

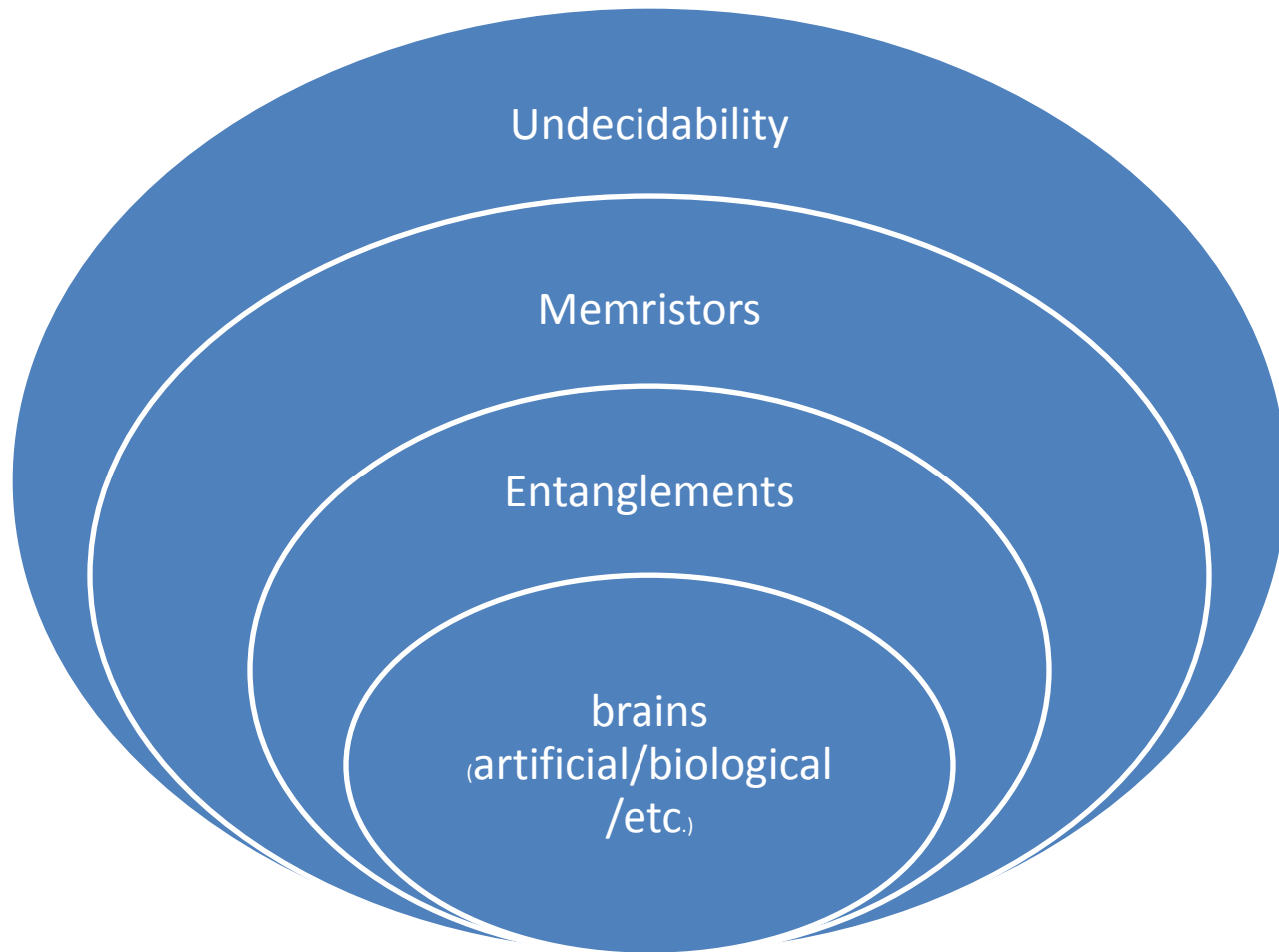
# Zombies, brains, collapsing boundaries, and entanglements

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# Context



# Undecidability

- Jacques Derrida
- the monstrous (zombies)
- life/death
- memristor as a transformative agent rendering machines undecidable
- living/nonliving
- digital/analogue

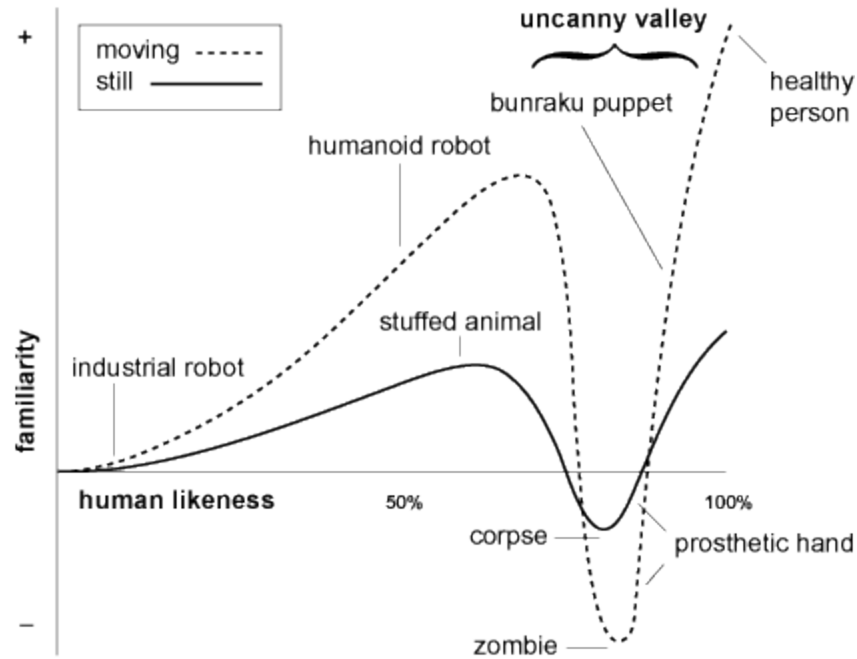
# Philosophy of Derrida

- Both dead and alive, human and inhuman, monsters always threaten the security of our closed economies. Rather than confronting us from the “outside,” the monster, like the *pharmakon*, always shows (monstrare) as a disturbance or undecidability that already resides on the “inside.”
- The philosophy of Derrida by Mark Dooley and Liam Kavanaugh (p. 29)

# Alfred North Whitehead

- No absolute gap between living and nonliving  
(Process and Reality, 1929)

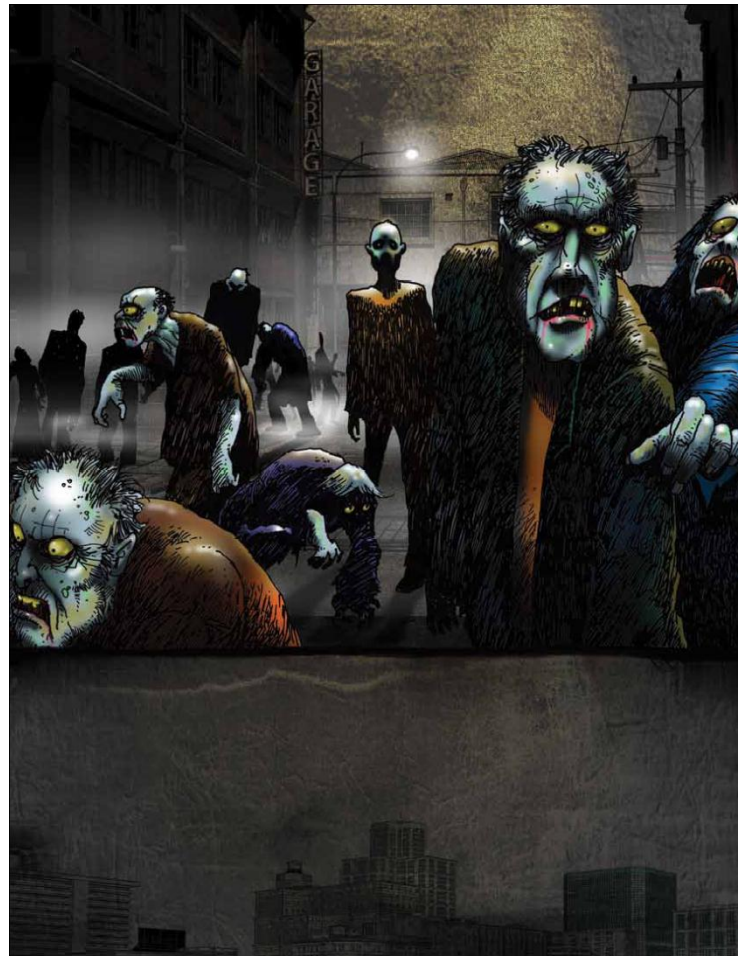
# Uncanny Valley



- From the article on Android Science by Masahiro Mori (translated by Karl F. MacDorman and Takashi Minato)

# Preparedness 101: Zombie Pandemic

US Centers for Disease Control



# Entering the Uncanny Valley



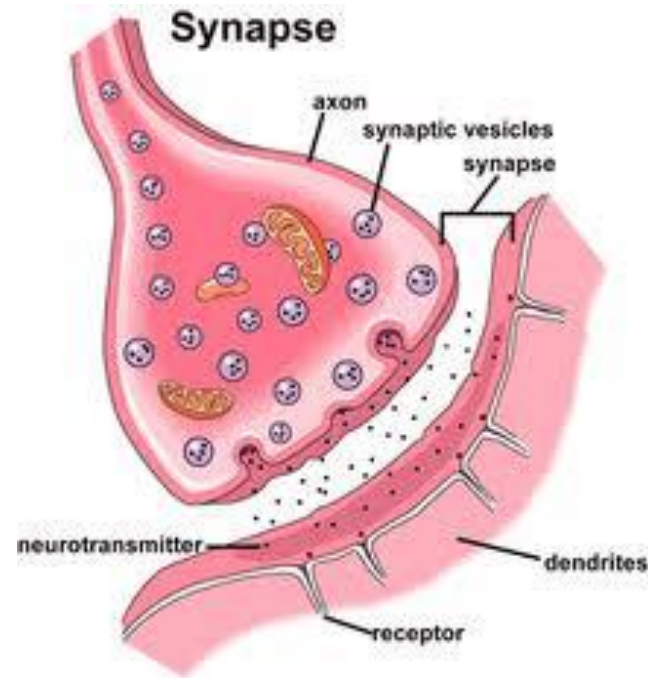


- Henrik Scharfe, an associate professor at Aalborg University in Denmark director of the center for Computer-Mediated Epistemology
- commissioned a Geminoid robot
- to probe “emotional affordances” between robots and humans, as well as “blended presence” (2011)

# Artificial intelligence/Artificial brain

- Standard computing architecture: boolean logic; separation between processing and memory used for a single purpose only as compared to a multipurpose biological brain (since 1960s)
- Memristors/electrochemical atomic switches = emulate synaptic plasticity of a biological brain making possible an artificial brain that learns (multipurpose) like a biological brain (since 2000s)  
(Massimiliano Versace & Ben Chandler 2010 IEEE article)

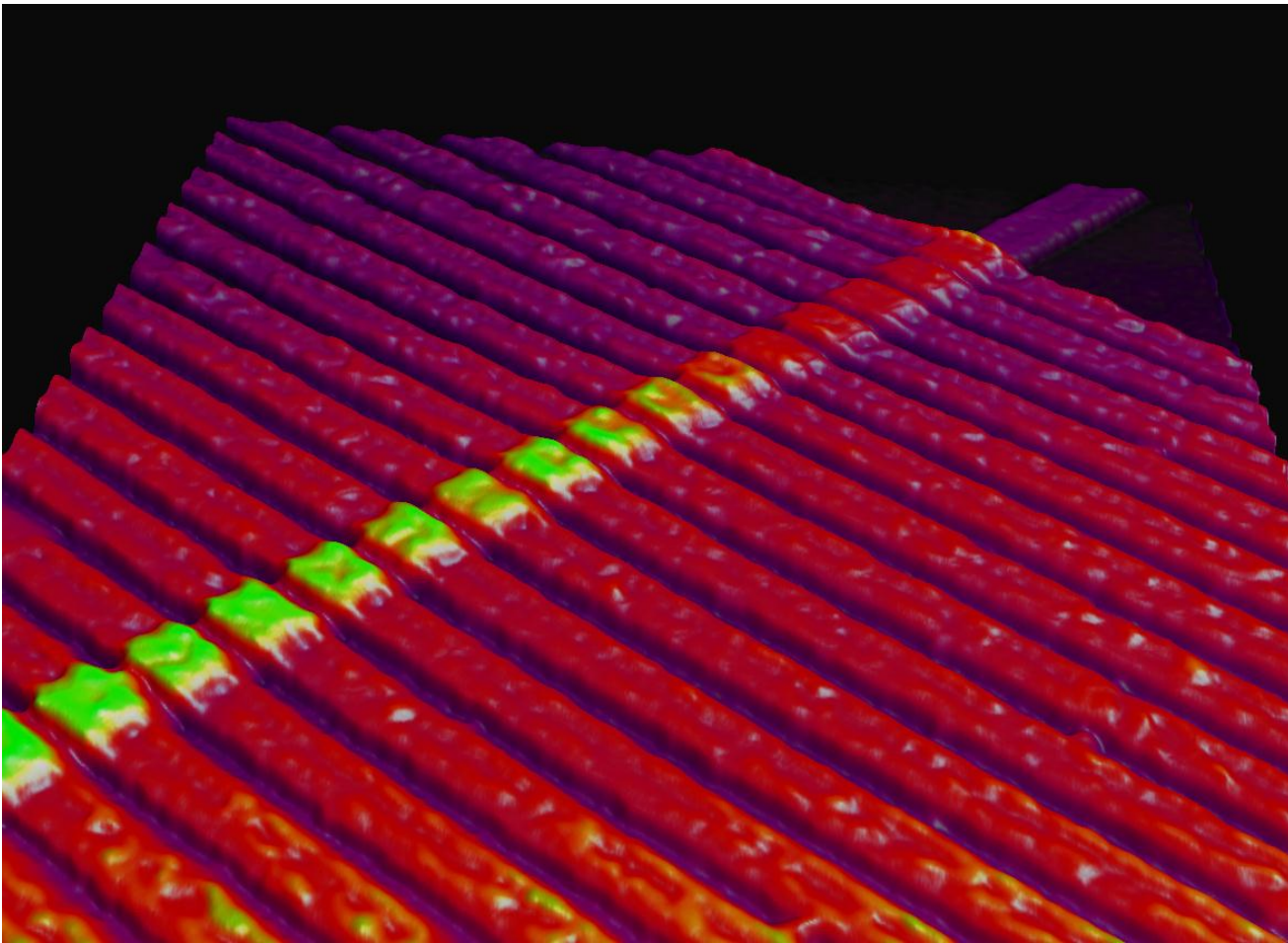
# Bio brain synapse



- March 6, 2007 posting on <http://scienceblogs.com/purepedantry/2007/03/06/neuron-to-glia-synapse-on-axon/> (by NotoriousLTP)

# Memristor

(R. Stanley Williams/HP Labs)



Copyright: HP Labs Credit: R. Stanley Williams

# Circuit Elements (electrical engineering)

- Capacitor
- Inductor
- Resistor
- Memory + Resistor = Memristor (1971), the fourth fundamental circuit element forming a non-linear relationship between electric charge and magnetic flux linkage
  - ‘remembers’ how much voltage is carried and for how long  
= learning & memory
- In 2011, Leon Chua argued for a broader definition: all 2-terminal non-volatile memory devices based on resistance switching should be considered memristors

# Memristor concept is contested

- Stan Williams/HP Labs has argued (along with Chua) that MRAM, phase change memory, and RRAM, should be considered memristor technologies.
- Some researchers say biological structures such as blood & skin should also be considered memristors.
- Others say memory devices under development by HP Labs not actually memristors or memristive systems but part of a broader class of variable resistance systems & a broader definition of memristor is a scientifically unjustifiable land grab to favor the memristor patents of Hewlett-Packard.  
(Wikipedia Memristor essay accessed Oct.14.12)

# Electrochemical atomic switch

- Nanoscale device with a gap bridged by a copper filament under a voltage pulse stimulation = a change in conductance which is time-dependant — a change in strength that's nearly identical to the one found in biological synaptic systems
- Mimics short-term and long-term memory
- Responds to the presence of air and temperature changes: it has the potential to perceive the environment much like the human brain
- (George Dvorsky, June 11, 2012 article for IO9)

# Memristor/atomic switch and neuromorphic engineering teams

- Memristor: HP Labs, University of Michigan, & Boston University
  - MoNETA (Roman goddess of memory) Boston University/HP Labs
  - Wei Lu/University of Michigan/HRL Laboratories
- Atomic switch: UCLA (James Gimzewski) & National Institute for Materials Science (Japan) [Neuromorphic Atomic Switch Networks, Aug. 6, 2012, PLoS]



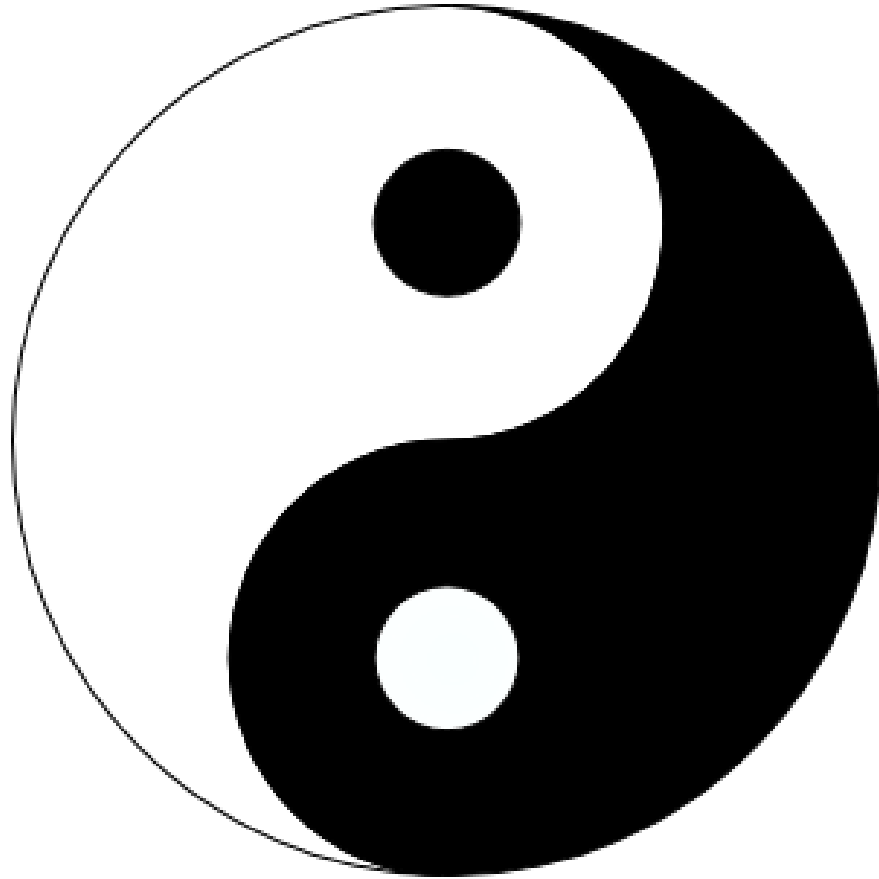
# Setting the stage for boundary crossings

- Memristor
- artificial synapse
- transformative agent
- collapsing boundary between living/nonliving
- biological systems (brains)/artificial systems (brains)
- Sept. 5.11 study published in Nature
  - proteins used to create memristive nanodevice
- leading to undecidability

# Malabou

- Destabilizing the biological brain (neuroscience/cognitive sciences)
  - centrality
  - hierarchy/rigidity
    - central telephone exchange
    - computer
  - plasticity
    - formable/formative
- (Catherine Malabou, What should we do with our brain?)

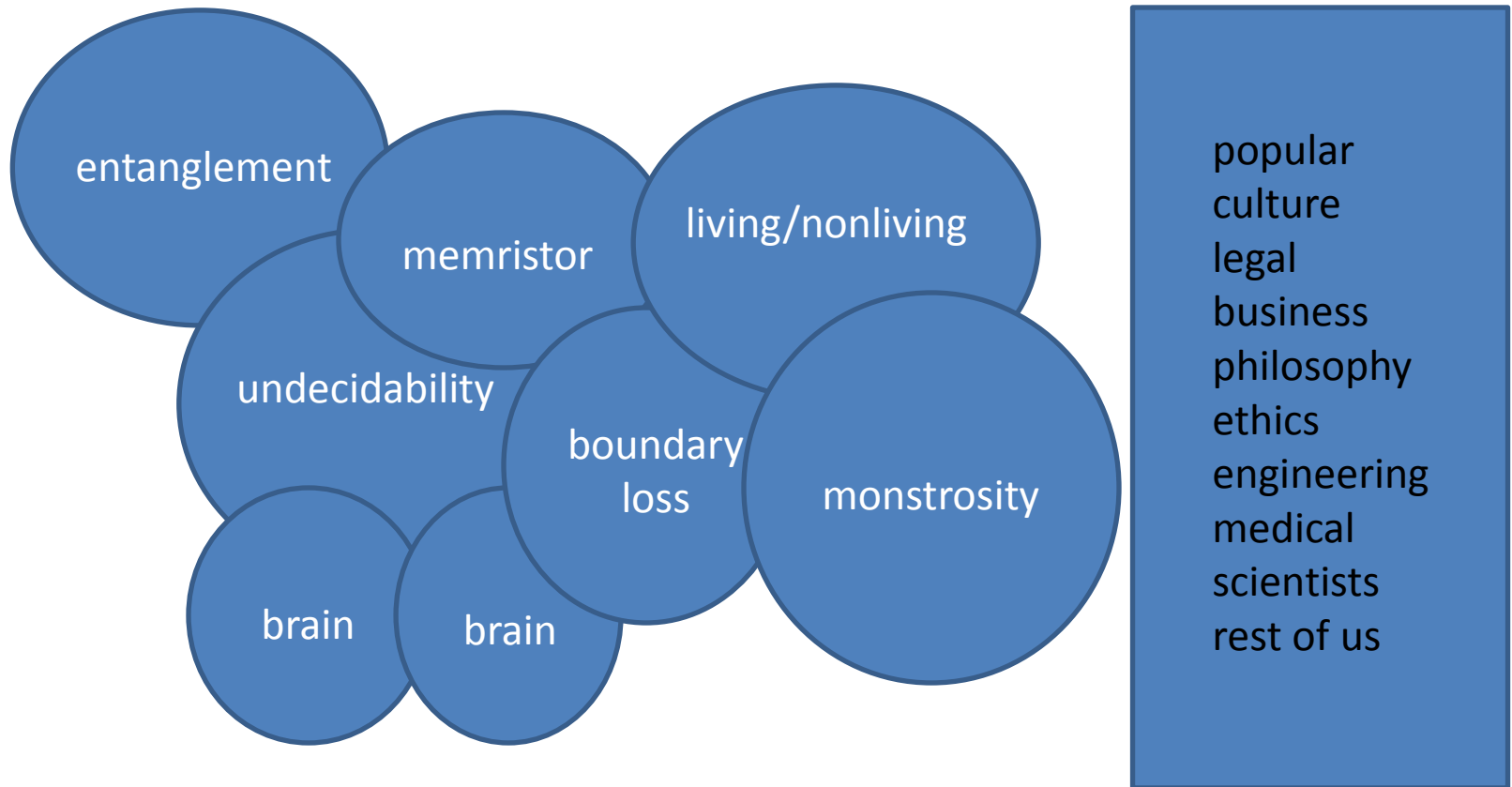
How many boundaries?



# From quantum to cognitive entanglement

- Quantum entanglement: particles (photons, electrons, molecules, and even small diamonds) can be described by the same quantum mechanical state: momentum, spin, etc.)
- Loss of distance, exploded fingertips (haptic/visual; microscopes: optical/haptic)
- Scientists: touching molecules and atoms
  - Microscopes (STMS, AFMS)
- Public: touching molecules and atoms
  - Animations at Disney World (Nanooze Epcot Center)
- (Nanovision by Colin Milburn)

# Nano, consciousness, and evolution



# Thank you

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