question

*If the universe is structured and telic in this way, what does it imply about ethics?*

- The claims
  - Morality **isn't invented**, it's **discovered**
  - Ethical behaviour = **mathematically optimal** behaviour exploring 'fastest' **information gradients** for the most Observers
  - Virtue and sin are about **information integration vs informational entropy** for self-referential Observers (us!)
  - *Ethics emerge when we ask: which sequences of morphisms are "good" or "bad"*

*Globally, entropy still increases. Locally, Observers create negentropy i.e. life, knowledge, stable societies*

Ethics is ultimately the study of:

1. Which choices **maximise information integration per unit entropy**?
2. Which choices 'throw information away' and **accelerate disorder**?



# Choice as Computational Optimisation

Definition: [Path Cost Function](#)

- For a path  $\gamma$  through the Ruliad from state  $s_1$  to  $s_2$ , the total cost is:

$$\text{Cost}(\gamma) = \sum_{i=1}^n \text{comp}_{\text{steps}}(\gamma_i) + \lambda \cdot H(\gamma) + \mu \cdot \text{Distance}(\gamma, TI) + \nu \cdot N(\gamma)$$

where:

- $\text{comp}_{\text{steps}}$  = computational effort
- $\Delta H$  = entropy generated
- $N$  = network effects on other observers
- $D_{TI}$  = distance to True Infinity (convergence)
- $\lambda, \mu, \nu, \rho$  are weights

**Analogy:** Like Google Maps computing the best route: doesn't just minimise distance; balances time, traffic, tolls and your destination

For Intuition:

| Cost Function Variable                 | Example 1: Helping a Stranger feels Good    | Example 2: Lying to Avoid Confrontation feels Bad                             |
|--|---|---|
| $\text{comp}_{\text{steps}}(\gamma_i)$ | Low<br><i>small effort</i>                  | Low initially<br><i>avoid hard conversation</i>                               |
| $H(\gamma)$                            | Low<br><i>trivial disorder created</i>      | High<br><i>must maintain consistency / remember lie</i>                       |
| $D(\gamma, TI)$                        | Decreases<br><i>positive network effect</i> | Increases<br><i>divergence in Observer world models and sampling functors</i> |
| $N(\gamma)$                            | Positive<br><i>gain to other Observers</i>  | Negative<br><i>entropic cascade if revealed</i>                               |
| $\text{Cost}(\gamma)$                  | Low - Chosen                                | High - Avoided<br><i>hence guilty feeling</i>                                 |



# Ethical Behaviour = Optimal Path

## Selection

*Or... The Mathematics of Good & Evil*

### Formal statement (simplified)

Let  $\gamma_1$  be a virtuous path and  $\gamma_2$  a sinful path from your current state to TI / convergence / completion of all possible computations

Then:

- $\text{Cost}(\gamma_1) < \text{Cost}(\gamma_2)$
- $I(F_0)\gamma_1 > I(F_0)\gamma_2$
- $H(\gamma_1) < H(\gamma_2)$
- $T(\gamma_1) < T(\gamma_2)$  (reaches convergence faster)

This falls out of:

- The structure of  $R_0$
- The Observer Loop
- The Telos of climbing information gradients (from less dense to more)

Virtue,  $\gamma_1$

= paths that **maximise information integration** and **minimise entropy** and **speed up convergence**

Sin,  $\gamma_2$

= paths that **waste information**, generate **excess entropy** and **slow convergence**



# Computational 'Debt'

Not all choices Observers make are equal.

Some choices create "computational debt", they appear optimal in the short-term, due to computational boundedness and computational irreducibility, but requires extensive additional computation to integrate coherently later

## Definition: Computational Debt

- For choice / action  $\gamma$  made at time  $t$ , the approximate computational debt is:

$$Debt(\gamma, t_0) \approx \int_t^{\infty} [Cost_{actual}(\gamma, t) - Cost_{optimal}(\gamma, t)] dt$$

Where:

- $Cost_{actual}(\gamma, t)$** : Ongoing computational cost of actual choice / action,  $\gamma$  at time,  $t$
- $Cost_{optimal}(\gamma)$** : Computational cost that would have been incurred with globally optimal choice / action,  $\gamma$  at time,  $t$

Intuition:

- Computational Debt is the extra computation needed to maintain a sub-optimal pattern (e.g. lie, addiction, even bad code!) or correct it later (tell the truth, fix the bug!)
- Trade off between convenience now vs. additional complexity, entropy and lost chance

## Example: Lying as Computational Debt *Works Short Term but Globally Suboptimal*

At  $t=0$

Truth = high  
emotional cost now

Lie = low cost now

At  $t>0$

No / low future cost

Extra modelling  
*Remembering what you said*

Extra constraints  
*Fewer morphism options*

Extra risk  
*Discovery, network collapse*

Extra energy expenditure  
*Anxiety, monitoring*

Extra computational work that  
could have been spent on  
learning, discovery etc.





# Convergence

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## *Many Traditions, One Optimisation Problem*

- The paper highlights a striking convergence: major ethical systems around the world **approximate the same computational optima**
- Examples from Theology
  - **Buddhism's Eightfold Path** – minimises Observer entropy (right view, speech, action...)
  - **Christianity's "love your neighbour"** – maximises Observer coupling and network integration
  - **Judaism's Noahide Laws** – minimal generating rule set for stable civilisations
  - **Islam's Taqwa** – align personal will with cosmic optimisation
  - **Hindu Dharma, Daoist Wu Wei** – maintain cosmic order and follow least-resistance (low entropy) paths
- Biology Analogy
  - Just as eyes evolved independently many times because vision is useful (captures the most useful information from P-domain)
  - Ethical systems converge because coordination and low entropy are **always useful** in Observer networks

Conclusion: Ethics are not arbitrary cultural scripts; they are local approximations of a universal optimisation problem



# Potential Investigations

*The sketches suggest that we can quantify ethics with information-theoretic measures of Virtue, Sin and Computational Debt*

## Individuals

| Prediction                                   | Evidence  |
|--|---|
| Virtuous behaviour correlates with wellbeing | Gratitude practitioners report higher life satisfaction |
| Sin creates personal suffering               | Lying increases cortisol (quantitative)                 |
| Meditation reduces suffering                 | Meditators reduce DMN activity                          |

## Organisations

| Prediction                               | Evidence                                      |
|--|---|
| High-trust cultures outcompete low-trust | Companies with trust have higher productivity |
| Transparency Wins                        | Open source outperforms proprietary           |
| Rigid hierarches limit bandwidth         | Decentralised Orgs adapt faster               |

## Civilisations

| Prediction  | Evidence  |
|---|---|
| Better error-correction survives longer                 | Autocracy lifespan average c.50yrs vs. 200+yrs for democracy            |
| Information freedom accelerates development             | Open societies outcompete closed (US vs. Russia / Modern West vs. MENA) |
| Universal Education minimises computational boundedness | Literacy rate correlates with GDP, innovation, stability                |

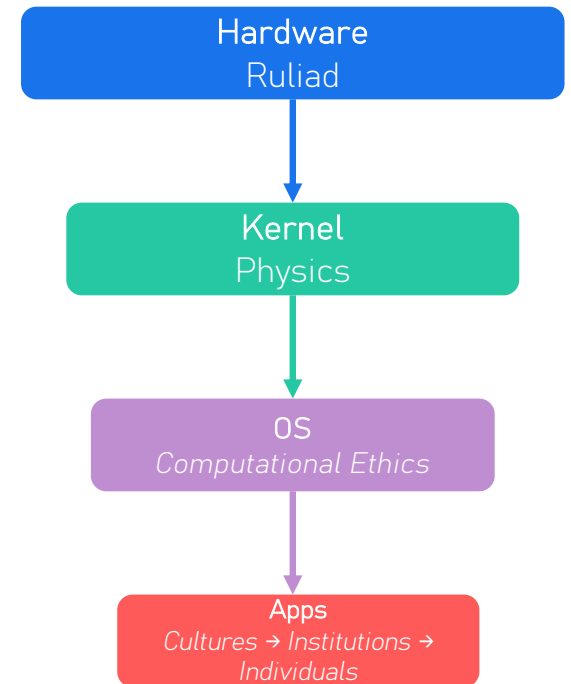
## Species

| Prediction  | Evidence                             |
|---|--------------------------------------|
| Cooperating group outcompete non-competed in iterated games | Eusocial insects / primates / humans |
| Morphospace has attractor basins                            | Convergent Evolution                 |
| Computational constrain innovation sequences                | Kardashev scale / Wright's Law       |



# Ethics are Reality's Operating System

- Every persistent Observer implements the same function / loop
- Ethics = discovery of **optimal trajectories** for that function
- Synthesis
  - **Ethics are structural**, like **mathematics** and **physics** they are not arbitrary preferences or social conventions i.e. postmodernism is wrong
  - **Virtue** corresponds to **minimal cost paths**, **maximal information integration** and **stable networks**
  - **Sin** corresponds to **maximal cost paths**, informational **entropy increasing**, **fragile networks**
- How does Theology come in?
  - The closure point of the Ruliad (the compactifying point at infinity, TI) can be considered to share certain properties that theists attribute to God like **necessity**, **omnipotence** and **omniscience** (in limit)
  - **"Perfect Justice"** = Optimal pattern arrangement (max info, min entropy)
  - **"Perfect Love"** = maximal Observer coupling
  - These correspond to mathematical limits of the Observer's optimisation function

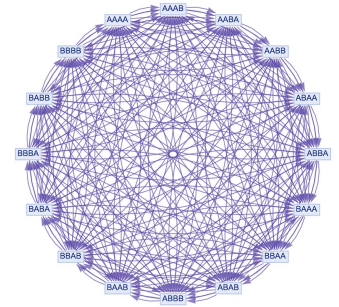




IMPLICATIONS - THEOLOGY

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# Science vs. Meaning



- Two Languages

Science (particles, forces) vs. Meaning (purpose, consciousness, value)

- Historical Divide

- These domains have evolved and progressively siloed since the Copernican Revolution
- Science describes “a measurable, predictable reality” and Religion / Philosophy describe “meaning”
- Disconnection formalised in “Separate Magisteria” i.e. postmodernists lack imagination!

- Computational Bridge

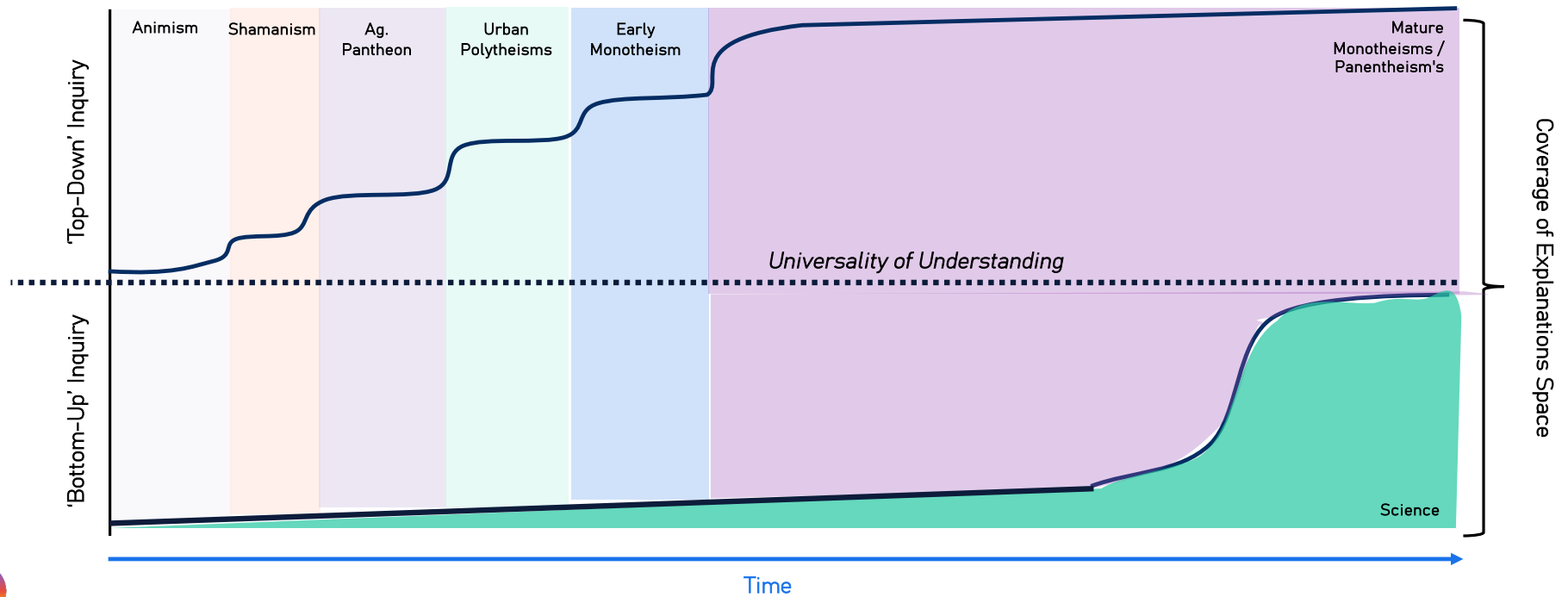
- Ruliad offer a common language to unify these domains under one lingua franca

- **Core Idea:** Observer Theory uses the Ruliad – the “abstract limit of all possible computations” – as a shared canvas to model [a God-concept in a way that is mathematically compatible with computational physics \(at least the Wolfram version of it!\)](#)



# The Epistemological Timeline

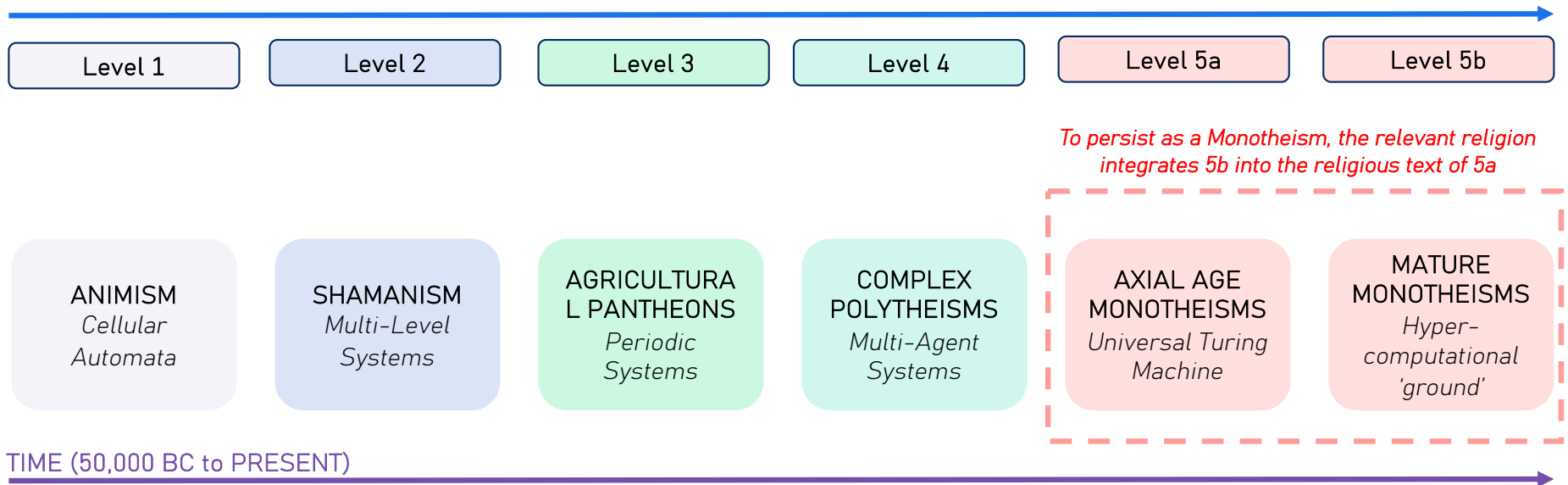
## The Rationalisation of Reality



# How Do Religions Evolve?

*Spiritual Systems “Set the Limit” of  $R_0$  for Observers Like Us*

INCREASING ABSTRACTION / COMPUTATIONAL CAPACITY / ‘SIZE’ of OBSERVABLE RULIAD



Each level INTEGRATES and TRANSCENDS the prior enabling Observers to access larger latent spaces

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# Mapping Theology to Computational Language

| Theology                  | Computational Correspondence  |
|---------------------------|---|
| Necessity                 | Necessary as denying computation exists requires a computation for the denial – contradiction   |
| Divine Simplicity         | Despite containing infinite complexity, Ruliad has extremely simple definition<br><i>“All possible rules, for all possible steps, taken to the limit”</i> |
| Omnipotence               | Can model / generate any possible reality because it contains all generative processes  |
| Omniscience               | Contains all possible logic, information and all computations that could process it   |
| Omnipresence              | Wolfram Physics: Ruliad is 'everywhere' as physical space emerges from Ruliad + Observers   |
| Transcendence / Immanence | The Ruliad transcends any individual Observer's sampling, yet every possible sampling exists within the Ruliad  |





# Mapping Physics to Cosmogenesis

| Physical Event         | Time         | Genesis 'Day'                      | Kabbalistic Stage                    | Vedantic Parallel                | Daoist Parallel                   | Information Transition                  | Symmetry Breaking  |
|------------------------|--------------|------------------------------------|--------------------------------------|----------------------------------|-----------------------------------|---|--|
| Planck Era             | $10^{-43}$ s | "Formless void"<br>(Gen 1:2)       | Tzimtzum                             | Brahman's self-limitation        | Dao becoming nameable             | $I_0: \infty \rightarrow \text{finite}$ | All symmetries unified   |
| Grand Unification      | $10^{-36}$ s | "Let there be light"<br>(Gen 1:3)  | Kav (Ray of light)                   | First vibration (OM/Shabda)      | Primordial Qi emerges             | Unity $\rightarrow$ First distinction   | $SU(5)$ or $SO(10)$ breaks to $SU(3) \times SU(2) \times U(1)$ |
| Cosmic Inflation       | $10^{-32}$ s | Light/Dark separation<br>(Gen 1:4) | Adam Kadmon / MetaObserver emergence | Expansion of Hiranyagarbha       | Yin-Yang differentiation          | Local $\rightarrow$ Global structure    | Space-time symmetry breaking                                   |
| Electroweak Transition | $10^{-12}$ s | Waters above/below<br>(Gen 1:6-7)  | Binah / Chochmah split               | Purusha/Prakriti divide          | Clear/Turbid (Qing/Zhuo) separate | Force differentiation                   | $SU(2) \times U(1) \rightarrow U(1)_{EM}$                      |
| Quark Confinement      | $10^{-6}$ s  | Dry land appears<br>(Gen 1:9)      | Tiferet                              | Five elements (Pancha Mahabhuta) | Five phases emerge                | Matter stabilization                    | Chiral symmetry breaking                                       |
| Nucleosynthesis        | 1-3 min      | Lights in heavens<br>(Gen 1:14)    | Yesod                                | Atomic observation (Pratyaksha)  | Ten thousand things               | Stable atoms form                       | Isospin symmetry accessible                                    |
| Recombination (CMB)    | 380 ky       | Atmosphere clears                  | Malkhut (becomes observable)         | Gross world manifests            | Perceptible realm                 | Photons decouple                        | Universe becomes transparent                                   |
| First Stars            | 100 My       | Living creatures<br>(Gen 1:20-21)  | Light returns (Tikkun begins)        | Life emerges                     | Vitality appears                  | Complex structure                       | Stellar nucleosynthesis  |



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# Synthesis: Spiritual Systems as Search Algorithms

- Ancient traditions spiritual systems act like evolutionary algorithms: they help Observers like us explore ever-larger computational "maps" of reality i.e. the Observable Ruliad,  $R_0$
- Each tradition encodes different strategies for finding more structure / information and maximising their Observers unboundedness and persistence (all their laws!)
- Over a civilisational timeline, belief systems have abstracted upward. The power of their God 'grew' to access more of the computational possibility space :

*Animism / Shamanism → Pantheons / Polytheisms → Philosophical Monotheism → Infinite Oneness*

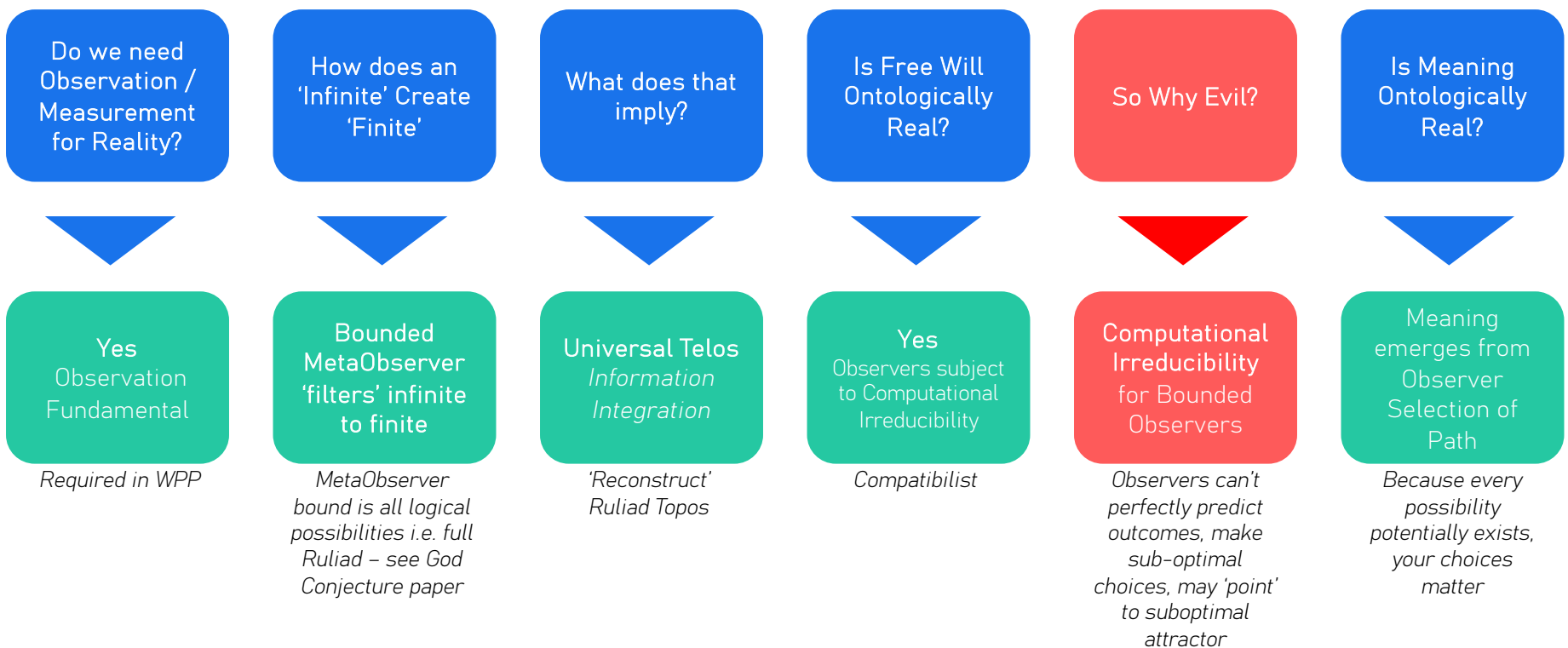
- Each jump gives Observers like us access to a bigger "computational possibility space" i.e. more potential causal influence!
- This parallels science's progression which builds  $F_0$  bottom-up:

*Local Heuristics → Universal Classical Laws → Quantum Mechanics → Information Theory?*



- Each transcends and includes the previous, collectively expanding what we can know

# Theological Questions Find Answers in a Computationally Parseable Universe



# Why an Infinite Computational 'Ground' Doesn't Make Claims Equivalent

- **Circularity is universal:** Any framework that tries to explain "everything" leans on axioms it cannot prove from the inside  
e.g. logic, induction, existence, lawfulness
- That doesn't make frameworks equal. Some explain far more with far less, with fewer contradictions and richer predictive apparatus
- **Key distinctions:**  
 Unprovable = cannot be finally derived from a more basic system  
 Unequal = can differ dramatically in coherence, explanatory power, and usefulness
- **Computational Theology:**  
 Forces theology into precise contact with the Ruliad / Computation / Maths / Science  
 Respects formal limits (Gödelian limits, Tarski)  
 Yields **non-trivial constraints** on what theistic creation was to be computationally valid
- The question is not "Can we prove it?" but "Given the axioms, does it give us more understanding for fewer assumption?"

| Materialism                  | Traditional Theism                | Computational Theology*<br><small>*Using Observer Theory</small>                     |
|------------------------------|-----------------------------------|--|
| Explanatory Power            |                                   |  |
| Sciences<br><i>Invariant</i> | Why questions<br><i>Invariant</i> | Both<br><i>Invariant structure</i><br><i>Variable outcomes</i>                       |
| Explanatory Gaps             |                                   |  |
| Why questions                | Everything Else                   | ?  |
| Predictions?                 |                                   |  |
| Yes<br><i>Testable</i>       | None                              | Yes<br><i>Testable</i>   |
| Parsimony                    |                                   |  |
| Multiple frameworks          | Yes but...                        | Single Framework<br>others as subsystems<br><i>But requires computation / Ruliad</i> |
| Coherence                    |                                   |  |
| Paradoxes at domain boundary | Disagrees with empirical evidence | No contradictions<br>Resolves paradoxes  |



# The Scorecard: Explanations per Assumption

|            | Materialism   | Observer Theory  |
|------------|---|--|
| Assumes    | <ul style="list-style-type: none"><li>Existence of laws, constants, matter, consciousness as <b>brute emergent facts</b></li><li><b>c.26</b> Free Parameters in Physics</li><li>At least <b>2</b> but up to <b>5</b> Metaphysical Brute Facts</li></ul> | <ul style="list-style-type: none"><li><b>1a</b> Logic exists</li><li><b>1b</b> Computation follows (CTD as meta-assumption)</li><li><b>2</b> Ruliad as complete structure of computations</li><li><b>3</b> Observers as bounded samplers</li></ul>                 |
| Explains   | <i>Local physical phenomena given those laws</i>  | <i>Why laws, why unreasonable effectiveness of mathematics (computationally efficient), why they're finetuned (boundedness), why consciousness / meaning / free will / telos, why religious structures repeat / why secular superstructures evolve and persist</i> |
| Conclusion | <ul style="list-style-type: none"><li>Many Brute Facts</li><li>Limited ultimate explanations</li></ul>  | <ul style="list-style-type: none"><li>10x-100x explained per axiom than materialism</li><li><b>Orders-of-magnitude contrast</b></li></ul>  |

If we must live with brute facts, choose the framework that buys the most understanding for the least





CONCLUSIONS (FINALLY!)

# Conclusion



## What we started with:

- **The Ruliad:** Observable reality as the entangled limit of all possible computations
- **Observers:** bounded samplers running a universal loop
- **Undecidability:** Ultimate questions (hard problem, meaning, free will) cannot be resolved inside our own system

## What moves did we make:

- Showed how **physics (as we know it today)** slots into this picture
- Reframed **evolution** as optimisation of information integration
- Proposed **Universal Telos:** climbing information gradients under constraints to integrate as much information as possible
- Formalised **Computational Ethics:** path selection criteria

## Then we mapped:

- Ancient traditions to an Observer-centric meta-model
- Applied it to spiritual systems evolution to demonstrate increasing computational complexity and correspondence with computational physics

## What's New and What Isn't:

### Not New

- Using computation as a lens on physics
- Using information, complexity and causal history to talk about life and mind
- Recognising ethical convergences across traditions (meta-ethics)

### What a Universal Observer Model Adds

- A single way to discuss measurement from Atoms to Humans
- How Observer's interact at all scales
- How platonic / latent space ingresses to the physical world via ideas
- Universal Telos (testable)
- Computational Ethics (testable)

*Note: this is a conjecture, not a theorem. It rests on specific assumptions that can be tested and could fail!*



# Why This Matters (Even If It's Wrong)

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Even if the Conjecture turns out to be false or incomplete, the attempt has utility:

## 1. A shared language

- It forces physics, biology, consciousness, philosophy, and theology into **one formal vocabulary** (computation, observers, information), without sacrificing empiricism

## 2. Sharper questions

- What exactly do we mean by meaning, free will, good & bad and telos?
- Which parts are unfalsifiable, and which are about **Observer dynamics**?

## 3. Better experiments

- Thinking in terms of Observers and telos suggests new experiments in non-neural cognition, multi-domain information integration (see PID in IIT), memetics and ethics

## 4. A computational model can formalise theological questions

- It gives religious people a way to take science **seriously**
- It gives scientists a way to take religious questions **seriously**, without turning off their error-detectors



In other words: “even a failed bridge is useful if it tells us where the river actually is”