



the supple mind  
and its connection with life

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Mark Bedau  
Reed College

# two clues

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1. all forms of life have “mental” capacities
    - sense the environment
    - behavior contingent on environmental information
    - inter-organism communication
  2. the relative sophistication of these mental capacities seems to correspond to and explain the relative sophistication of those forms of life
    - plants, bacteria, insects, mammals
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# agenda

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- “supple” regularities
    - a distinctive feature of the mind
    - also distinctive of life
      - e.g., edge of disorder law
  - suppleness
    - requires emergent architecture
    - explains misc features of mind
    - shows connection to life
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# exceptions in mental regularities

- **Practical Reason:** If A wants G and believes that M will produce G, then *ceteris paribus* A will do M
  - If A wants a beer and believes there is beer in the kitchen, then A will go into the kitchen
  - **unless** the conversation is too interesting, his mother-in-law is there, the house is on fire, ...
- **Pure Reason:** If A believes P and believes that P implies Q, then *ceteris paribus* A will believe A

# *ceteris paribus* law controversies

- status
  - trivial? tautologous? unfalsifiable? non-explanatory?
- source
  - open systems (hit by truck)
  - idealizations (friction)
  - design implementation malfunction (Fodor)
  - indeterminate effect of competition of open-ended range of conflicting desires (Horgan and Tienson)
  - “a condition of practices which are the condition of the possibility of all rule-like activity” (Dreyfus)

# two kinds of exceptions

- exception to Practical Reason: A wants G and believes M will produce G but does M\*
- rule-breaking exceptions
  - M is more reasonable given A's beliefs, etc.
  - A does the wrong thing in this context
- rule-proving exceptions
  - M\* is more reasonable given A's beliefs, etc.
  - A does the right thing in this context

# supple *ceteris paribus* laws

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1. manifest deeper, context-sensitive regularity
    - **prove the rule** by showing underlying meaning
  2. underlying meaning = achieving some purpose
    - rule breaks because a different means better achieves the rule's purpose
  3. open-ended context sensitivity
    - indefinite number of ways to achieve purpose in different contexts
    - no algorithm for how to achieve the purpose in an arbitrary context
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# suppleness of reason

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- **supple** regularity = manifestation of a deeper regularity about achieving some purpose
  - purpose of **Practical Reason**: our actions should serve our needs and desires
    - *ceteris paribus*, people do whatever is most reasonable given their beliefs and desires
  - purpose of **Pure Reason**: our beliefs should reflect reality
    - *ceteris paribus*, people infer whatever is most reasonable given what else they believe
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# explaining supple laws

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- goals of an explanation of supple laws
    - precise -- specify when *ceteris is paribus*
    - accurate -- no false positives
    - complete -- no false negatives
    - principled -- not arbitrary or *ad hoc*
    - feasible -- consistent with naturalism
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# two traditional approaches

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- common sense

- use *ceteris paribus* clauses
  - imprecise, unprincipled, unfeasible

- expert systems

- predigest contingencies in algorithm
    - brittle (inaccurate, incomplete)
    - openness debars algorithm (unfeasible)
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# explain with emergent model

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- emergent models
    - implicit supple macro laws emerge from population of explicit interacting micro agents
  - central claim: *emergent models are the only adequate explanation of supple laws*
    - argument: compare emergent models in biology
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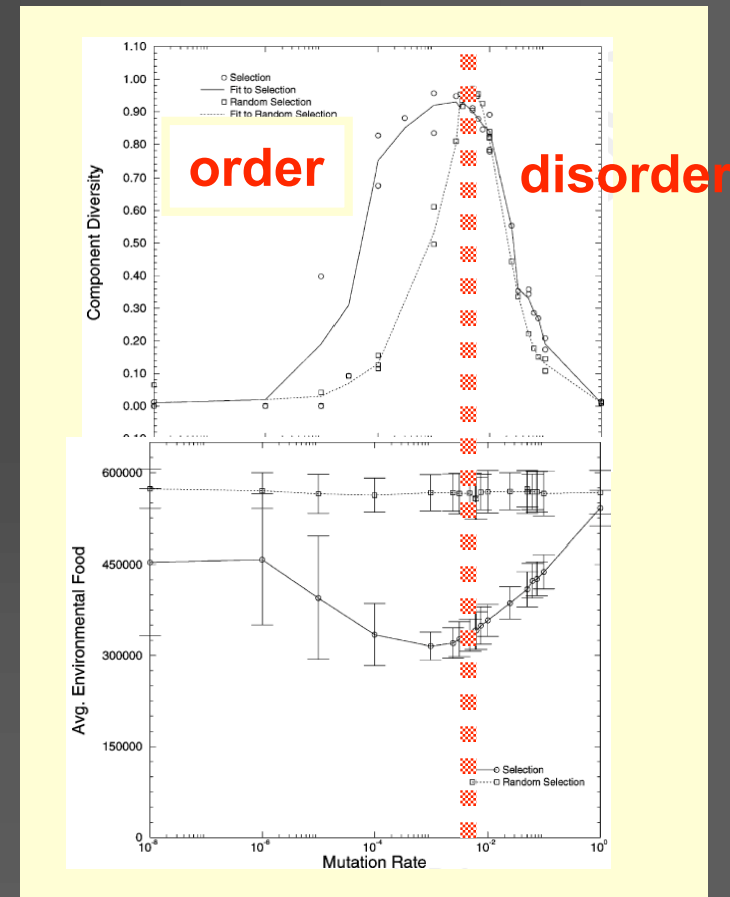
# emergent model: Packard Bugs

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- explicit micro entities (agents, food, space)
    - genes for sensory-motor strategy, mutations
  - emergent macro evolutionary phenomena
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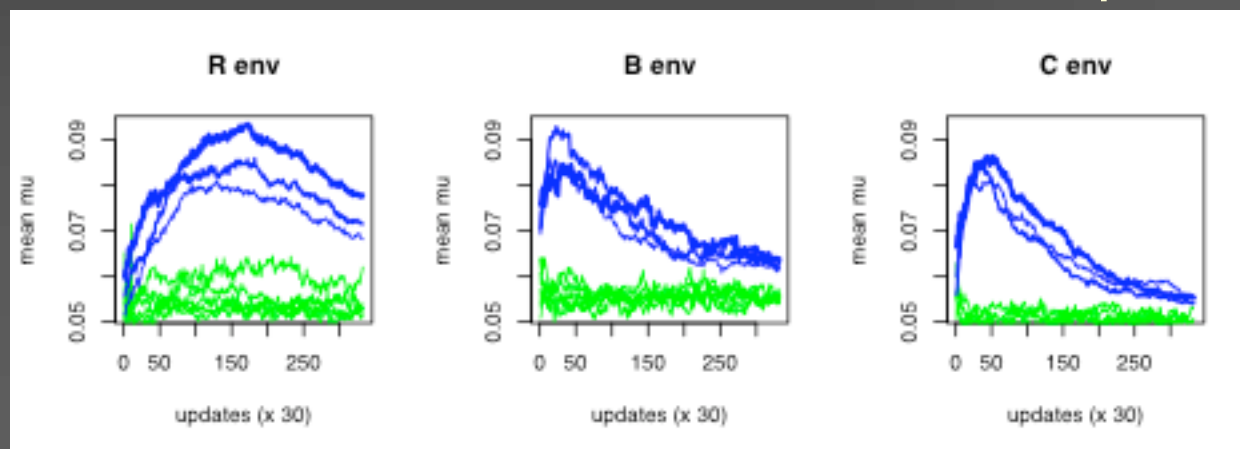
# edge of genetic disorder

- order/disorder phases
- adaptation maximized at edge of disorder
- **hypothesis**: balance memory and creativity
- test: adapt mutation rate



# supple Edge of Disorder law

- mutation evolves *cet. par.* to edge of disorder
  - mutation rates adapt as optimal balance point changes
- **rule-proving**: memory and creativity balanced away from edge of disorder
  - unpredictable how context alters balance point



Buchanan, Triant, & Bedau, Artificial Life IX, 2004

# supple Balance law

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- cannot be explicitly encoded
    - would not be flexible enough
    - can precisely describe only after the fact
  - describe implicitly with emergent model
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# supple mind is emergent

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- premise 1: emergent models are evidently the **only way** to explain supple biology
  - premise 2: supple biological laws are **analogous** to supple psychological laws
    - weakness: “only straw afloat” + analogy
    - want actual model
      - “put your model where your mouth is”
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# suppleness is special

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- unlike other *ceteris paribus* clauses
    - not just malfunctions, idealizations, etc.
    - not just indeterminate effect of competition of open-ended range of conflicting desires
  - suppleness is the **open-ended ability to adapt** to unanticipated circumstances
    - suppleness = supple adaptability
    - supple adaptability is the essence of life and mind
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# explaining the supple law

- cannot state law explicitly and precisely
  - not all exceptions reflect suppleness
    - open system
    - idealization
    - implementation malfunction
    - stochasticity
  - explaining the suppleness is key
- emergent model is an **implicit** explanation

recall other sources

# emergent explanation

	MICRO	MACRO
precise?	yes	as desired
accurate?	enough	as desired
complete?	enough	as desired
principled?	ideally	yes; produced by one model
feasible?	yes	yes

# approaches to emergent models

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- contemporary cousins
    - connectionist networks
    - Hofstadter's fluid cognition models
    - Holland's classifier systems
    - Edelman's neural Darwinism
  
  - similarity: fluid macro dynamics emerge from interactions of simple micro agent
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# contrast with connectionism

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- more general emergent architecture
  - more general learning algorithm
    - no learning vs. application phases
    - no omniscient teacher
  - no human giving meaning to input, output
    - meaning from autonomous sensory-motor loop
  - no stable attractor
    - novel focus: macro dynamical rules evolve
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# picture of the mind

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- **emergent** and **dynamic** mental processes
    - folk psychology emerges
    - rule-governed behavior is supple, not rigid
  - **non-computational** mental processes
    - supple implies non-computational
    - underlying processes are computational
      - computation changes, rules evolve
      - cp. Hofstadter active symbols emerge from computational subcognitive processes
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# emergent functionalism

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- not “mind as software”
    - mind is not computational
    - no explicit definition of pattern
  - mind defined by emergent supple patterns
    - characterize pattern by generative model
    - model is implicit definition, like a grammar
    - mind implies emergent architecture
      - but still multiple realization
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# frame problem

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- = problem of *ceteris paribus* rules
    - rigid, passive rules won't automatically generalize, adapt to changing contexts, swiftly remain relevant
  - solution: active, supple rules
    - not passively following attractor
    - all life forms solve their own frame problem
      - else don't survive
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# Searle's Chinese room

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- Searle's Chinese room
    - problem: how to ground symbol meanings
      - meaning depends on observer's interpretation of input, output
      - machine just does not care
      - also applies to connectionism
    - solution: get a life
      - machine cares about survival, flourishing
      - meaning comes from contribution to way of life
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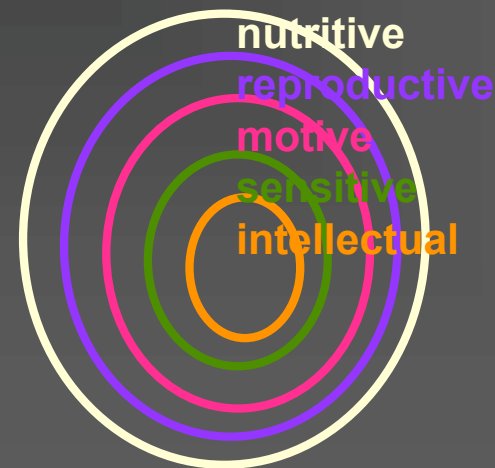
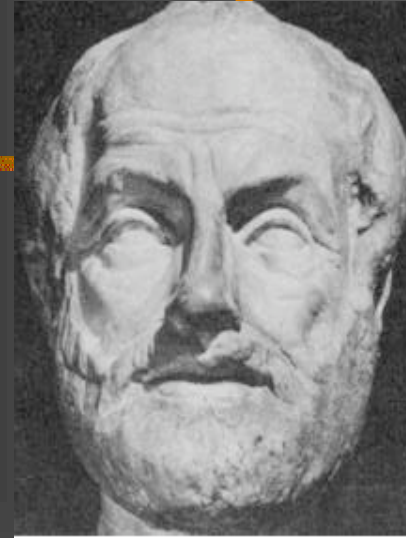
# Dreyfus against connectionism

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- to us the generalizations seem unnatural
  - need ad hoc restrictions for human-like generalizations
  
  - solution: get a life
    - don't judge by human interests but by its own purposes
    - natural selection automatically builds generalizations apt for its way of life
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# Aristotelian view

- a life form's mental activity is the exercise of its soul's capacities and potentialities
- its natural activity = its mental activity



**consciousness**

sensation  
emotion  
desire  
motion  
reproduction  
growth

# our Cartesian legacy

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- Q - why is the life/mind link ignored?
  - A - Cartesian perspective
    - reject Aristotle
    - decontextualize the mind
    - consciousness = mind  $\neq$  life = machine
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# Descartes's near miss

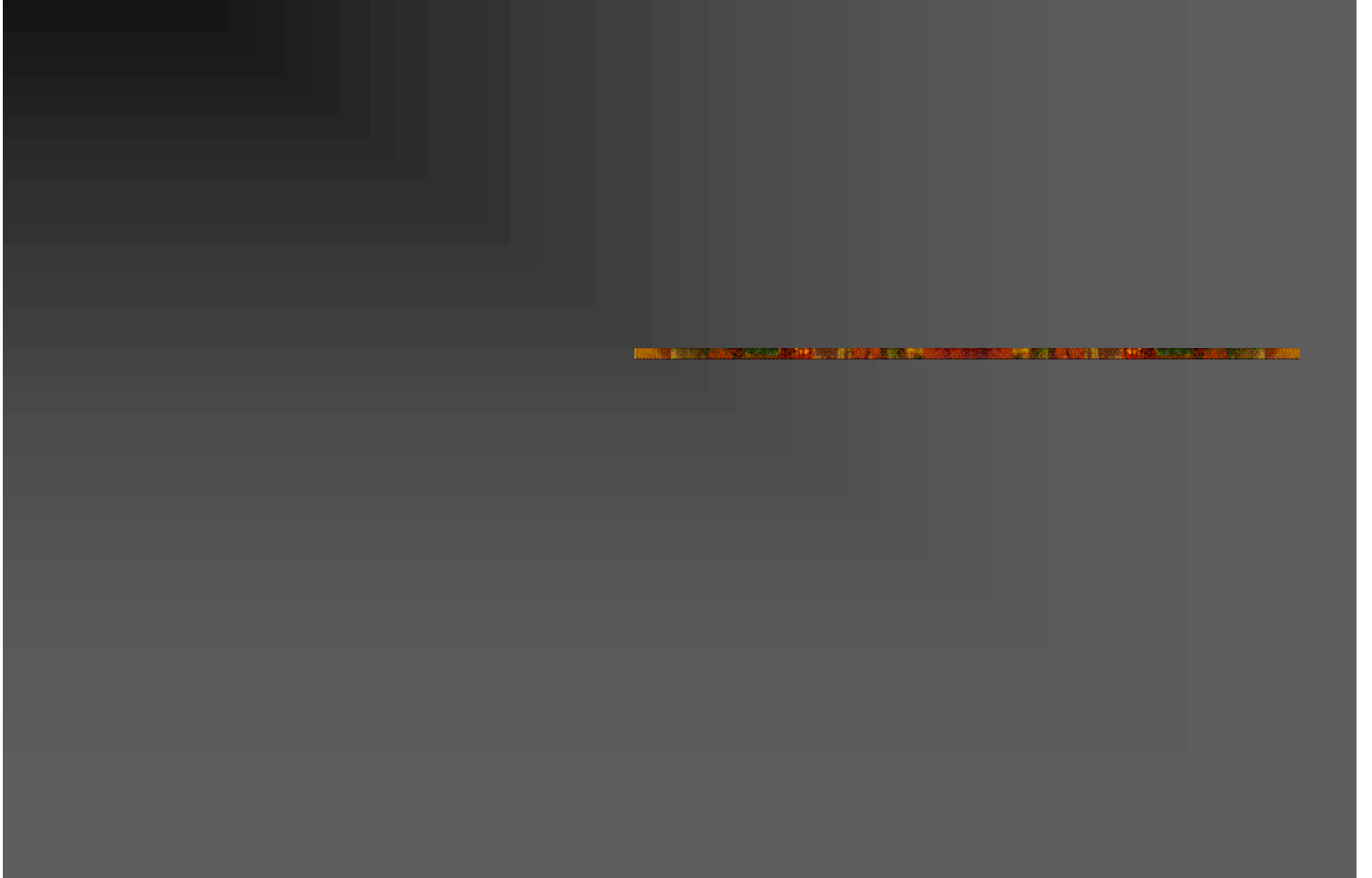
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- "... although [machines] perform many tasks very well or perhaps can do them better than any of us, they inevitably fail in other tasks; by this means one would discover that they do not act through knowledge, but only through the disposition of their organs. For while reason is a universal instrument that can be of help in all sorts of circumstances, these organs require a particular disposition for each particular action; consequently, **it is morally impossible for there to be enough different devices in a machine to make it act in all of life's situations in the same way as our reason makes us act.**"
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# conclusions

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- *ceteris paribus* clauses are a symptom of supple adaptability
    - the essence of life and mind
    - life and mind are essentially the same process
      - biological evolution ~ cultural evolution
  - need to move beyond our Cartesian legacy
    - shatter the Cartesian ego
    - see the mind as supple emergent process
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- goal: explain supple mental processes
  - essential to intelligence
  - difficult to describe and explain
- virtues of emergent models
  - the only straw afloat
  - explains intelligence shared by life and mind
    - Aristotle's picture, not Descartes's picture
    - The psychological activity of a life form is the exercise of the various capacities and potentialities assigned to its soul. A living thing's natural activity just is its psychological activity.



# fundamental claim

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- in principle, supple macro phenomena can be described and explained only as the implicit emergent product of explicit micro phenomena
    - a hallmark of life, a hallmark of mind
    - reflects creative intelligence and adaptability
    - life and mind are deeply connected
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# agenda

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- the issue
  - supple *ceteris paribus* laws
    - in psychology and biology
    - emergent explanations of suppleness
  - implications for psychological models
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# supple adaptability

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- not just any form of suppleness, but **open-ended ability to adapt** to unanticipated circumstances
    - hypothesis: this capacity to adapt is the source of suppleness
    - supple adaptability is the essence of life and the essence of mind
      - life and mind are essentially the same process
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