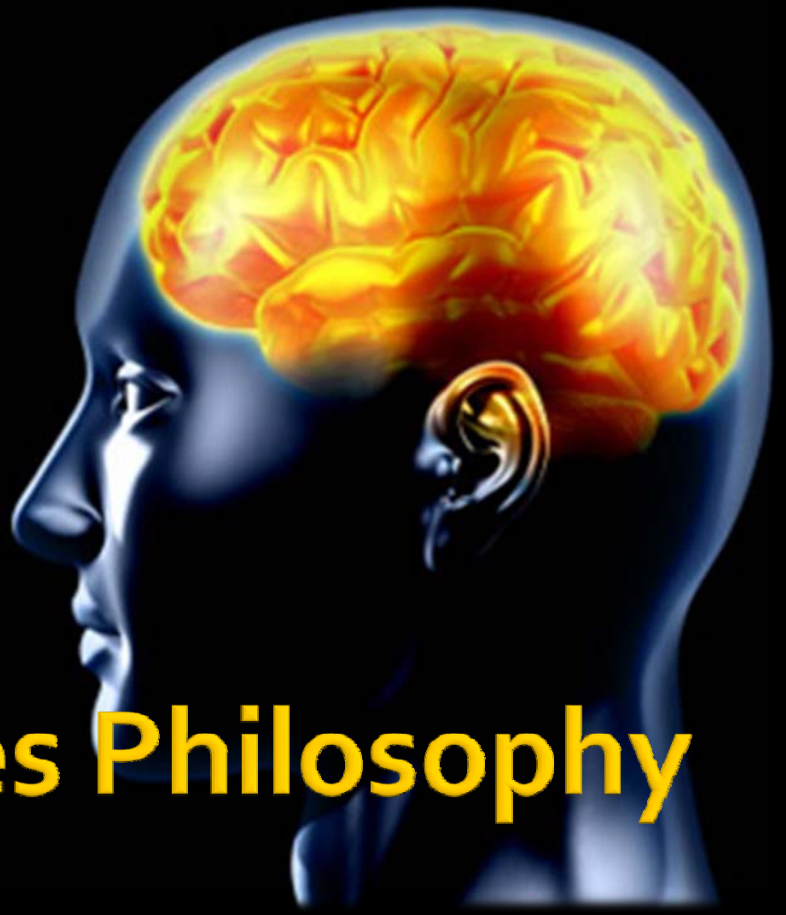


Towards Unity

Cognition Requires Philosophy

(in progress...)

Agenda

Time (pm)	Item
1:00	Start
	Problem Statement
	Line of Argument
	Frustrations → Topic
	Show
	Background Info
	Main Presentation
2:10	Q & A
2:30	Discussion @ Mike's

Problem Statement

- Newell (1973 & 1990)
  - research programs not adding up
  - Oversimplified dichotomies
  - unify via integrated control
- Today
  - Just as bad, even with control

Line of Argument

- Cognitive Science unification must proceed in the following order
  1. Update metaphysics with modern physics
     - Remove Substance Metaphysics: what things are
     - Introduce Process Metaphysics: what changes
  2. Qualitatively unify: Philosophy of Cognition
  3. Quantitatively unify: Cognitive Science

Frustrations → Topic

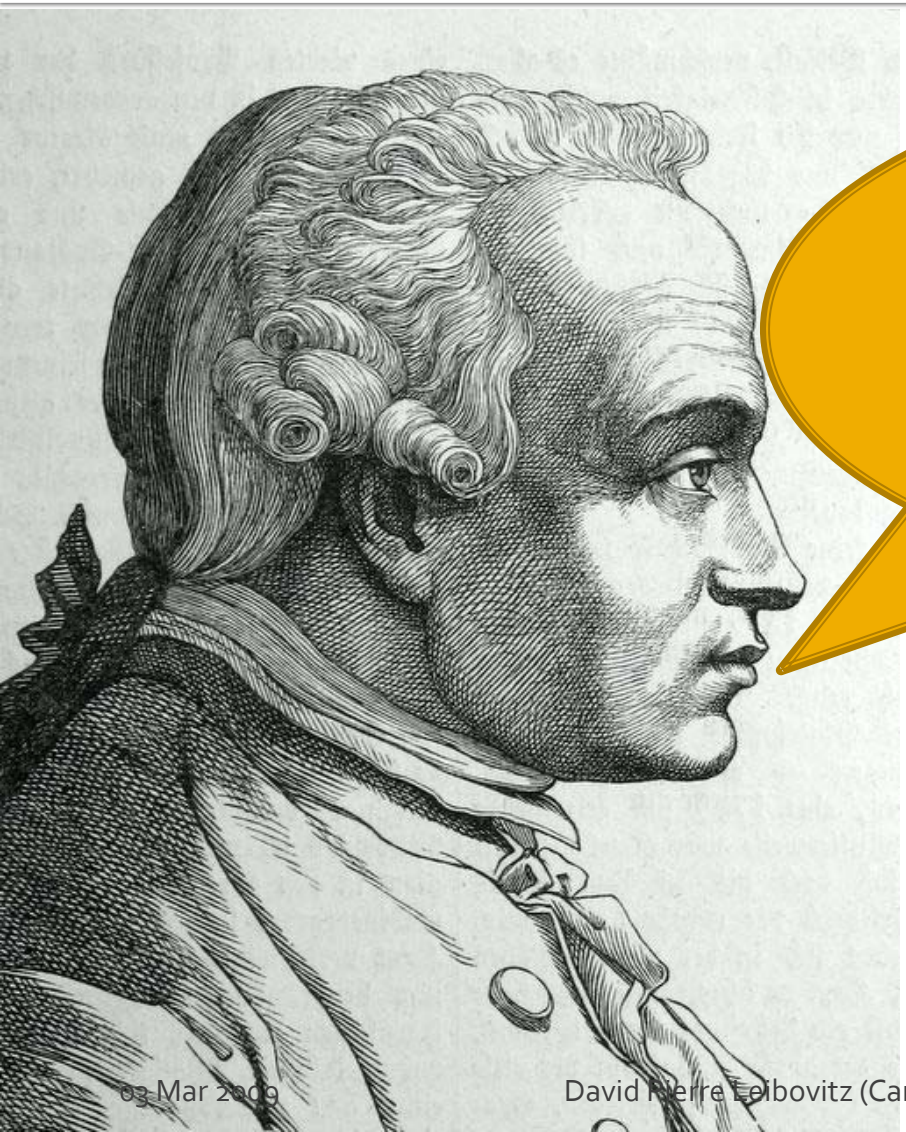
- Frustrated with
  - Philosophy
    - Includes metaphysics
  - Cognitive Science
- Topic
  - What is the role of Philosophy General with
    - Physics
    - Metaphysics
    - Philosophy of Cognition
      - Premature birth
      - Rebirth
    - Cognitive Science
  - What can be improved?

Show

- Background Information
- How my research fits into things
  - Why I need philosophy
  - Why this affects you
- Why you might require philosophy as well

Background Information

Metaphysics Frustrations

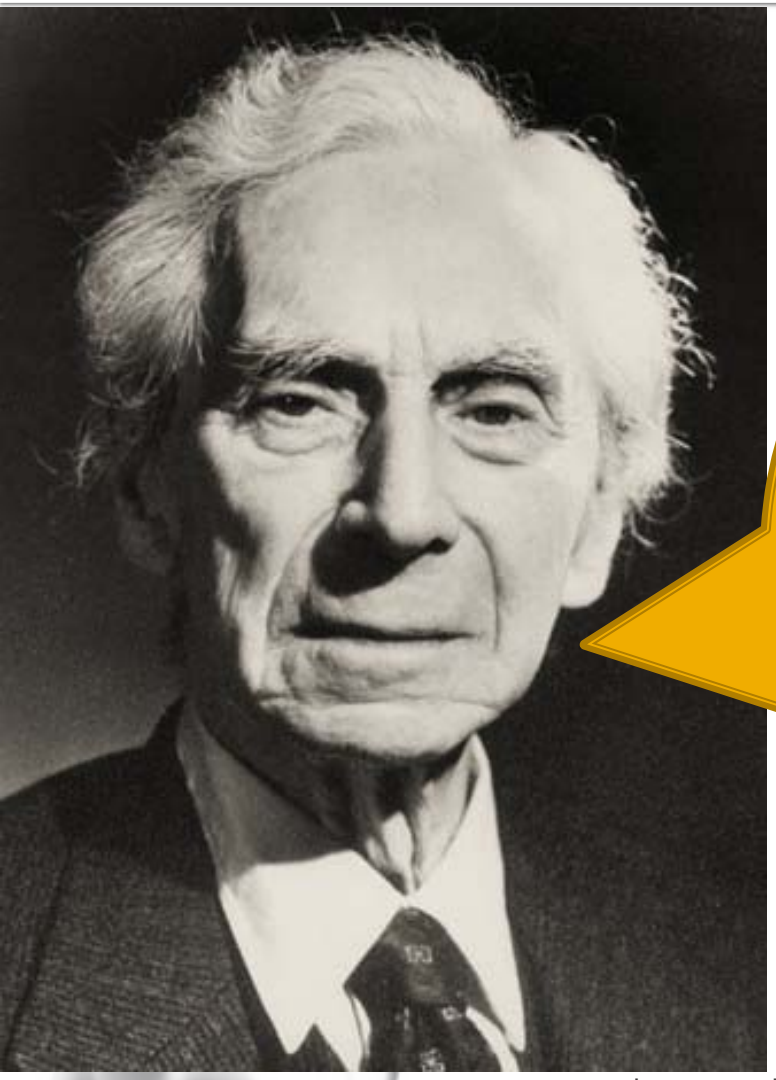


Metaphysics is a dark ocean without shores or lighthouse, strewn with many a philosophic wreck.
– Immanuel Kant

Metaphysics

- How we view and decompose the world
- History
  - ~500 BC Process Metaphysics lost out to Substance Metaphysics
    - Due to bad timing
  - ~1900 AD Physics implicitly rewrote metaphysics for themselves with great success
    - Huge foundation of Substance Philosophy to overcome
  - Philosophy of Cognition and Cognitive Science are still thrashing
    - Is it time to put physics explicitly back into metaphysics?

Philosophy Frustrations



The point of philosophy is to start with something so simple as not to seem worth stating, and to end with something so paradoxical that no one will believe it.

– Bertrand Russell (1872 - 1970), The Philosophy of Logical Atomism

Formal Philosophy

- Anyone can informally philosophise
  - Not aware of dangers
- Adds rigour
- Awareness of fallacies (errors in reasoning)
- Formal and informal tools
  - Various logics, e.g. Temporal Logic
  - Deduction, Induction, Abduction
  - *Reductio ad Absurdum*, Infinite Regress, Paradox
  - Thought Experiments
- Greater awareness of related material
- Specific Terminology
  - Internal Efficiency (Jargon, Lingo)
  - External Barrier (Gobbledygook)
    - Can anyone truly understand "Intentionality" in less than ½ year?
    - Does this matter?

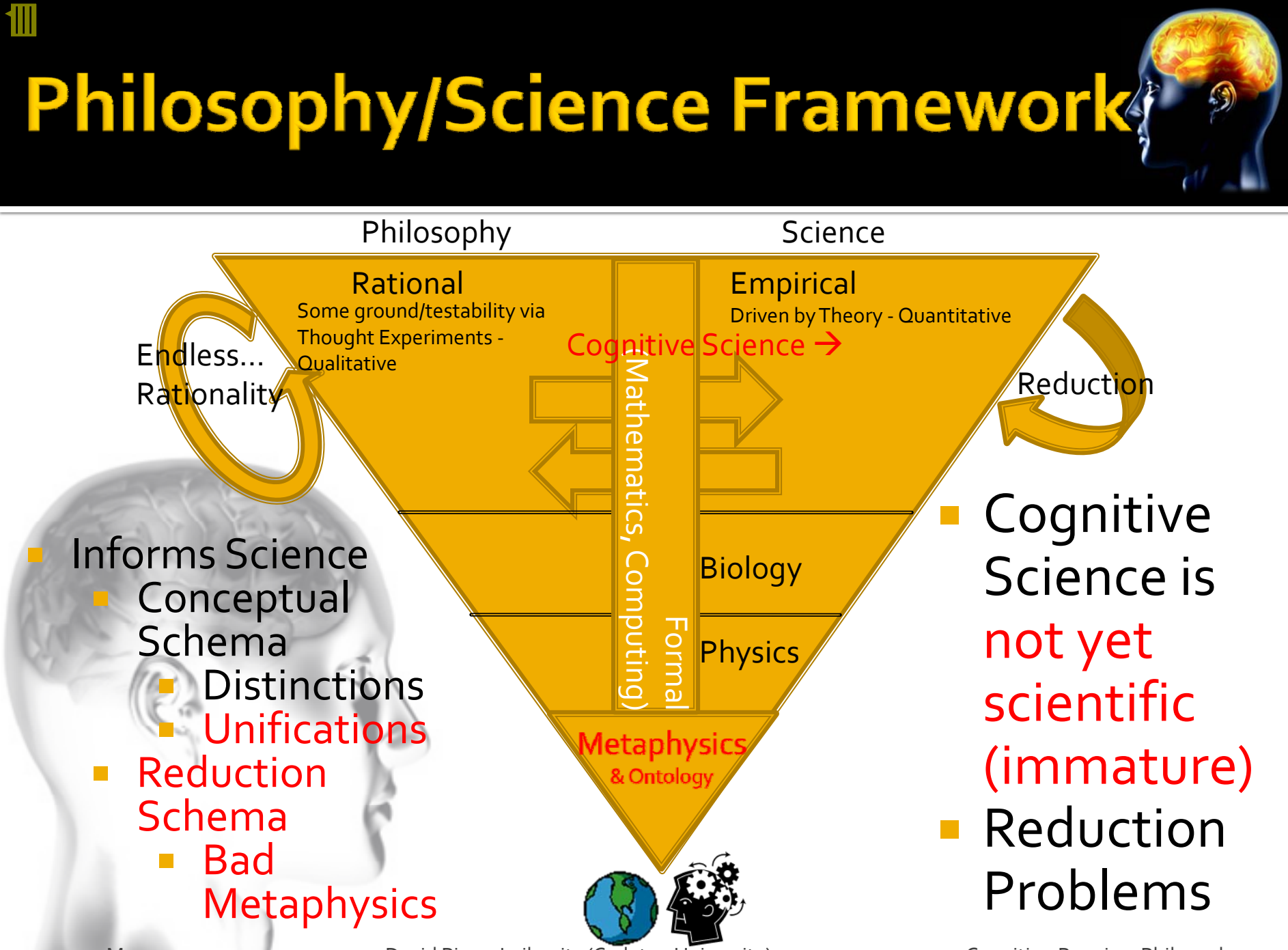
Introduction

- Interest: Inducing Formal Qualitative Unified Cognitive Architectures
  - By understanding: Time, Change & Recursion
- Lead me to the following analogy/summary

	Cause	Relation	State Change	Field	Status
	Momentum	is to	Bodies	Physics	✓ ☺
as	Intentionality	is to	Minds	Cognition & Philosophy	✘

- This is my circular journey through cognition, philosophy, metaphysics and physics (and back)
  - All about motion/change/process – how do minds think

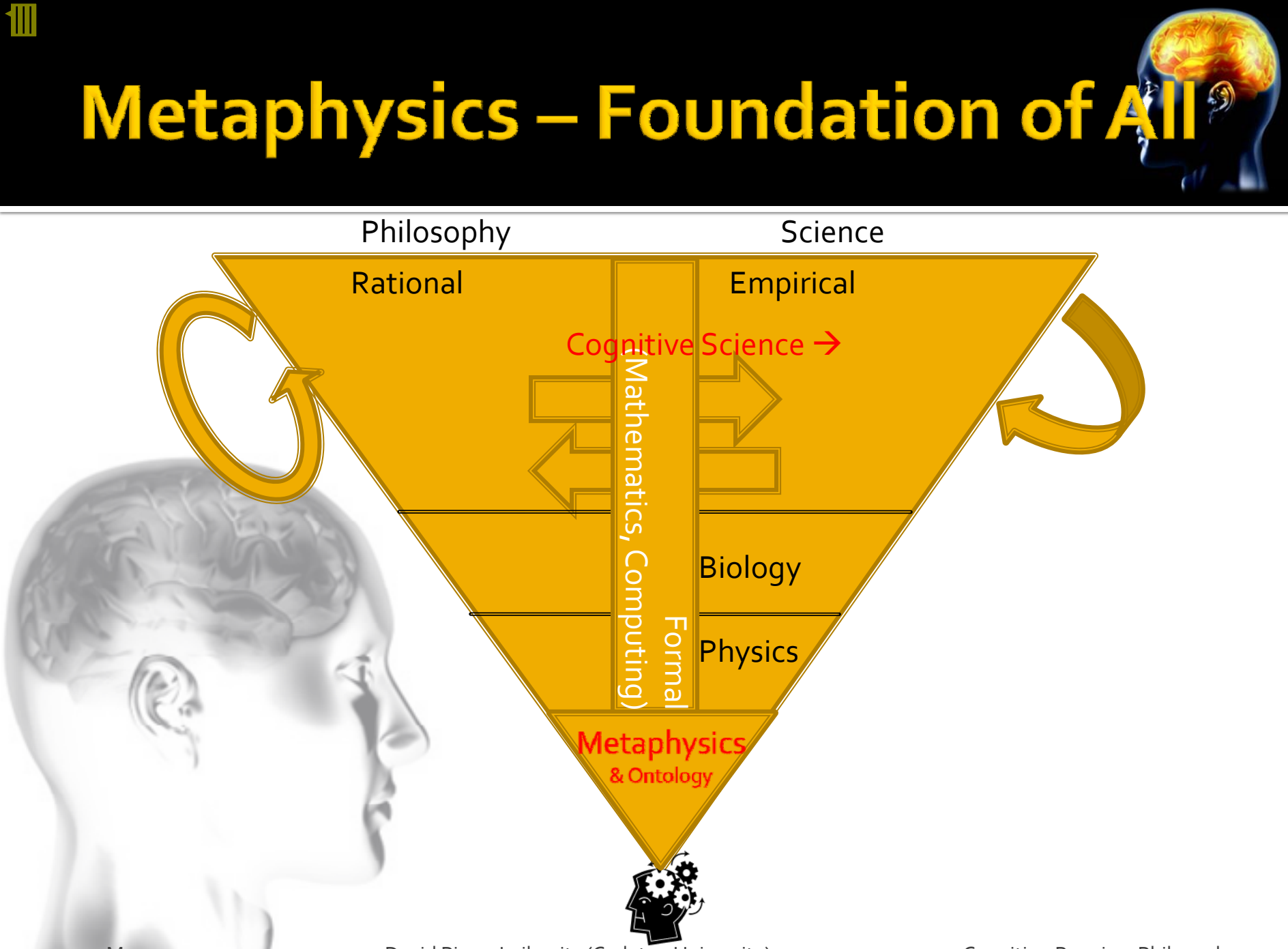
Philosophy/Science Framework



- Informs Science
  - Conceptual Schema
    - Distinctions
    - Unifications
  - Reduction Schema
    - Bad Metaphysics

- Cognitive Science is not yet scientific (immature)
- Reduction Problems

Metaphysics – Foundation of All



Metaphysics Is?

As a "first philosophy", what **is** metaphysics?

- Classical (general being; ontology)
  - Categories of being - things that do not change
  - Substance
  - First cause (theology?)
- Current (relational among categories)
  - Denial of classical thesis (only change, no categories, no 1st cause)
  - Modality (of being)
  - Space/Time; Personal Identity Across Time
  - Mental/Physical; Free Will
  - Material Constitution
  - Truth? Reference? Analytic
  - Ultimate Reality?
- Poorly Defined. Is it even possible?
  - Needs to be updated by Physics

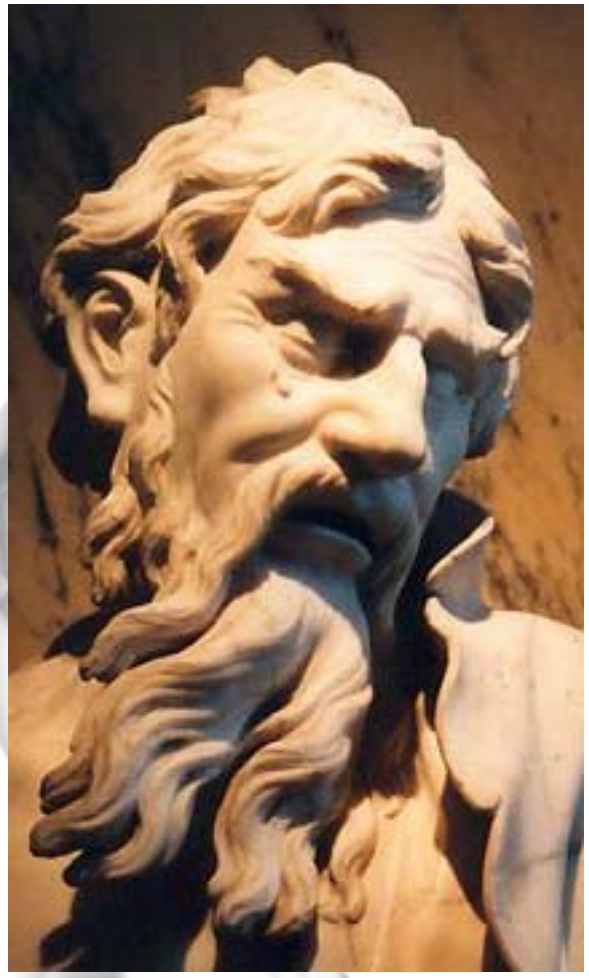
Metaphysics Does

- Metaphysics less important for what it **is**. Most people, including philosophers do not tread into that "dark ocean".
- Metaphysics more important for what it **does**. Implicitly it affects
  - How we view the world
  - How we reduce the world
  - How we create conceptual schemes for our sciences
- Substance vs. Process Philosophy/Metaphysics
  - Computer Metaphor – ill understood

Its all about Change

Change causes change causes change causes change…

Heraclitus (535-475 BC)



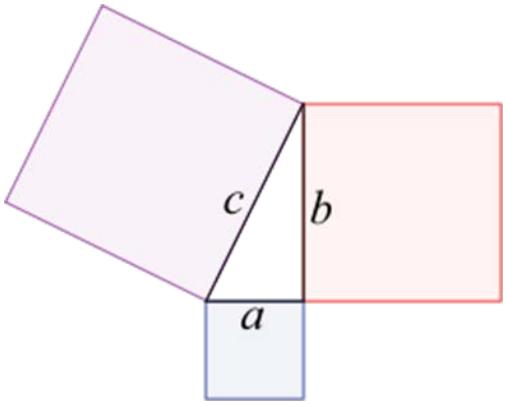
- Father of Process Metaphysics/Philosophy
- Aphorisms
  - "Everything is in a state of flux"
  - "The only constant is change"
  - "All things are one"
    - All things change at the same time and affect each other
  - Unity of opposites
    - Equilibrium

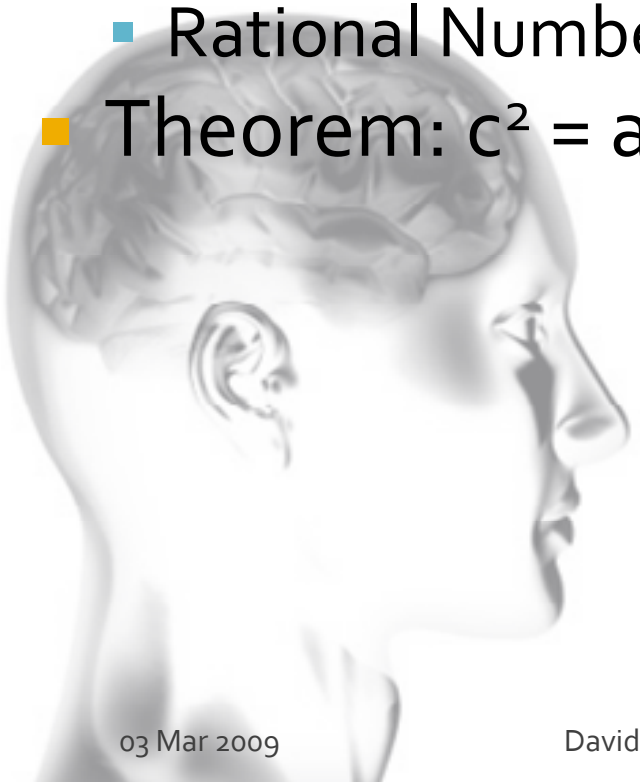
Process Metaphysics Failed – Why?

- Change based worldview failed
- Heraclitus known as "The Obscure"
- Dynamics is more complicated than statics (even today)
- Change is full of paradoxes
- No ability to measure change (speed)
- No formalism
- Mystical
  - Similarities to Eastern Philosophies/Religions (Taoism, Buddhism)
  - Aphorisms reflective rather than prescriptive
    - "You can never step into the same river twice"
    - Harder to grasp, easily misunderstood
  - Internal Orientation
    - How to see the world, vs. what is in the world
    - Much like enlightenment
    - However, still focused about the world vs. internal well being.
    - In actuality, an ontological scheme for reducing the world, i.e., a metaphysics

Then Current Mathematics

- Pythagoras (580-490BC)
- Based on Geometry
- Ratios of lengths of string
  - Rational Numbers (Fractions)
- Theorem: $c^2 = a^2 + b^2$





Speed at Heraclitus Time?

650AD: Zero first used in India

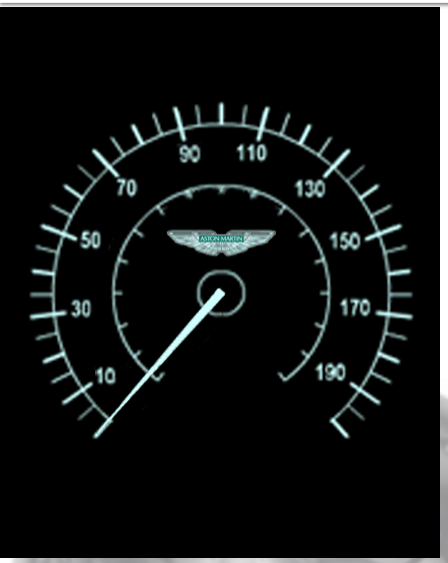
820AD: Al-Khwārizmī introduces decimal separator in Iran

1670AD: Seconds measurable via pendulum clock

RateOfChange = 201.345 units/second

~360BC: Eudoxus of Cnidus handles Incommensurable Magnitudes (Irrationals - hints of infinity)

Speed/Time Measurement



- 1475: Pocket Watch with minute hand
- 1670: Pendulum clock with second hand
- 1761: Marine Chronometer (for longitude)
- 1821: Chronograph (timekeeping + stopwatch)
- 1888: Speedometer invented (+- 10%)
- 1910: Chronograph in wristwatch
- 1967: Quartz Clock (Japan) (1/100th second, stopwatch for sports racing)

Zeno of Elea (490–430 BC)

- Motion Paradoxes
  - Infinite algorithm by dividing up time
    - Achilles and the Tortoise - You cannot overtake something slower
      - {1/2, 3/4, 7/8, 15/16, 31/32, …}
    - Dichotomy Paradox - You cannot move
      - {…, 1/32, 1/16, 1/8, 1/4, ½, 1}
  - Infinite algorithm by dividing up space
    - Arrow Paradox – Flying arrow is motionless
      - Motion requires a change of position. At any instant (think snapshot) of time, a moving arrow can only move to where it is, or to where it isn't. It cannot move to where it isn't, as we are in one instant of time, and it cannot move to where it is, because it is already there and we said the arrow is in motion. Therefore it never moves at any time. [What dichotomous fallacies?]
- Change is full of paradoxes, infinities and infinitesimals (time/space) that we do not understand, so lets focus on substance
  - Plato (428-347BC) did just that with his Theory of Forms

Zeno Interpreted Today

- About discrete vs. continuous
- Although we have the tools to mathematically handle the **net computed result** of infinite series, the bottom line is that any algorithm with an infinite number of steps must **operationally** take an infinite amount of time as Zeno intuited.
  - Mathematical or computational equivalence does not equate to operational (nor metaphysical) equivalence over time. [Important to my formalism]
- Thus Zeno's paradoxes are not an indictment against change (which is known to occur), but against treating **continuous** entities (position in spacetime) as **discrete** points. There are an infinity of such infinitesimals.

- Cognitively/philosophically: one can think but cannot have a distinct thought (nor mental state)
  - Moreover, if mind can be reduced to, or supervenes over brain, and if brains are continuous physical systems, so too must the mind
  - Am I (yes/no) this instant in a mental state of pain? Or is the level of pain a continuous quantity? Is my level of attention to a cut a continuous quantity?
  - My research is in treating almost all things cognitive as continuous, including "rules" and "symbols". In other words, converting substance to process…
    - The only substance remaining is an innate baby mind, all learned things adult forever flow…

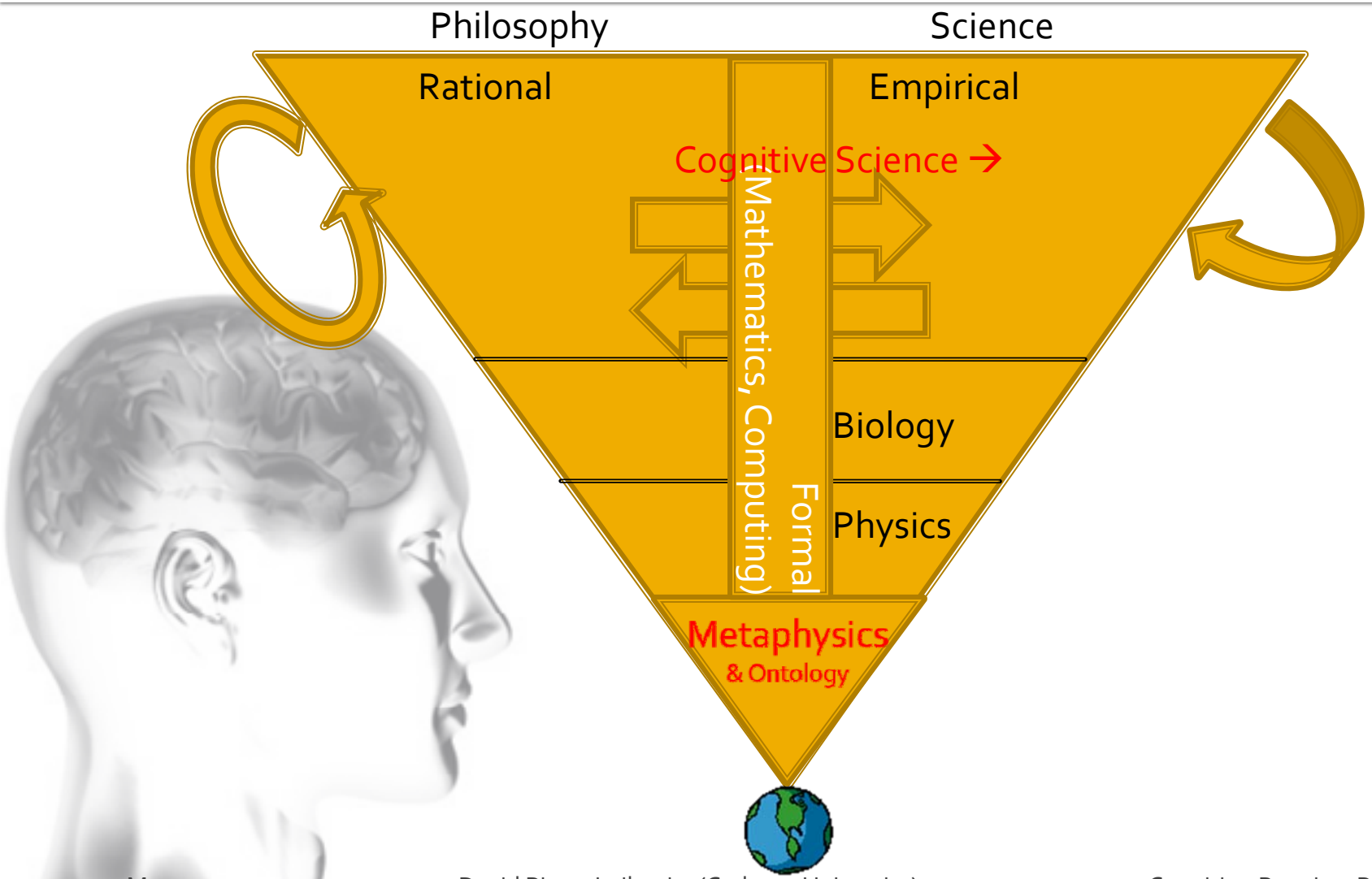
Computer Metaphor

- Computers are symbol processing systems.
- However, when we simulate physics (e.g., weather forecasting) we do not say that the entities being simulated, e.g., clouds, mountains and lakes exchange symbols.
  - Symbol processing systems can simulate non-symbol processing systems.
    - Non-symbolic systems are almost always stimulus/response systems with quantities that vary continuously
  - A real valued (continuous) number should not be metaphysically considered as representing an external substance or state value, even if internal to the computer, it is a symbol
- Should the mind be considered as a symbol processing system? I would like to simulate it via continuous means
  - Issues with atomic changes to representation
  - A computer can be built via only NOR gates – purely stimulus response elements (digital computers are analog systems)

Substance Metaphysics

- Current metaphysics is so dominant, it doesn't have a name. I name it "Substance Metaphysics"
  - Language doesn't help. Everything has a noun form.
- Includes temporal logics
  - Required as a metaphysical patch – inherently the world does change
  - These describe atomic before/after state of affairs, but not how the change transpires
  - Includes Functionalism!
- Suggest: Greatest philosophical blunder of all time
  - We are all paying the price
  - Need physics, metaphysics & philosophy to rectify

Physics


Philosophy
Science
Rational
Empirical
Cognitive Science →
Mathematics, Computing)
Formal
Biology
Physics
Metaphysics
& Ontology

Physics/Math – History of Change

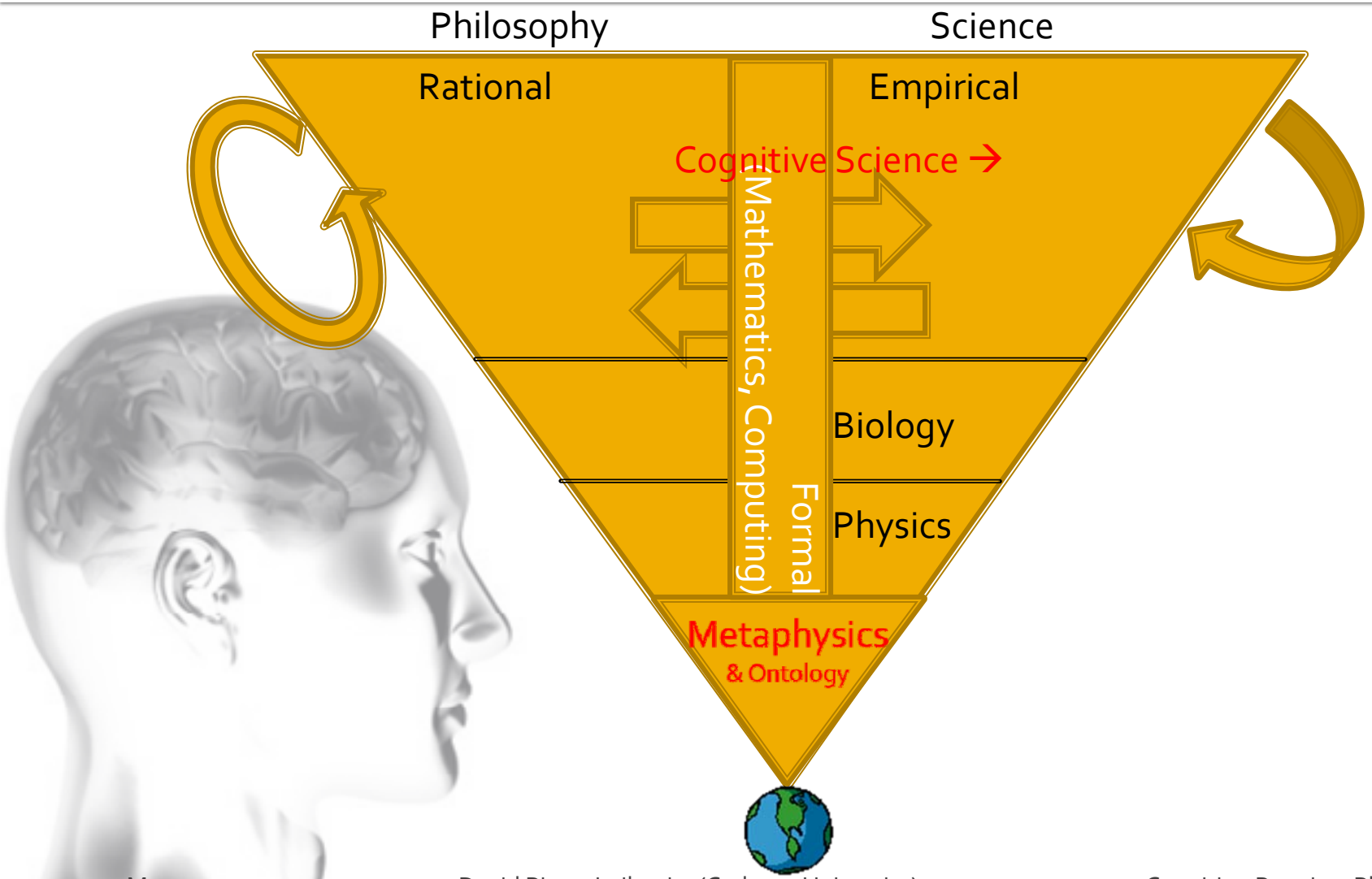
Time	Area	Scientists
322 BC	Ancient dynamic laws	Aristotle
1358 AD	Theory of Impetus	Buridan
1660	Infinitesimal Calculus* Dynamic Systems, Difference Equations, Differentials	Newton & Leibniz
1687	Laws of Motion, Momentum Gravity force field has action at a distance. Still problematic	Newton
1822	Difference Engine*	Babbage
1868	Control Theory*, centrifugal governor	Maxwell
1874	Various Infinities, Set Theory	Cantor
1905	Relativity, $E=mc^2$	Einstein
1926	Particle-Wave Duality*, Wave Function	Schrödinger +
1927	Uncertainty Principle (position & momentum)	Heisenberg
1960	Rigorous Infinitesimals	Robinson
1988	Time Scale Calculus*	Hilger

Only now do we have a foundation for handling change philosophically

- The ancients were right to stick to substance, but…

*Related to my formalism

Science → Philosophy



Science X ←→ Philosophy X

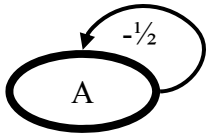
- In general, there is a steady exchange between
  - The Science of X, and
  - The Philosophy of X
- In many cases, this only concerns the philosophers and scientists knowledgeable in X alone
  - Often, they were one and the same individual
    - E.g., Einstein with spacetime and quantum interpretations and use of thought experiments
    - The ancient polymaths
  - Sometimes, opportunity strikes
    - E.g., Brooks with subsumption architecture and meaning based on "non-symbolic" embodied reactive behaviours
  - In any case, these scientists and philosophers understood each other at some level of discourse
- Exchange mostly takes the form of (poor guess at this point)
  - Minor simplifications, alternative (dichotomous) viewpoints & conceptions
  - Few issues at any one time
  - Many philosophical X issues resolvable via grounding of science X
  - The exchange is lopsided. Philosophy takes more than it receives
    - How does X affect ontology? Meaning? Experience?
    - Philosophy slowly becomes self absorbed and looses relevance to a mature science X
- However, as philosophy general has been diminished by the birth of the science of X it has increasingly found itself operating in the above mode only
  - Philosophy of Cognition (beyond the social sciences) is the most active philosophy left.
  - It is currently not-grounded in science (as cognition is not mature)
    - Failure of philosophy divorced from science
      - no ground, endless rationality, too many dichotomies
    - Failure of science divorced from philosophy
      - immature science, no paradigm, too many dichotomies, wasted empiricism
  - Science and Philosophy need each other!
  - Too many unresolvable dichotomies.
  - Forgotten how to give birth to a science. When was the last time?

Science X → Philosophy Y

- I want to introduce the science of change into metaphysics, philosophy and cognition
  - Reason is for unity to be made apparent shortly
- Why hasn't this already been done?
  - Will show later why temporal calculi are patches
  - The jargon of X is not accessible
    - Math too difficult
      - Wave Functions and Partial Differential Equations, Matrix Operations
      - Fields, Tensors, Non-Euclidean Geometry
  - Metaphysics & Philosophy has built an enormous house (of cards) based on 2½ millennia of substance metaphysics
    - Only I am silly enough to shake such a foundation (but it must be done…)
  - The Philosophy of Y is too complicated for Science X
    - And in general, philosophy has a bad rap for endless rationality
    - Don't depend on physics to **push** such ideas into Philosophy of Mind. They will not simplify their physics for our purposes.
      - They have withdrawn and created their own implicit metaphysics
      - The birth of physics as a science has left meta-physics diminished of all empiricism
    - We must make the effort to **pull** back and simplify these ideas together for ourselves
  - The days of polymaths (knowing X and Y) is mostly over
    - Life has gotten so much more complicated

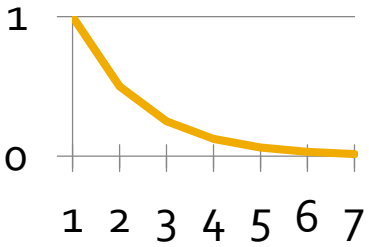
Process Metaphysics – Simple Process Example

- A simple observed process is formulated as

A += -A/2 or 

(1)

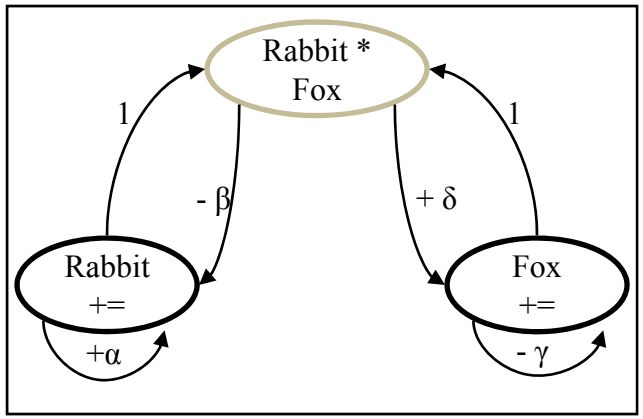
- The change operator ("+=")
  - updates the observed value on the left-hand side (LHS),
  - by the observed influence terms on the right hand side (RHS)
  - Update operations take an arbitrarily small amount of time to occur, denoted by Δt, but this is not normally indicated.
    - Much smaller time than an atomic operation. This simulates continuity.
- Example could produce the sequence {1, ½, ¼, … $1/2^n$} every Δt
  - This could represent a battery becoming discharged
  - Note: non-linear exponential behaviour emerges despite being simply a linear sum of parts. This is due to recursion.

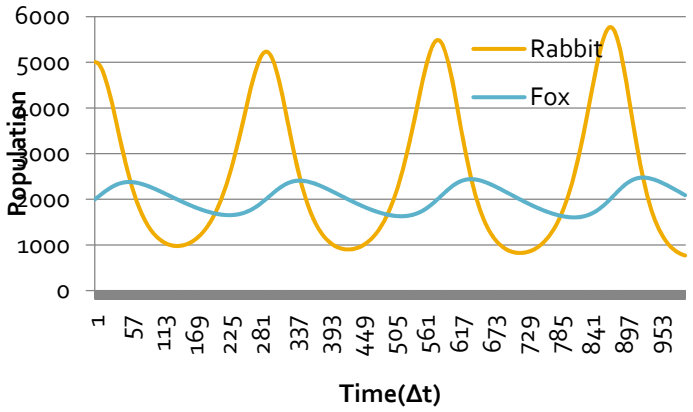


- Process must have self-reference (recursion)
  - Allows it to change/unfold over time
  - Even if an external stimuli is removed
  - This gives it a measure of independence and observed reality
  - (This is explicitly not allowed in Causal Bayesian Networks)
- Processes are approximate and may ignore minor terms of influence
  - This enables processes themselves to change over time
- The LHS is also an emergent
  - The LHS acts like a state and is said to emerge (that's what all observables truly are)
  - Because it is derived from the stateless function: Δ A(t) = –A/2
  - Approximates a substance
    - Crisp substances loose their creations, hence substance metaphysics must add intentionality
- The RHS is an explanatory (micro) set of changes
  - Over iterations, it approximates an atomic discrete operation, but it adds explanatory power

Process Metaphysics – Simple Process Ensemble

- All processes in a system interact continuously and are shown in an ensemble. Here is the Lotka–Volterra predator-prey example
  - *Rabbit* += (α**Rabbit*) – (β**Rabbit***Fox*)
  - *Fox* += (δ**Fox***Rabbit*) – (γ**Fox*)
- The Rabbit*Fox term is not recursive, is not independent, has no observable reality and is simply shown for simplicity
  - Represents the chance that fox and rabbits will meet
  - Has no delays
- RHS influence LHS often
  - Interactively
  - Terms of Opposition (+ vs. -)
- System is time invarient





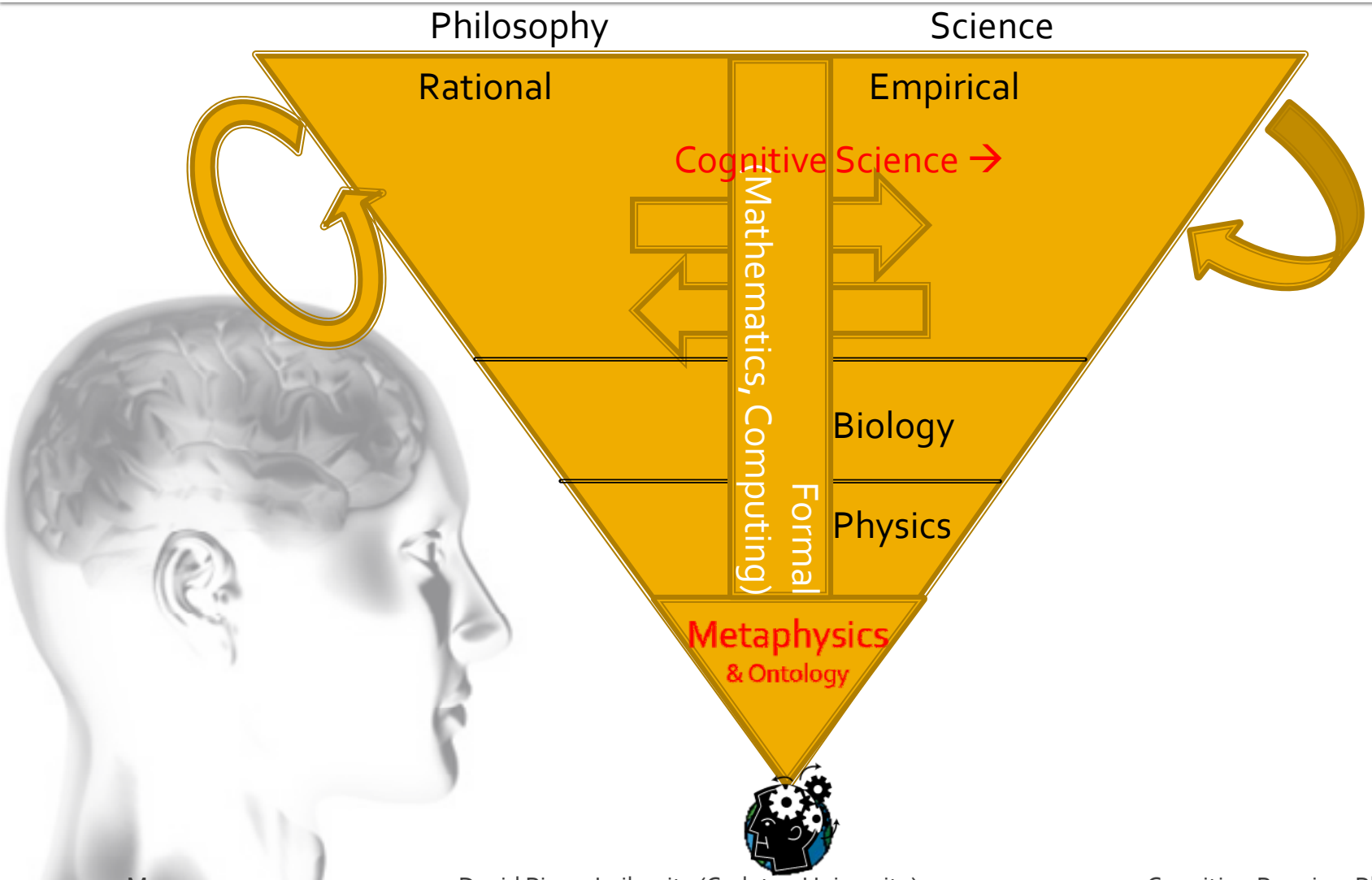
Metaphysics Comparison

Item	Process Metaphysics	Substance+Action Metaphysics
Formalism	$\Delta A = f(A, B) \rightarrow A \mathrel{+}= \Delta A$ $\Delta B = g(A,B) \rightarrow B \mathrel{+}= \Delta B$	$A(t) = f(A,B,t); \Delta A(t) = A(t) - A(t\text{-}1)$ $B(t) = g(A,B,t); \Delta B(t) = B(t) - B(t\text{-}1)$
Mechanism	Algorithmic, Temporal Ordered	Functional, Time Dependant
Sentence	Imperative (+=)	Declarative (=)
Truth	N/A	Yes
Substance	Emerges on LHS as Fuzzy	Crisp
Action	Continuous on RHS as Fuzzy	Crisp/Atomic/Discrete
Power	Explanatory	Descriptive
Substance vs. Action	Joined via +=	Disjoint
Causality	Via +=	Thrown out with bathwater
Intentionality	Not-needed	Required; Substance causes action; Need interpreter
About	How change affects change, i.e., What happens, What to do	What something is

Philosophy of Philosophy

- Suggest that the role of Philosophy General is to
  - Give birth to
    - a Science of X, and its
    - associated Philosophy of X
      - Bridging Sciences to/from X and their philosophies
  - Diminish itself so ultimately all that is left is
    - Philosophy of Philosophy General, and
    - Philosophy of Science General
    - Philosophy of various Social Sciences
      - These are normative and we mere mortals are not Gods
      - Nor is evolution directed nor final – its an anarchist free for all
      - Too many conflicting "Free Wills"

Birth of a Science

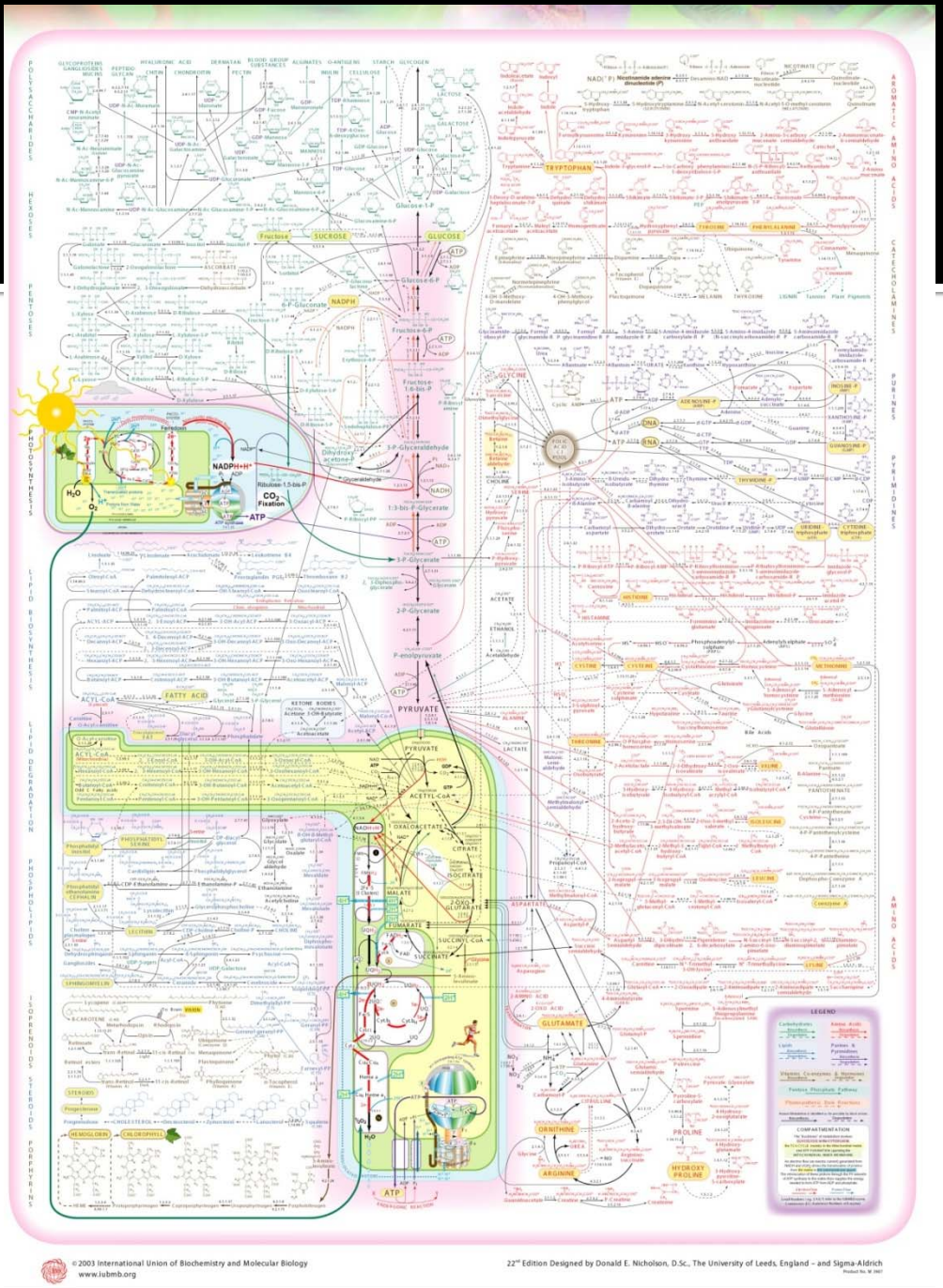


Birthing a Science - Historical

- Cognitive Science seems to be the last science to be birthed
- Philosophy has forgotten how to do so
  - It is in the Philosophy of X mode forming distinctions galore
  - Historically, the **few** ancient polymaths wore both science and philosophy hats
    - In any case, they worked extremely closely
      - Shared the same jargon
  - Today, philosophy has gotten too big – too many non-polymaths
    - Its own unique jargon that has become too confused and less relevant to foetal sciences
- Kuhn suggested a paradigm shift needs to occur
  - Only a philosophical unification can do so

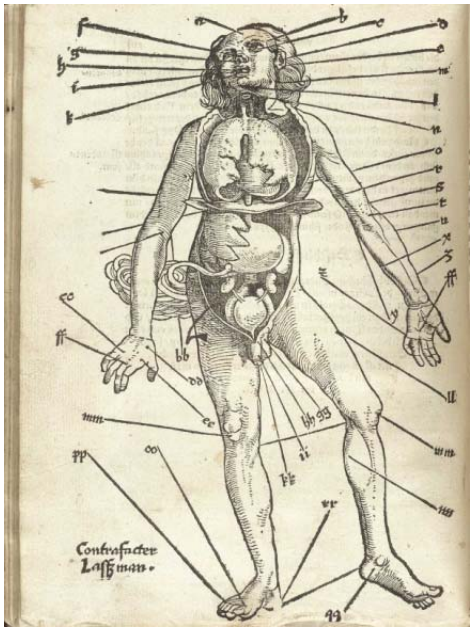
Is Cognition Too Complex?

- Metabolic Pathways
- With numerous interacting processes

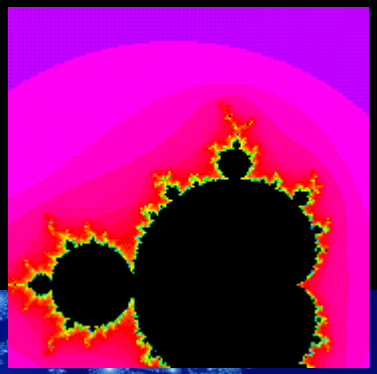


(Anti)Reducing Complexity

- Complex systems can be (anti)reduced
  - As long they deal with (unified/agreed upon) tangibles
    - Water, Air, Earth, Fire (but not Aether)
    - Galaxy, Corporation, Country, Family, Herd
  - A few hypothesized non-tangibles are eliminated when science allows for direct observation
    - 370BC (Hippocrates) Humours (Blood, Yellow/Black Bile, Phlegm), bloodletting
    - 1632AD (Leeuwenhoek) Microbiology
    - 1858 (Virchow) Cell Pathology
  - Processes harder
    - Phlogiston → Oxidization



Intangibles

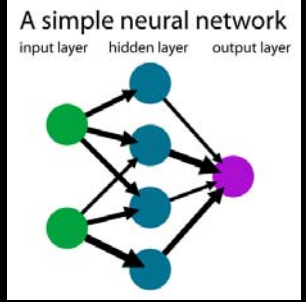


- Chasing endless **surface** features or symptoms
- v.s. simpler **deep** structures or processes
  - $f_c(z) = z^2 + c$ (recursed)
    - Colour depends on speed of divergence
- Not implying cognition is this bad!

Intangible Reduction

- Requires unification
  - E.g., Geocentrism vs. Heliocentrism
- Judicious use of Occam's Razor
  - Would not have applied to the above initially
  - Number of distinctions in Philosophy of Cognition far exceed the practical number of things considered in Cognitive Science

Many Intangibles



- Reduction in science progresses easily when
  - Only a few significant dichotomies at a time
  - At the edges of the unknown
  - Like a single layered neural network
    - Hypotheses compete, and empiricism slowly changes their relative merits
- Cognition is a case of too many significant intangibles at all layers
  - Hypothesis are dynamic and change with empiricism
  - Sometimes against accepted evidence, or poorly understood philosophical truths (vehicles vs. content)
  - Anarchy (Feyerabend)
    - So much so that everyone shrugs their shoulders, ignores philosophical warnings and competitive hypothesis, and continues on their own path

Mind Reduction?

- The mind cannot be reduced via substance thinking
  - Because it is not tangible
  - No agreement on what it is
  - No agreement on any of its parts
  - Each philosopher and scientist has a different, if not private, theoretical set of parts
    - Although one part could connect to another, the theoretical sets cannot
    - Its an apples and oranges debate
    - With so many dichotomous choices in parts and assumptions, the chance of any set being correct approaches nil
- Mind slightly more easily reduced via process thinking
  - Each part is fuzzy and can gradually morph to another so that theoretical sets can connect
    - An apple can become an orange
    - However, such gluing can become an unmanageable mess of epicycles

Computer Reduction Issues

- Already seen that computers can simulate both symbolic and continuous systems
- What about Marr's tri-level hypotheses?
  - Any hardware layer can be simulated by software
  - Simple software functions can be replaced by dedicated hardware accelerators (e.g., sorting)
  - Each layer can be tri-layered within
    - Is the algorithmic layer within all layers still the algorithmic layer for the system?
  - Many software modules are not layered but are networked
- Miller's 7±2: is that a
  - (neural) implementation,
  - (strategic) algorithmic or
  - computational (problem) limitation? Which is responsible for response time?
- Systems are multiply realizable on all accounts
- Looked closely, the brain is known to be a non-layered complex networked mess unlike hardware engineered products

Unification – Not

- Not connecting existing theories together
  - They do not ordinarily fit!
    - Meaning based on symbols or behaviour
    - ACT-R control models
  - When they do, there is less of a problem
    - Categorization is a mixture of Templates & Prototypes
    - Attention can have both early and late selection
    - Brain often has multiple connective paths between two systems
      - What and Where visual processing streams
    - Of course dynamics between the two or more…

Unification Requirements

- Unification requires
  - Major synthesis (breadth with significant depth)
  - Brand new coherent hypothesis →Paradigm Shift
  - Re-carving nature at her joints – Plato
    - Must have **few** renaissance butchers
      - Most others can continue along (but keep an eye out for connections)
      - Create fuzzy conceptions (more later)
    - New conceptual categories
    - New Ontology
    - New metaphysics
      - Obliterate most existing dichotomies
      - Easier to agree on what things do vs. what things are (meaning, consciousness)
  - Like software engineering
    - As more functionality accretes, or more systems integrate, software becomes convoluted and must be refactored (reorganized)
    - Despite our best system analysis techniques (CMMI), even in military, both complex design and implementation end up being refactored, especially due to unforeseeable dynamics.
      - E.g., Strategic Defence Initiative, Air Traffic Control
  - Inducing the mind qualitatively (in Philosophy) before being reduced quantitatively (in Science)

Unification via Induction

- Implemented a Process Network Architecture
  - For **Philosophers** and Cognitive Scientists
  - Try out various combinations of parts to
    - See if they have the causal power to do what they need to do for the entire system to have qualitative intelligence
    - Even polymaths cannot keep track of such complex interactions
  - Have a specific Cognitive Architecture in mind
    - In progress
    - Future presentation

Unification - Why

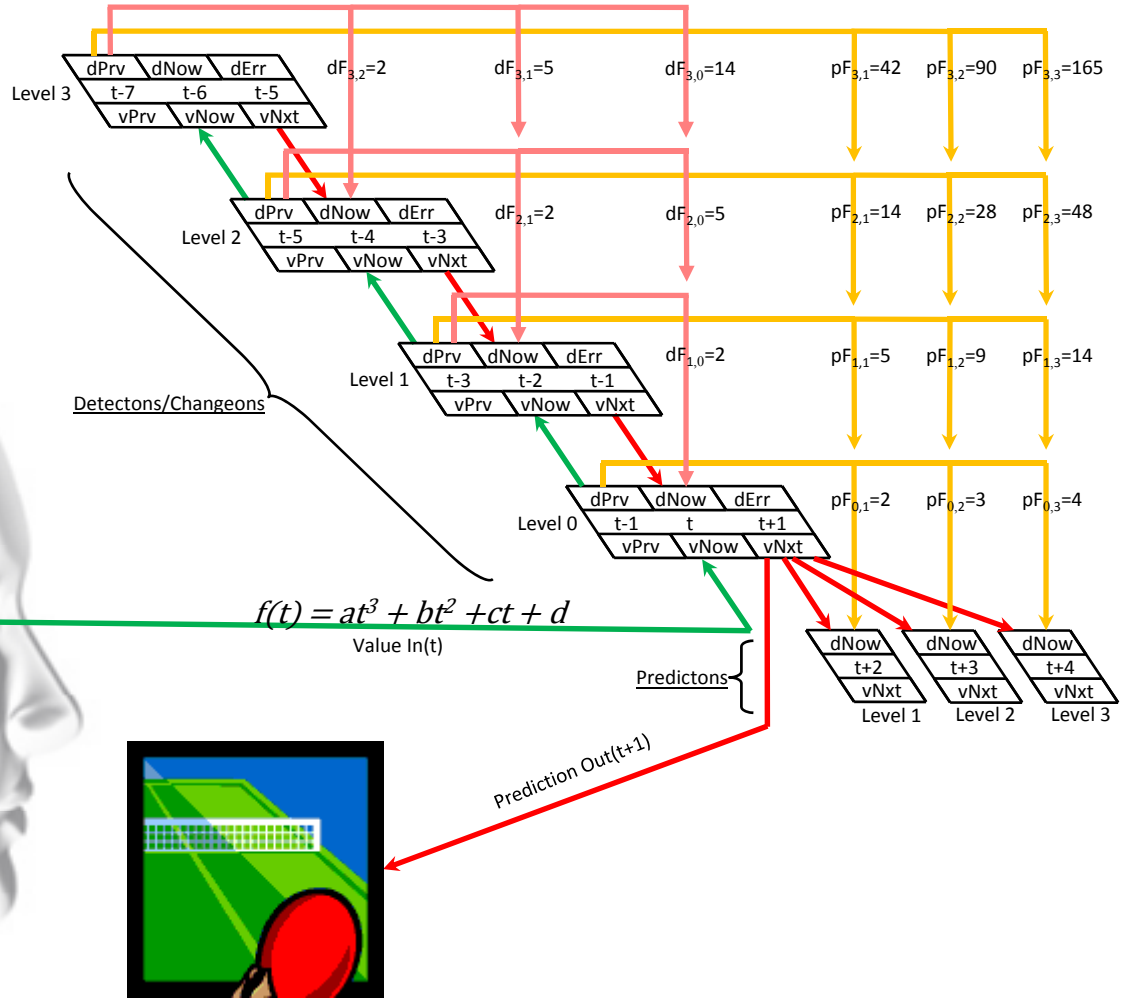
- Do our parts have the necessary machinery to do what they need to do?
  - In our layering and approximations, have we thrown the baby out with the water
  - Have we shuffled the hard problem elsewhere?
    - Infinite regress? Homunculus?
- Philosophers say this several ways
  - Do the parts have the necessary causal powers?
  - Are we manipulating vehicles rather than content?
  - Does the high-level reduce to (or supervenes over) the low-level (or emerge from it)? If not, where does the extra content come from?
- E.g., Symbols, in themselves, have no causal powers
  - They require an interpreter. Is that a homunculus?
  - The only causal power in a computer machine stems from the movement of electrons – a process – a change, i.e., energy. There is no "computer" per se, no software, nor symbols! All is continuous at this level.

Metaphysical Unification

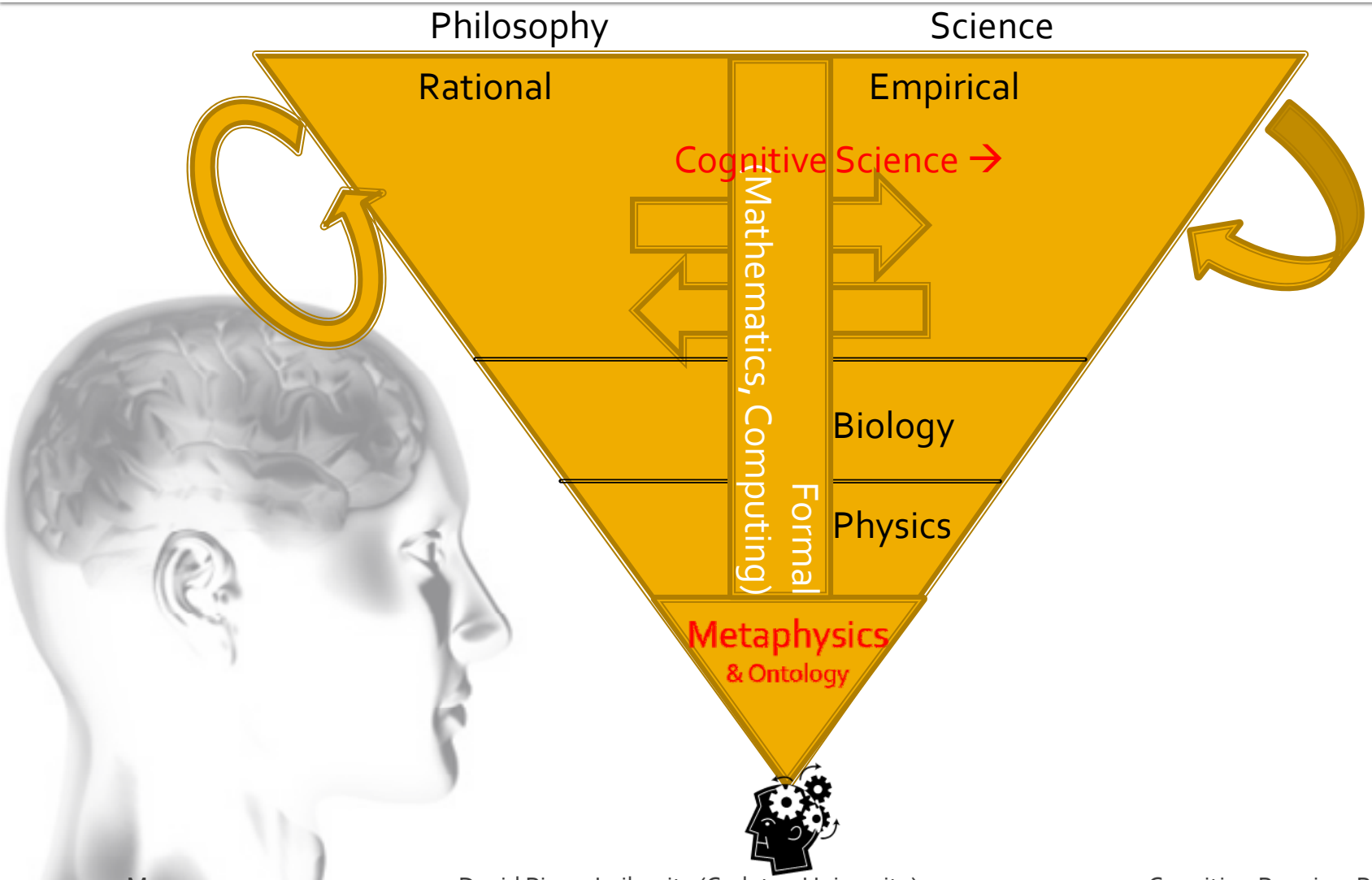
- Process metaphysics unifies substance and atomic change
  - Substances are fuzzy, less than they seem and can become, bego, bemorph and beinteract
  - Macro changes are made causally continuous by looking at micro changes. They are more than they seem. They can interact.
  - Focus is on recursive architectures and emergence
- Many philosophical distinctions based on crisp dichotomies are shown to be false dilemmas
  - Process philosophy is the excluded middle
  - Intentionality disappears as it was the causal baby of process philosophy that was thrown out with the water when crisp substance based approximations were made
- A simpler unified philosophy of mind enables unity in cognitive science

Process Network Example

- Automatically generates missing info
  - blink
  - Optical blind spot
- Continuous Interaction
  - Bottom-up
  - Top-down
- Incremental Learning of Dynamics
  - Not solution
  - No substance (weights)
  - Adaptive
- Incremental Levels
  - Improve accuracy
- No Delay
  - 8 Spreadsheet Columns
- Delay
  - Need Network
  - +Efferents
- Far Predictors
  - Not needed



Philosophy → Science



What can Philosophy do for You? Short Term

- Cognitive Science is in Anarchy
  - An example of runaway empiricism without a paradigm
    - What happens when a baby is born premature with no one to guide
    - In panic mode thrashing everywhere
  - Newell himself suggested that the normal means of science may not suffice and that unification, although required, is a fantasy
  - There are too many detailed and quantitative theories of incompatible and inconsequential surface features to make unification possible or **desirable**
  - Process metaphysics/philosophy can minimize this increase in entropy/anarchy/disorder now
- Normally, a mother would scold such a child, but philosophy does not speak the same tongue and the child will not listen
  - Short term: Philosophy must make itself immediately relevant to and listened by cognitive science
    - Simplify, do not complexify (we are in birthing mode)
  - Process philosophy will help obliterate numerous dichotomies
  - Pay attention to your mother

What can Philosophy do for You? Long Term

- Philosophy of Cognition can more readily unify
  - Simpler, because it is at a qualitative level
  - Does require process philosophy
  - Does require computation tools for philosophy
  - Produces a qualitative unified cognitive architecture – the paradigm shift
- At this point, Cognitive Science can be reborn and start reducing the intangible
  - All hypotheses need to be recast (or start over again)
  - This will be iterative
    - A much reduced philosophy of cognition will speak the same tongue as Cognitive Science
    - Will work for/with cognitive science, rather than being internally focused
- A qualitative computational Cognitive Architecture can be quantitatively extended

Status of Cognitive Science

- Make no mistake. Today, Cognitive Science is nothing more than speculative philosophy
  - It is has not been born in practice
  - It is interdisciplinary in terms of
    - Knowing who the players are
    - Superficially understanding their language
    - Still in the forming stage of group dynamics
  - But not in having a common language – the paradigm shift
    - Need to storm, norm and finally perform
  - Work closely with philosophy
  - Yes, all Cognitive Science products will feed into qualitative models so no need to suddenly terminate your work
    - Do try to direct your work to higher, qualitative concerns, rather than deep technical divides.
      - Start philosophizing – you might come to like it ☺
    - It will help to have a unification eye now

Conclusion - From a Cognitive Science Perspective

- We are a special science because
  - We are premature and must be reborn
  - We come late in the game, and mother has forgotten how to give birth
    - She is now too used to scolding our sisters and arguing with dad
  - We try to reduce the intangible – it has never been done before
    - Must ask mom for help
- Philosophy is important because we all practice it
  - Let's learn to do it well
- Philosophy must simplify so we can understand mom
  - We need our own baby-talk
- Philosophy must qualitatively unify to birth us in practice
- As adults, we must jointly iterate the qualitative to the quantitative
  - With mutual respect and understanding
- We must not forget our elder sister Physics
  - All roads lead through the process metaphysics she has pioneered
  - We'll just use some simpler tricks
- Computers make the worst metaphors, but are formally indispensible

PS.

- Sometimes mother likes to talk in paradox. Often, dad argues in kind. That's when I need to look at the world differently and seek enlightenment. They never tell me how!
- Likely, the same thing is true when mom and dad argue over the same thing for (100s of) years.
- I think they are both Buddhists.

Q & A

Time (pm)	Item
	Part I
1:00	Audience Survey
1:10	Main Talk
2:10	Q & A
	Part II
2:30	Discussion @ Mike's
?	**Sleep…**

Reference or Deleted Material

Pedagogy – State of Affairs

- Cognitive Science is a premature baby
  - Textbooks contain lists of varied approaches and theories
    - Nothing is mentioned of accepted theories
    - Professors that contradict each other
  - Inclusion of Philosophy
    - What other sciences do so for the general students?
    - Not even written for Cognitive Scientists!
- It strives to appear as a (scientific) adult
  - Certainly it does use empirical methods
    - But are these chasing analytical creations?
  - Simplifies the problem
    - Layered reduction vs. complex networks
    - Analysis of individual and approximated parts rather than systems
    - If only we had more compute power!
  - Superficial breadth

Pedagogy - Suggestions

- Two Streams [Tentative]
  - Current Specialized Stream (for majority)
  - Unification Stream (for the few)
    - Detailed breadth and depth
    - Needs a change in how degrees granted
      - Synthesis and breadth not rewarded
      - Possibly a much longer program (with funding issues)
    - All co-supervised with one specific faculty "unifier"
      - Working together on one continual unification project
    - Collocated
  - Work with Philosophy of Cognition to create a unified (process based?) ontology
    - More analogies to computers as the embody the spirit of cognition
- Focus on current critical issues and outstanding problems
  - Less history
  - Possibly taught by dissenting professors simultaneously (or one in science and another in philosophy)
    - Good to know what people do in fact agree upon
  - Actually help us to determine thesis topic
- Focus on bridging work
  - Vs. loose connections
  - Teach how to bridge – an eye on systems thinking
- Philosophy (& Linguistics) taught specifically for Cognitive Science
  - Make it relevant to non-philosophers and non-linguists
  - Students can contribute to edited (online?) textbooks
- Mandatory presentations and attendance every year
- Teach process philosophy
- In progress… To get discussions going

Keywords (Areas Covered)

- Philosophy
  - Philosophy of Science
    - Decomposition/analysis, reductionism, unification/synthesis
  - Metaphysics, Ontology
    - Substance, process, change, action, behaviour, event
    - Stimulus-response
    - Formalism
    - Causality, Relations/Reference, Emergence, Truth
  - Philosophy of Mind
    - Philosophy of Language
  - Theory of Knowledge (Epistemology)
- Cognitive Science

About Me

- I am not a formal philosopher, and likely never be
  - Most of the views/errors expressed will be my own
  - Please do correct/interrogate me throughout!
- In my previous life I was a Computer Engineer
  - Worked on telecommunication management (human machine interaction) software - very complicated systems
  - As senior developer, designer, architect
  - As team and project leader, manager
  - Like to use small circuits & software as grounded thought experiments
- In my new life, hoping to become a Cognitive Scientist
  - Cognitively/developmentally inspired AI
  - Process Metaphysics
- What I **was** fundamentally shapes what (& how) I want to **become**
- Now I'm tired. Please excuse the slightly depressing attitude

Confession

I have a ☺/☹ relationship with philosophy…

- ☹Find it extremely frustrating
  - Why?
- ☺"Feel" it to be important and not ignorable
  - How?

Presentation Purpose

Complaining is not enough…

- Explore the reasons for deep seated feelings from a semi-outsider perspective
- Suggest improvements in philosophical
  - Pedagogy (taught)
  - Content (theory)
  - Application (traditions within and without)
- Energize others about Philosophy

Result Summary

- Philosophy is the most significant aspect within cognitive science today
  - But it must also change with the times
- A change based metaphysics is introduced to solve world hunger
  - Crisp substances are the root cause of all evil
  - But not consciousness and qualia yet
- How it will help/affect you?

Doctor of Philosophy

- We all have a Ph.D., (or aspire to one)
  - So we better darn well know how to philosophize!
- Philosophy is the mother of all science
  - We will investigate the relation between Philosophy and Science
    - Relation between Science of X and Philosophy of X
    - Relation between Philosophy and aspiring Science of X, e.g., Cognitive Science
    - Diminishing of Philosophy and change in tradition
- We all philosophize, or listen to those that do
- We all engage in philosophy every day
  - Investigate explicit (not much) and implicit usage
  - We will investigate how philosophy affects us implicitly every day
    - Implicit impacts (view the world, reduce the world, hypothesize, judge/prioritize/rationalize similar/opposing viewpoints (differences that matter)
    - Computer Metaphor

Problem - Simon

- Herbert Simon (1916-2001)
- [had some quote ??? About hoping to unite symbolic and behaviour approaches ???]

Summary

- Philosophy & Metaphysics
  - Prior to Physics as a Science
    - Rejected Change & Focused on Substance (~500BC)
- Physics as a Science
  - Came to understand Change/Motion/Process well
  - Not accessible to other fields (Cognition & Philosophy)
- Philosophy & Cognition
  - Still based on ancient metaphysics
    - Will discuss negative impacts to both
- (Neo) Process Metaphysics
  - Accessible Formalisms (& tools)
  - Will discuss positive impacts to Philosophy & Cognition
  - How it can help you!

TODO [Summary]

- Analytics vs. reality
- Crisp vs. Fuzzy
- Critique of Philosophy
  - Used to drive all sciences; Now reacting, and inward talking
  - Used to unify; now only differentiate
  - Used to be grounded; now only rational and non-empirical

Philosophy → Science

How does philosophy contribute to Science?

- The mother of all sciences
  - Historical (Birth of a Science of X)
    - Conceptual schema
    - Conceptual change/paradigm shifts (Kuhn)
      - Unification
    - Reduction schema (via metaphysics – not appreciated)
  - Current (Philosophy of X)
    - Clarification (specifying, simplifying)
    - Distinctions that matter (complexifying, new avenues of research)
    - Relating elsewhere (starting Bridging Sciences)
- Rationality
  - Logic and other formalisms, Noticing Fallacies
  - Scientific method (empiricism, falsifiability)

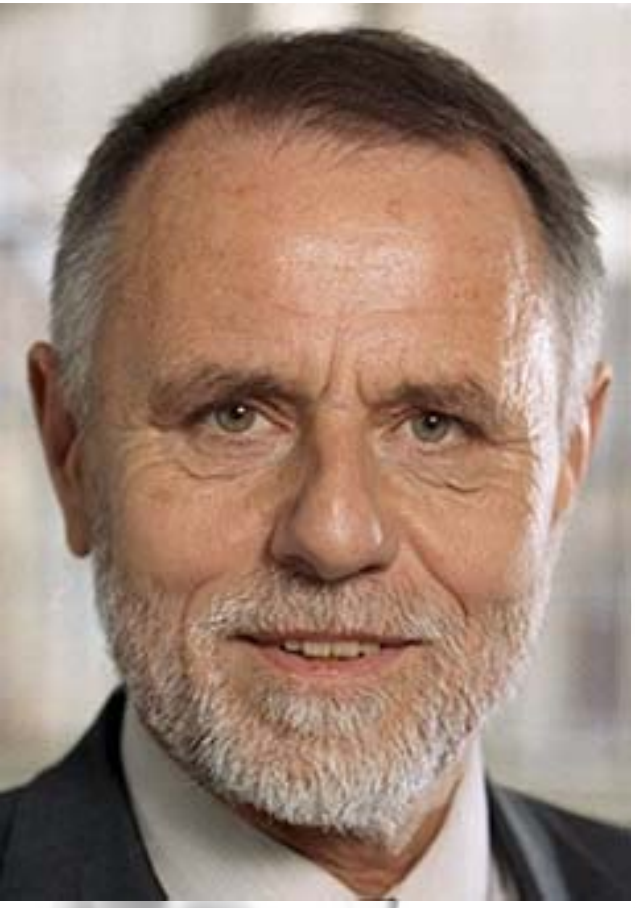
Problem – Newell (1973)

- Allen Newell (1927-1992)
  - 1956: Dartmouth Conference: Birth of AI
- 1973: *You can't play 20 questions with nature and win*
  - Matters become muddier with time
    - [wrong conceptions; chasing surface features]
  - Never-ending series of clarifying experiments
    - [Just like philosophy! → Not yet a (mature) science!]
  - Oversimplified Dichotomies
  - Research model will not "add up"
    - [The hard part is always shifted elsewhere]
  - Suggests
    - Model (invariant) control structures
      - [just as non-integrated today. A baby's mind?]
    - Integrated Systems (for unity)
      - Normal means of science might not suffice!
        - [Understand reductionism]
        - [need new metaphysics]
        - [need breadth]

Problem – Newell (1990)

- 1990: *Unified Theories of Cognition*
  - *Holism/Integration/Unity is a "fantasy" in practice*
  - *Prioritized list of investigation*
    - *Focus on integrative control*
    - *[Who does so?]*
- Today:
  - Just as bad
  - Hundreds of disparate control models (ACT-R, etc) not integrated nor adding up
  - Need a systems approach [but why?]

Problem - Bibel



- Wolfgang Bibel (1938)
  - German AI Founder
- 2000: in "*AI's greatest trends and controversies" (Hearst & Hirsh)*
  - Too many specialized logics
    - [Metaphysical separation of substance and action]
  - Integrated into a "single powerful, and yet uniform system"
    - [Process Metaphysics]