

Physical implications of computational complexity

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ProtoLife Inc, San Francisco

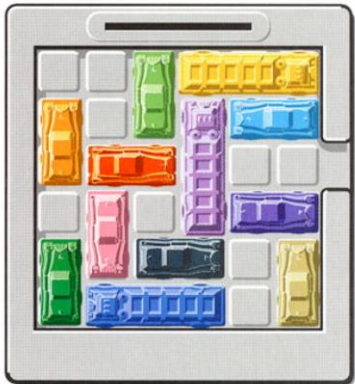
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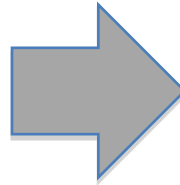
- Consider *kinetically constrained models* from physics as prototypical examples of Embodied Artificial Evolution
 - Microscopic elements that are spatially extended, and are constrained not to overlap
 - Example: the rush hour gas:

RUSH HOUR[®]

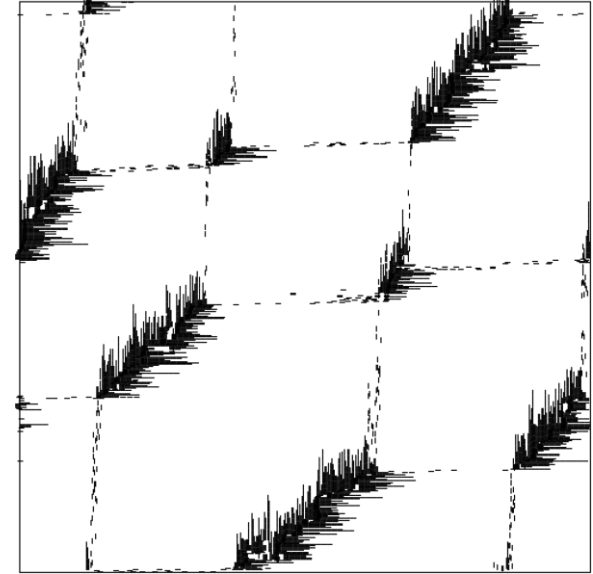
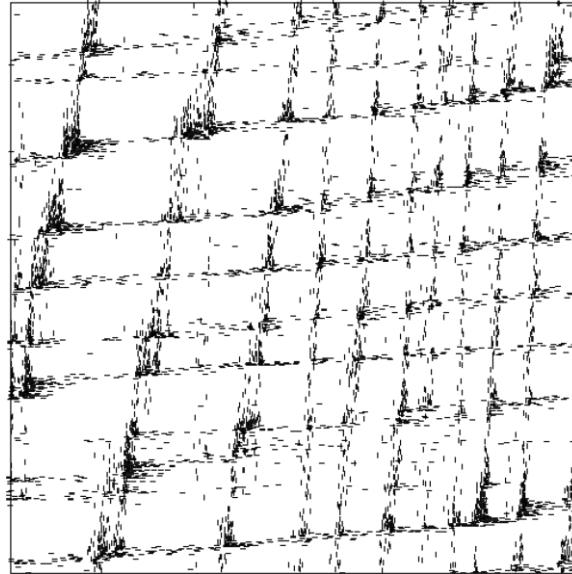
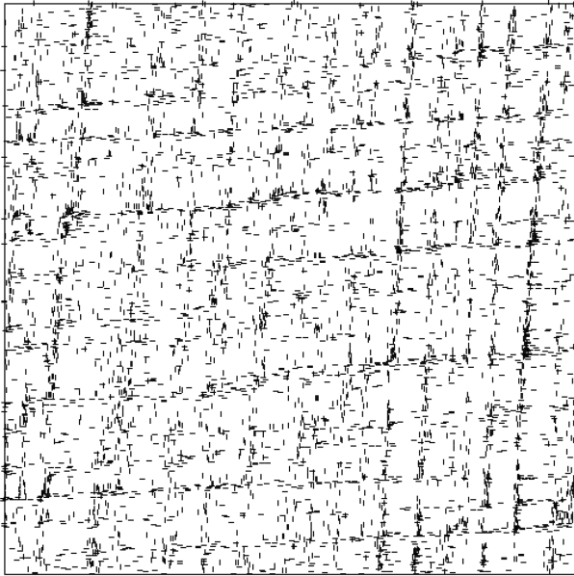


Rush hour =
children's puzzle

Computational
complexity =
PSPACE complete



When forced out of equilibrium, macroscopic patterns emerge:



⇒ Emergence of Body?

Pressing questions:

- How can microscopic interactions and boundary constraints be engineered for particular macroscopic patterns?
- What is the relationship between the computational complexity of microscopic interactions and the structuring of macroscopic patterns?
- What are the thermodynamic laws governing the emergence of patterns (relating energy gradient, entropy production, etc.)?