The Von Neumann Self-reproducing Architecture, Genetic Relativism and Evolvability

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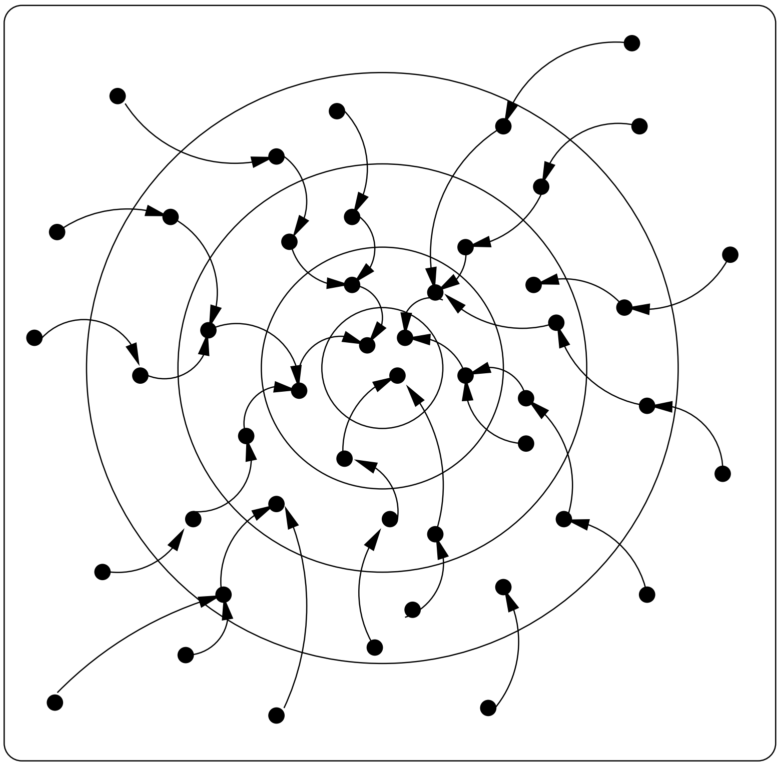
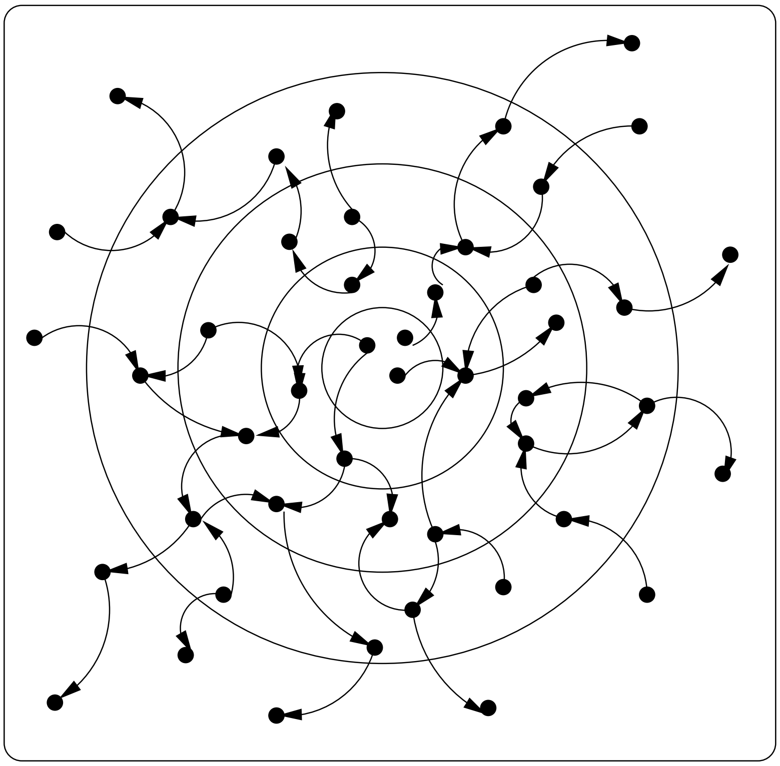
Evolvability—of what?

- *von Neumann's Problem*: How can machines manage to construct other machines more "complex" that themselves, in a general and open-ended way—i.e., with the potential for unbounded evolutionary growth of complexity.

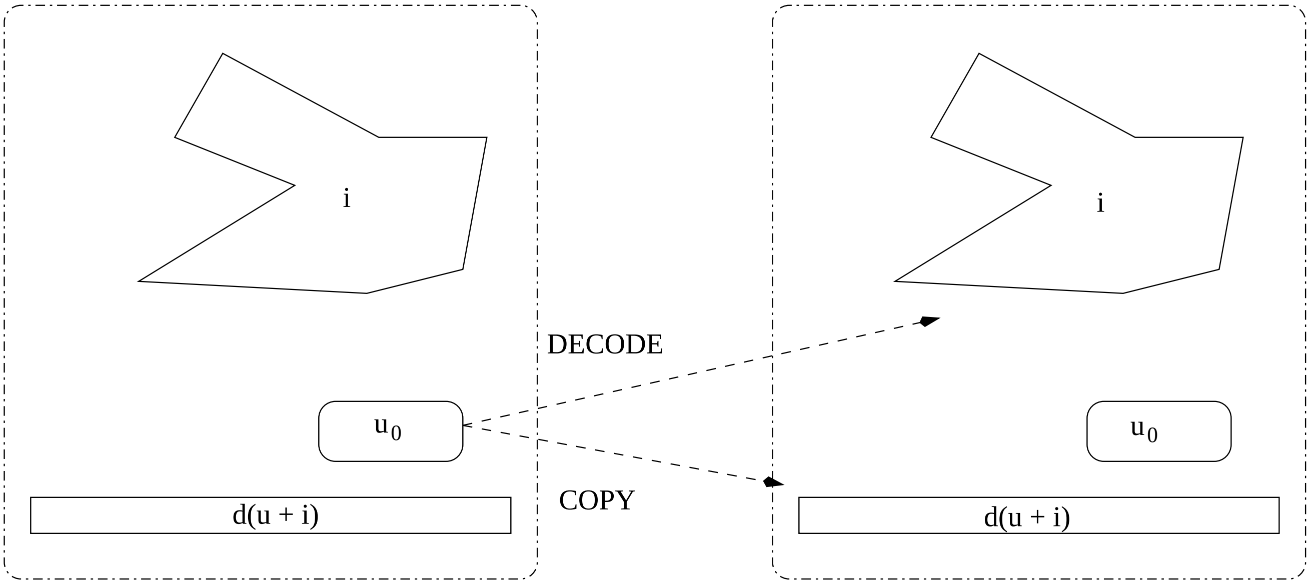
Degeneration of Complexity (Engineering)



Growth of Complexity (Biology)



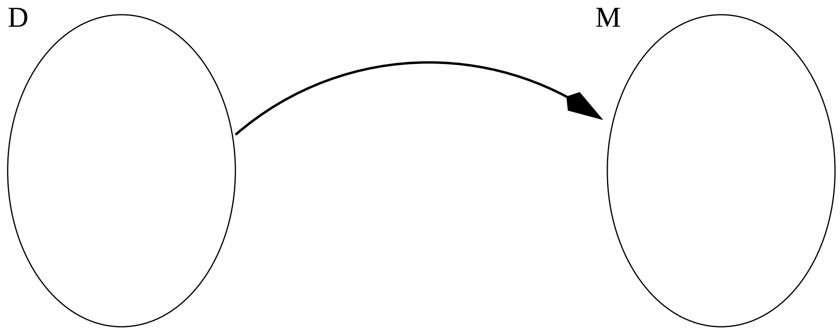
Von Neumann's Solution?
The General Constructive Automaton



$$((u_0 \oplus i) \oplus d(u_0 \oplus i)) \rightsquigarrow ((u_0 \oplus i) \oplus d(u_0 \oplus i))$$

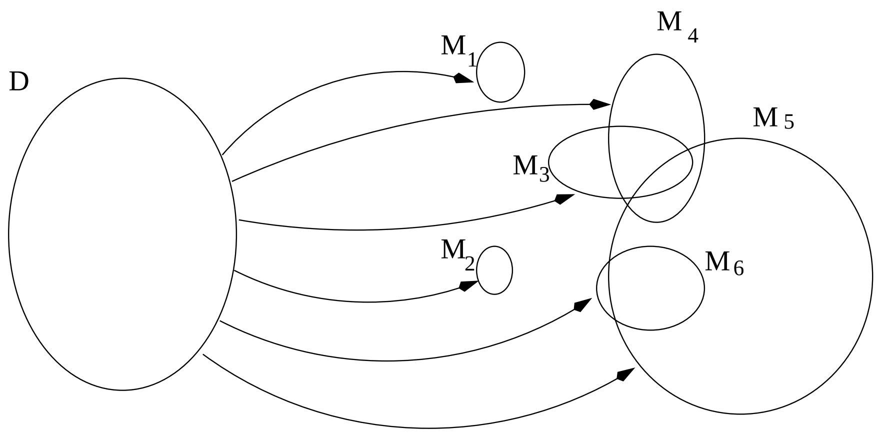
- Common u_0 subsystem: *Genetic Absolutism.*

How General is "General"?



- How "big" is M? (or even D?)
- How "complex" is M?
- However do we get to u_0?

Alternative: Genetic Relativism?



Conclusion

- The "absolute" framework is not *necessary*.
- "General" can start off being pretty "special".
- Alternative networks enrich evolutionary options.
- Biological plausibility.

Related Online Resources

- Full Paper:
  - `http://www.eeng.dcu.ie/~alife/bmcm-2000-02/`
- DCU Alife Laboratory:
  - `http://www.eeng.dcu.ie/~alife/`
- Research Institute for Networks and Communications Engineering (RINCE):
  - `http://www.rince.ie/`

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