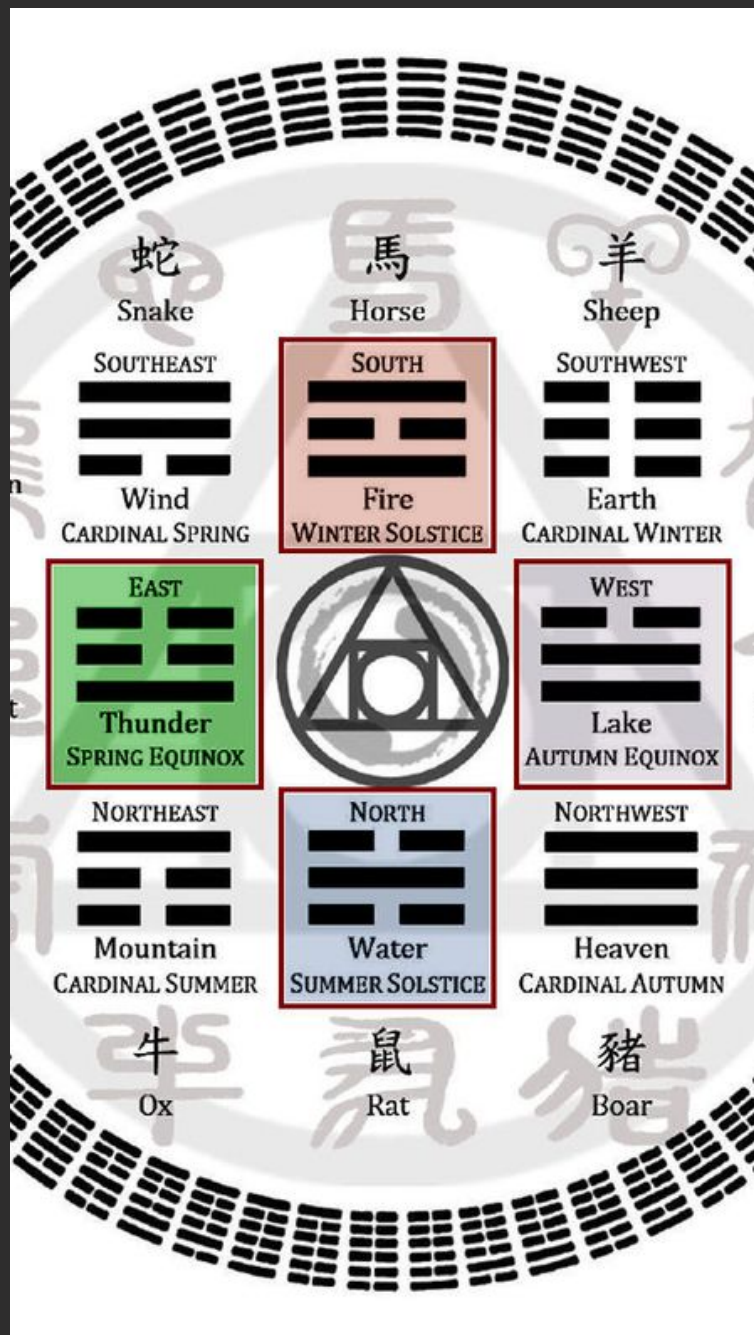


Emergent Digital Ecosystem: Holon and Hierarchy

Presented by
Jintong Yang

Why this topic

- Many digital systems behave neither fully *mechanical* nor fully *biological*.
- They *sense, respond, evolve, reorganize*.



I-Ching



Fractals



Quantum Physics



Neural Networks

【BioMedien】



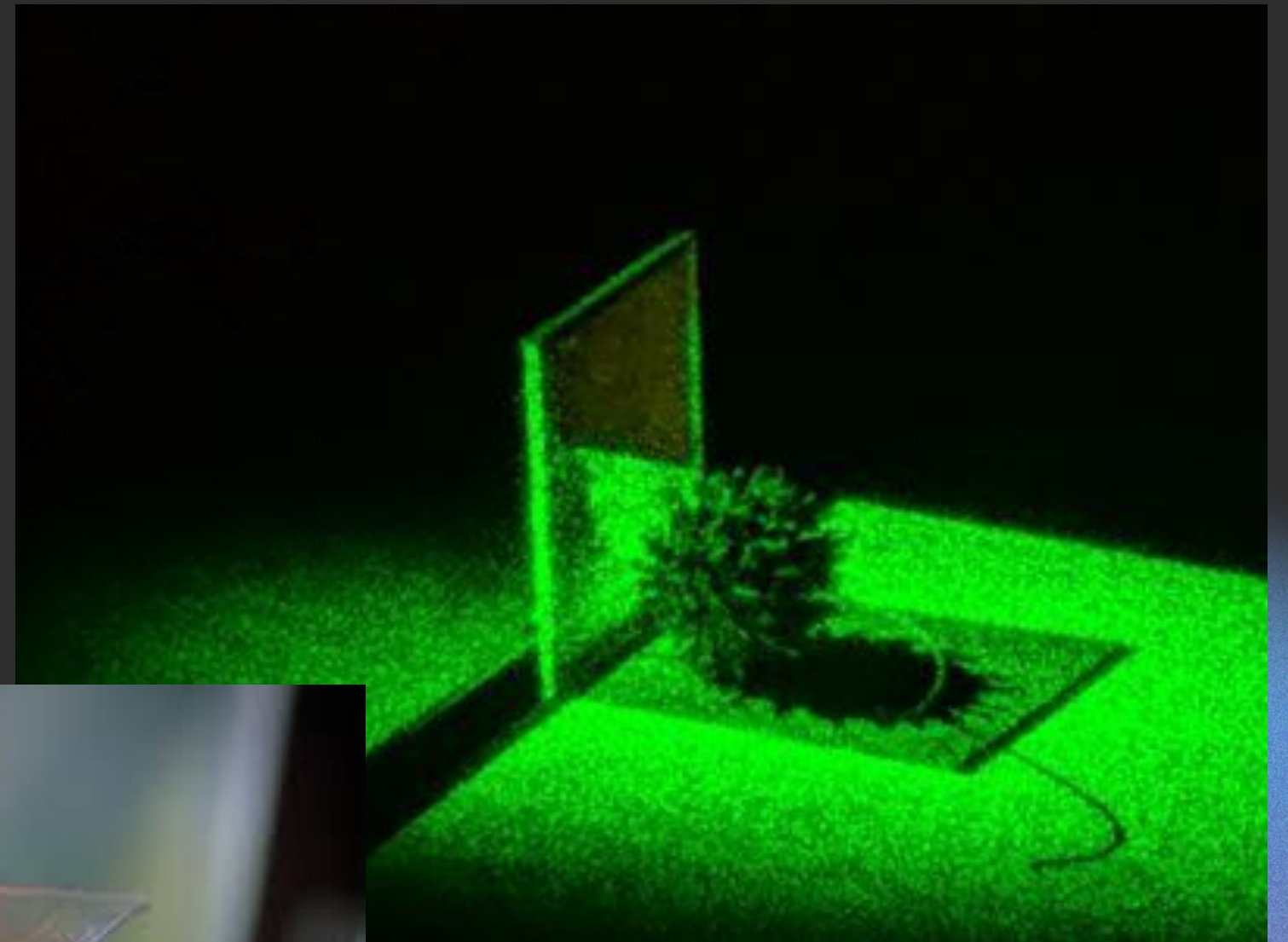
Biomedica (2020)

ZKM | Center for Art and Media Karlsruhe



From Holography to Holon

- Dennis Gabor (1947) — **Holography**
- A light wavefront can store information to reconstruct an entire image.
- In ancient Greek:
 - “holo” = *whole*
 - “-graphy” = *to write*

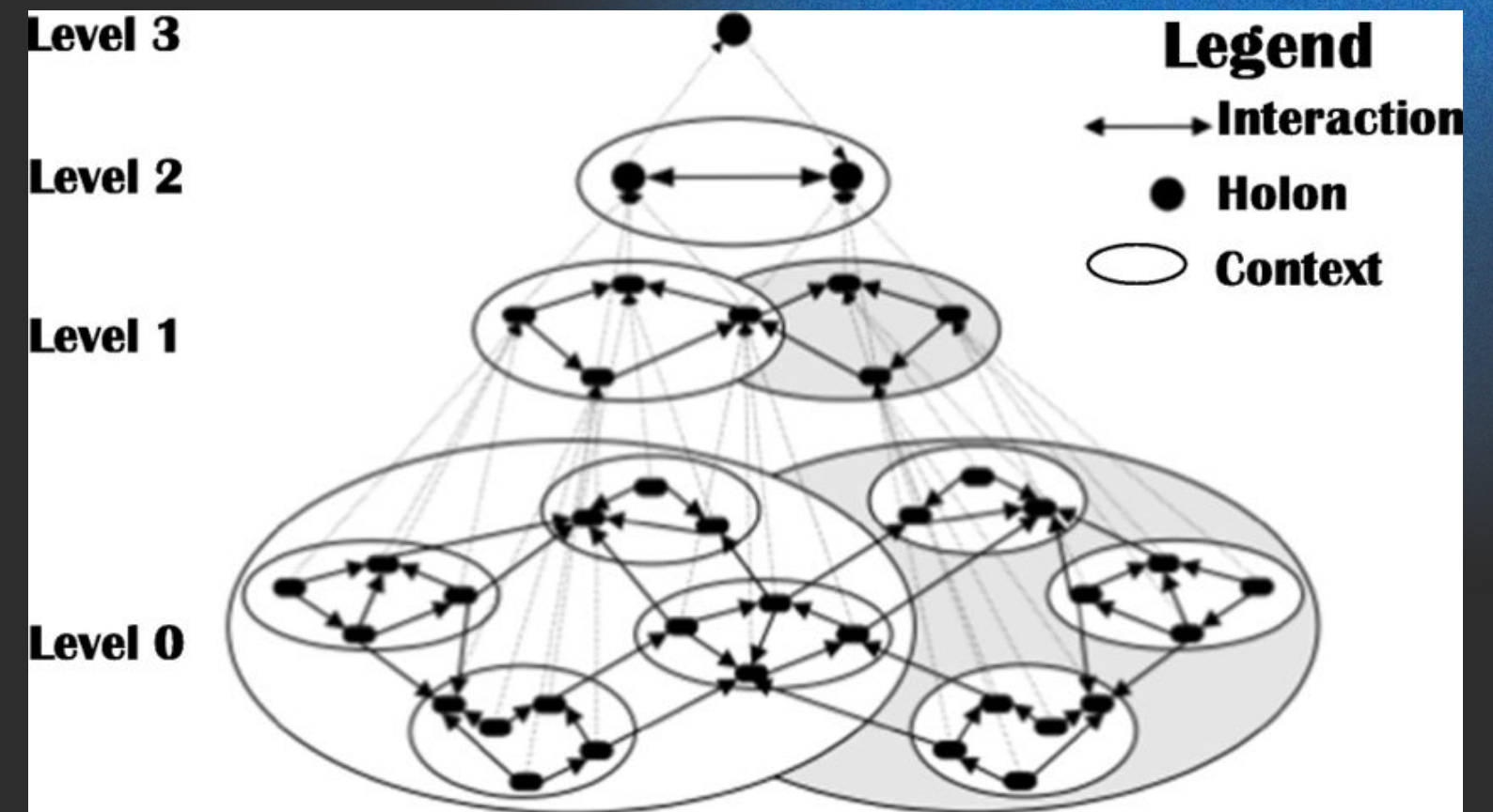


Koestler's Theory: The Holon

- Arthur Koestler (1967) — **Holon**
- *Whole* (“holo”) + *part* (“-on”)
- A holon is both a whole and also a part of a larger whole.

From Holon to Holarchy

- A holon is autonomous but not isolated.
- Internal rules + constraints
 - molecules → cells → organs → organisms
 - agents → swarms → ecosystems
 - neurons → layers → neural networks
- **Holarchy**: a layered system of holons

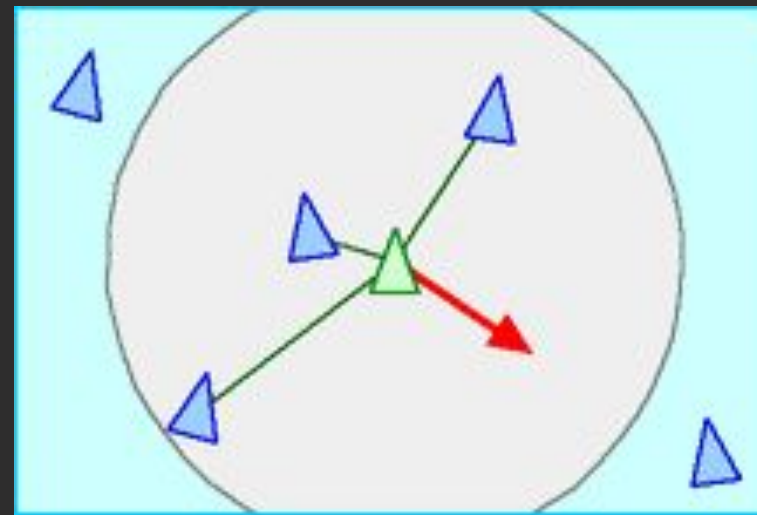


From Holon to Holarchy

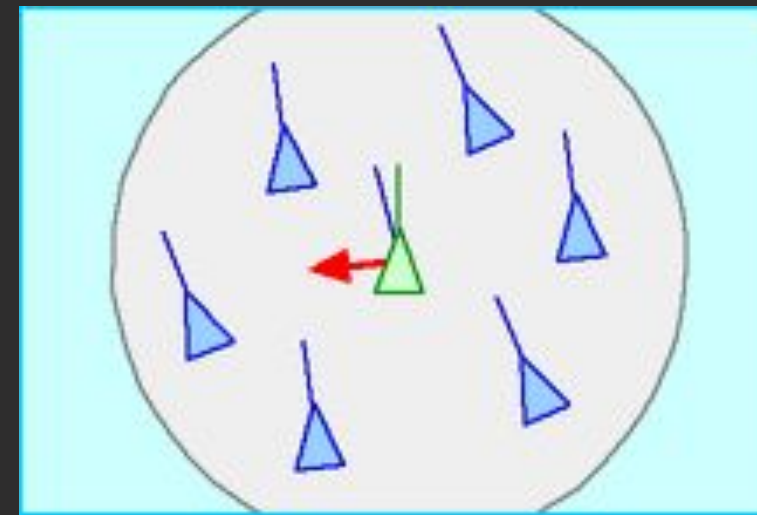
- A holarchy is a **self-organizing structure**
- Complex systems evolve more rapidly when they are organized hierarchically.

Craig Reynolds, *Boids* (1986)

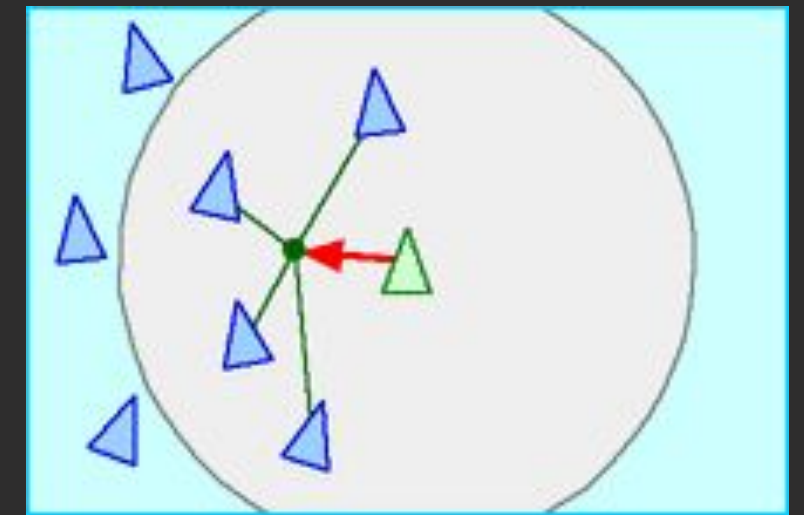
- Artificial life simulation
- Birds flock



Seperation

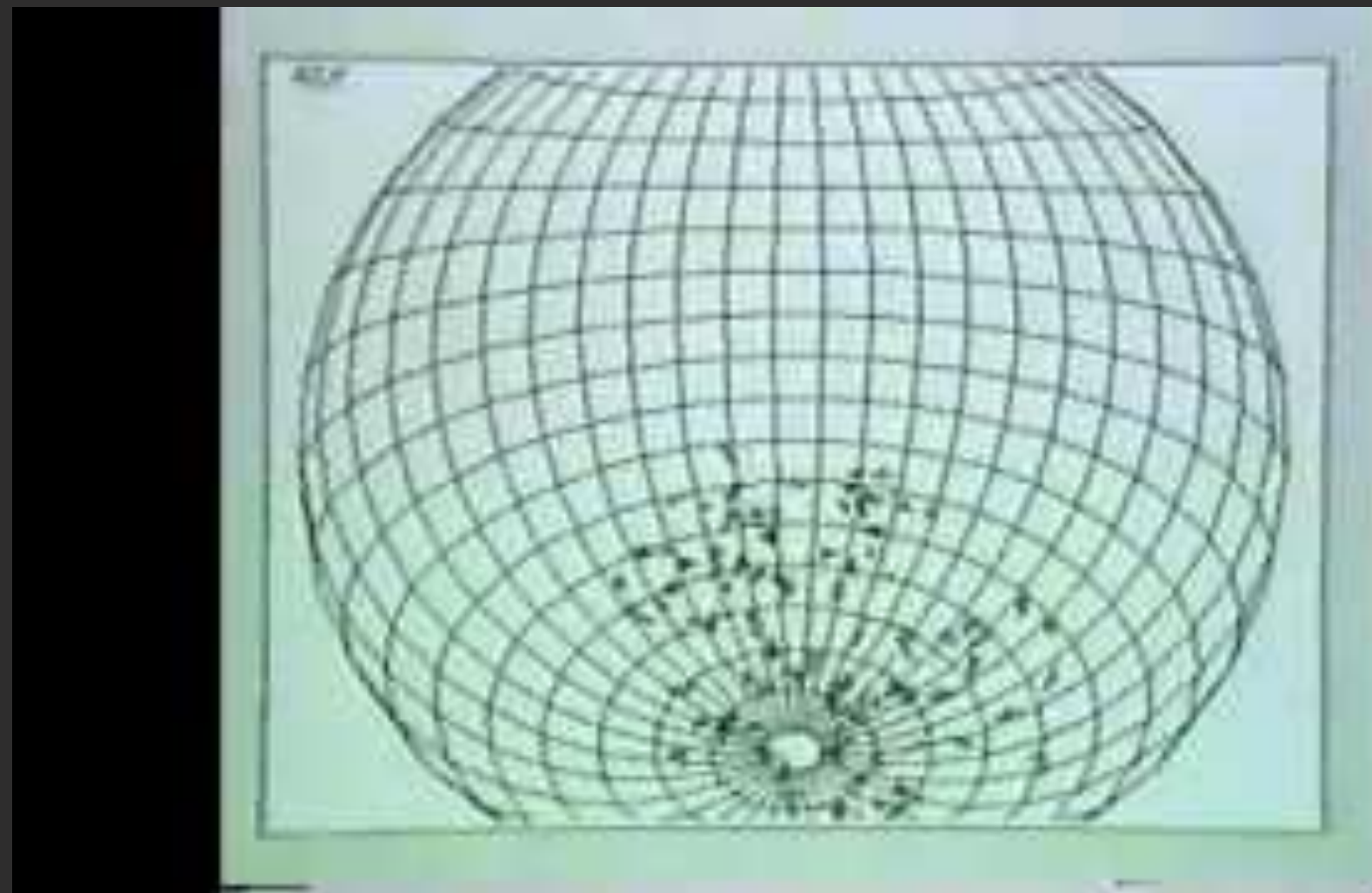


Alignment



Cohesion

- Three rules:
 - Seperation
 - Alignment
 - Cohesion





https://www.youtube.com/watch?v=3bTqWsVqyzE&list=RD3bTqWsVqyzE&start_radio=1

Why Holon Theory Matters in Digital Ecosystems

- **Digital ecosystems**
 - **independent units**
 - The environment **changes, adapts, reorganizes** over time
 - Distributed information, behavior, and decision-making
 - Collective behavior emerges

Why Holon Theory Matters in Digital Ecosystems

- **Emergence**

- Arises from self-organization
- **local interactions → global patterns**
- Media systems → dynamic environments → ecosystems

Why Holon Theory Matters in Digital Ecosystems

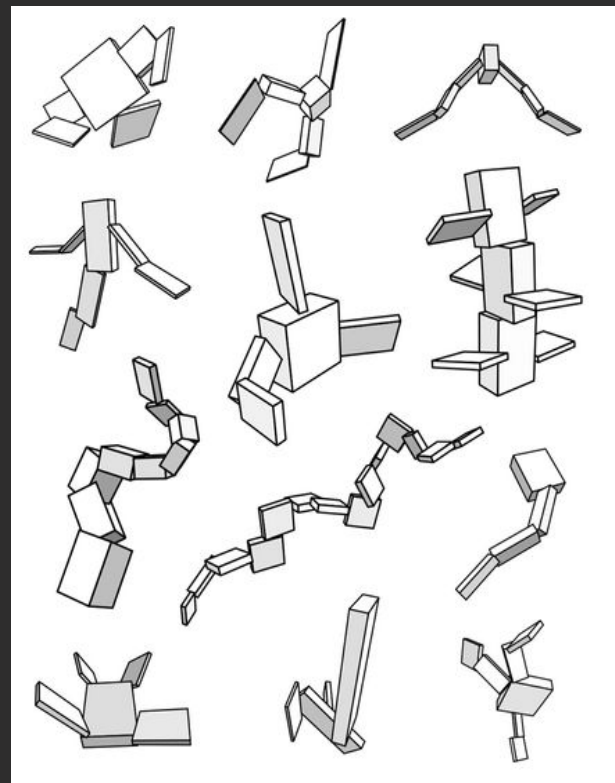
- What makes a system feel *alive*?
- Where does organization come from without central control?
- How do complex digital ecosystems emerge from simple rules or small units of information?



FormSynth Drawing: The Empire of Form (detail). Evolutionary Rule-Based Hand Drawing, Artist: William Latham, 1985-86

Karl Sims, *Evolved Virtual Creatures* (1994)

- Digital evolution + A-life
- *Evolution* → organizing force
- Behaviors emerge through repeated cycles of mutation, selection, and survival.



https://www.youtube.com/watch?v=JBqG_VSP7f8

Rafael Lozano-Hemmer, *Pulse Room* (2006)

- Light bulbs + heart rate + participatory
- *Collective presence* → organizing force
- "Relational media"





<https://www.youtube.com/watch?v=h1i7llwnNCE>

Ian Cheng, *Emissaries* (2017)

- Virtual world + AI characters
- *Emergent narratives*
- “Open systems”





<https://www.youtube.com/watch?v=TO6Luilc4Bo&t=5s>

Conclusion

- For digital creators...
- For audiences...
- Holon & Holarchy — an ongoing conversation

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Thank for Watching

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