materials selection

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Ames Laboratory
Simulation, Modeling, and Decison Science

materials s design on

Richard LeSar ark Bryden

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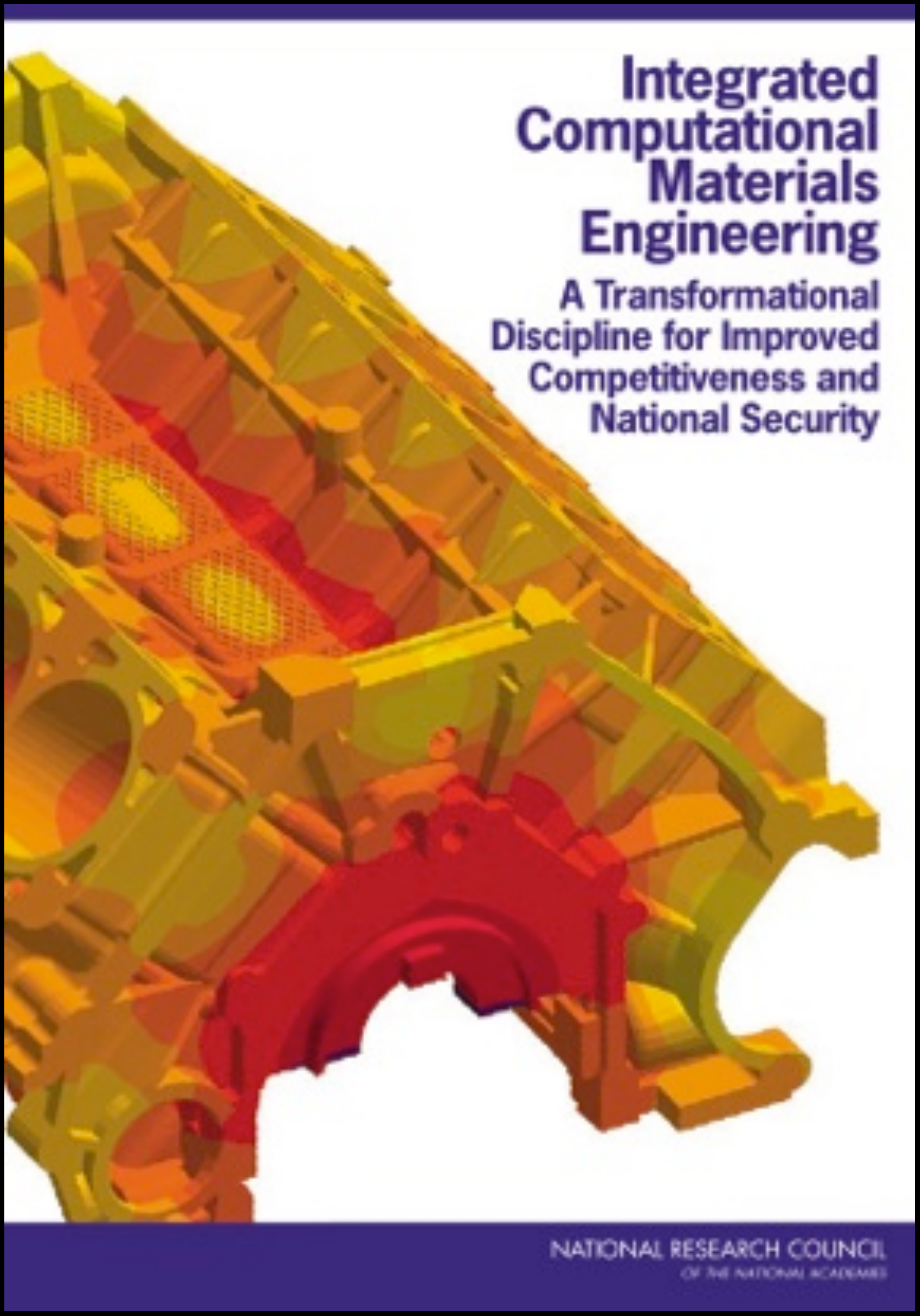
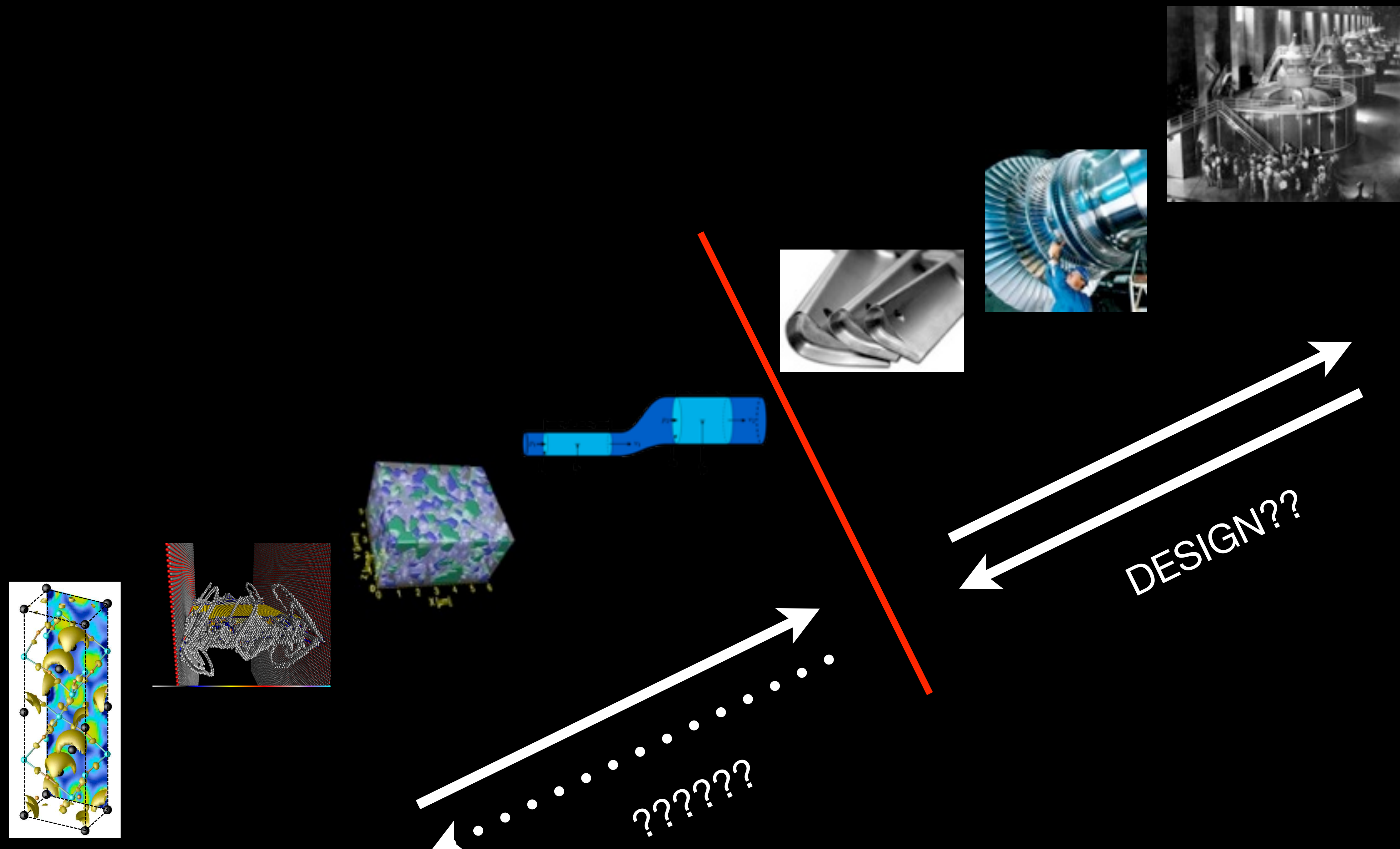


a new paradigm

a marriage of experiment, m… …imulation,
information sciences and design

design

the materials challenge



three big questions ...

- what is the nature of multiscale design?
- how we mathematically represent multiscale systems?
- how do we interact with multiscale systems?

- quantitive information
- qualitative information
- metaphor
- narrative

the nature of multiscale design

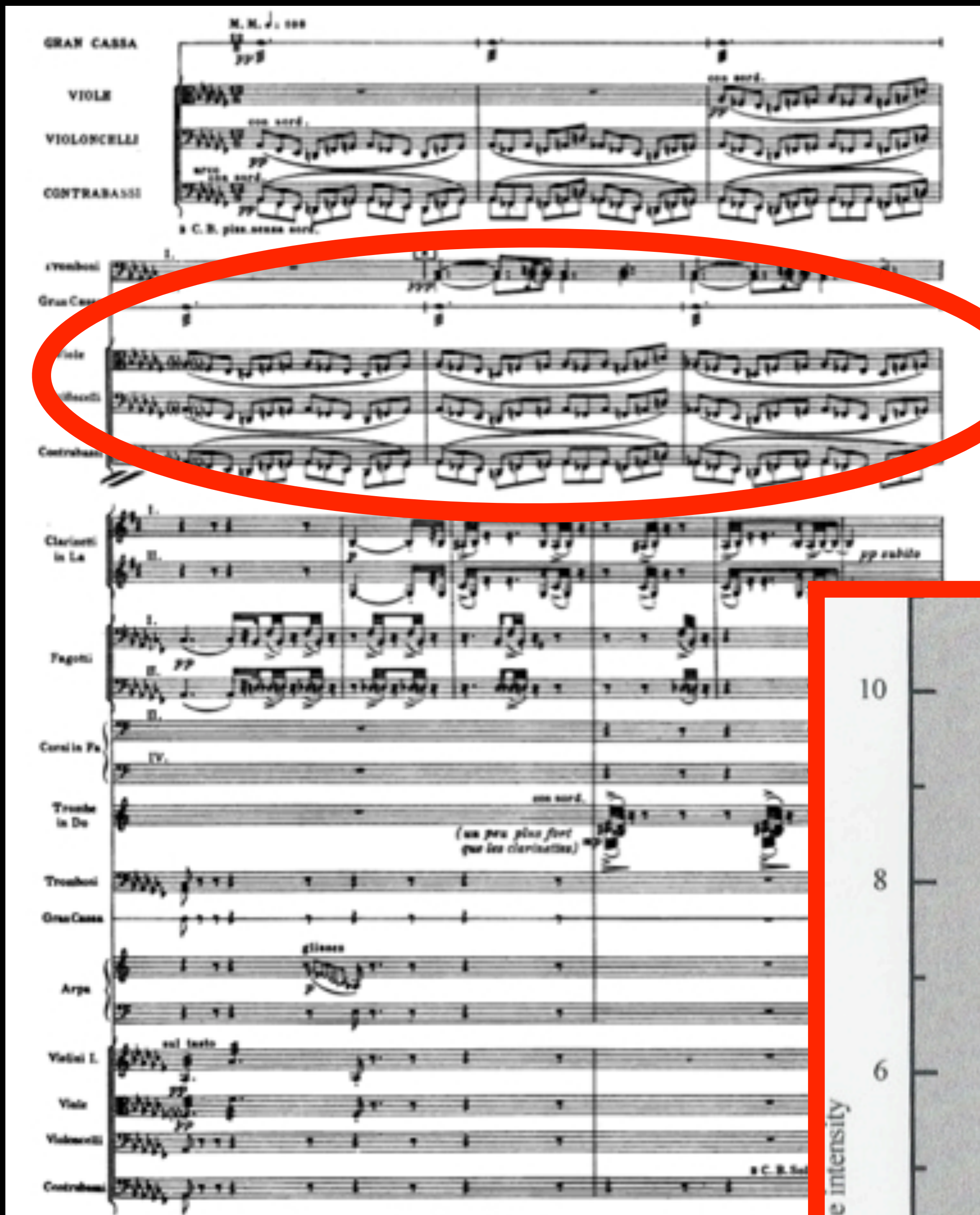
narrative

“Plot, then, is the first principle and, as it were, soul of tragedy, while character is secondary.”

- Aristotle, Poetics VI

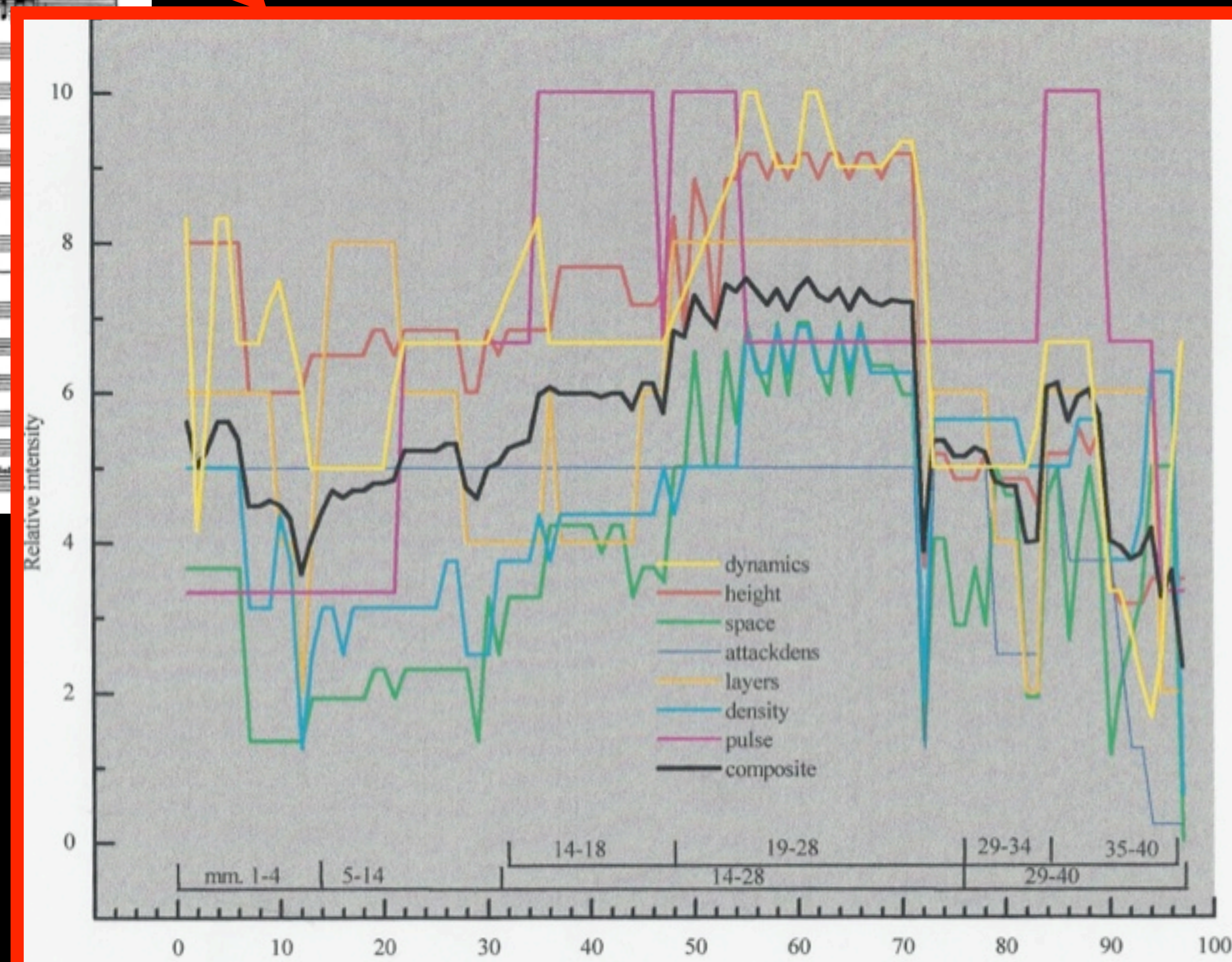
nature of multiscale information and objects

- music
- the “PORS” problem
- origami
- digital manufacturing



"What delivers me from the anguish into which an unrestricted freedom plunges me is the fact that I am always able to turn immediately to the concrete things that are here in question."

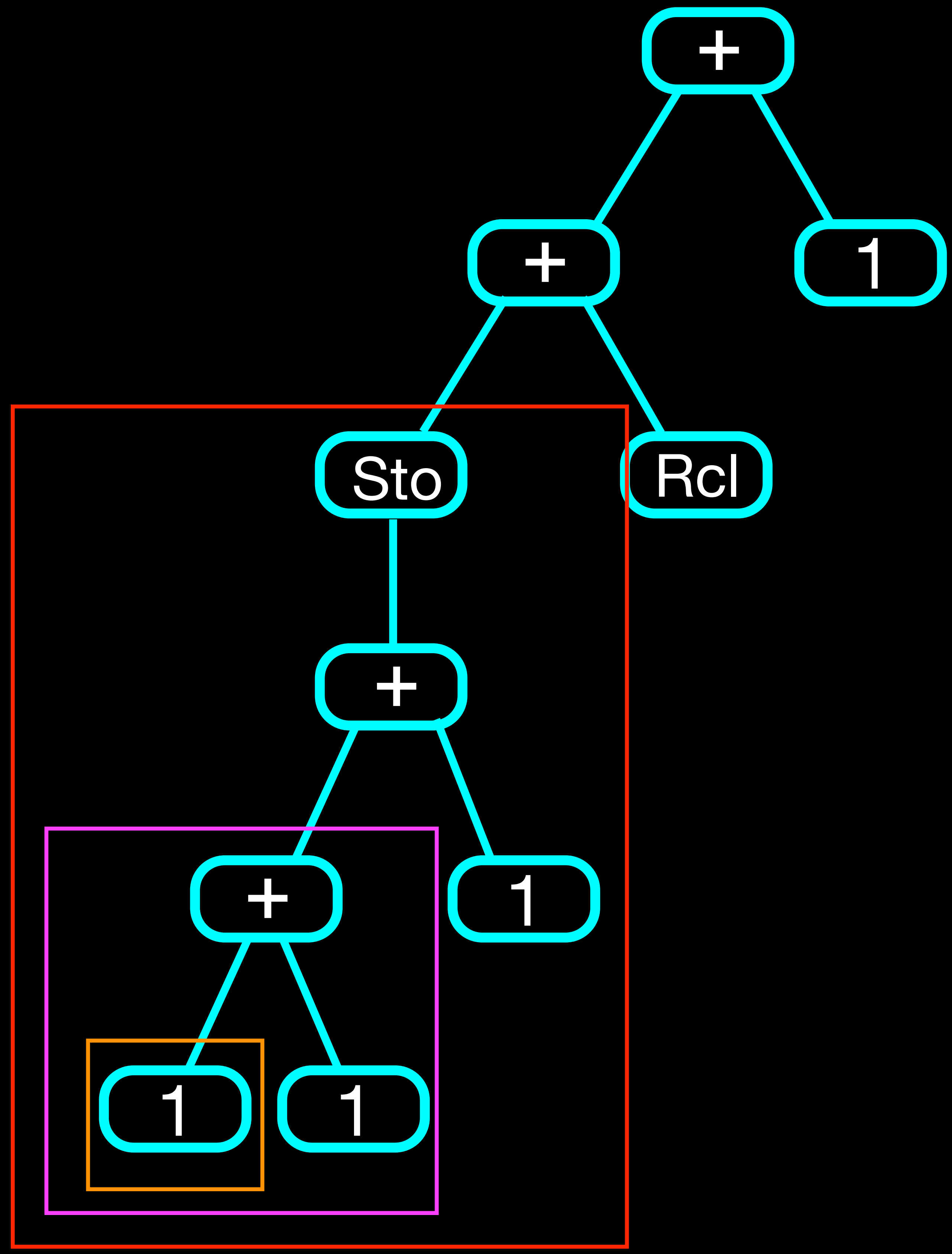
I. Stravinsky



PORS

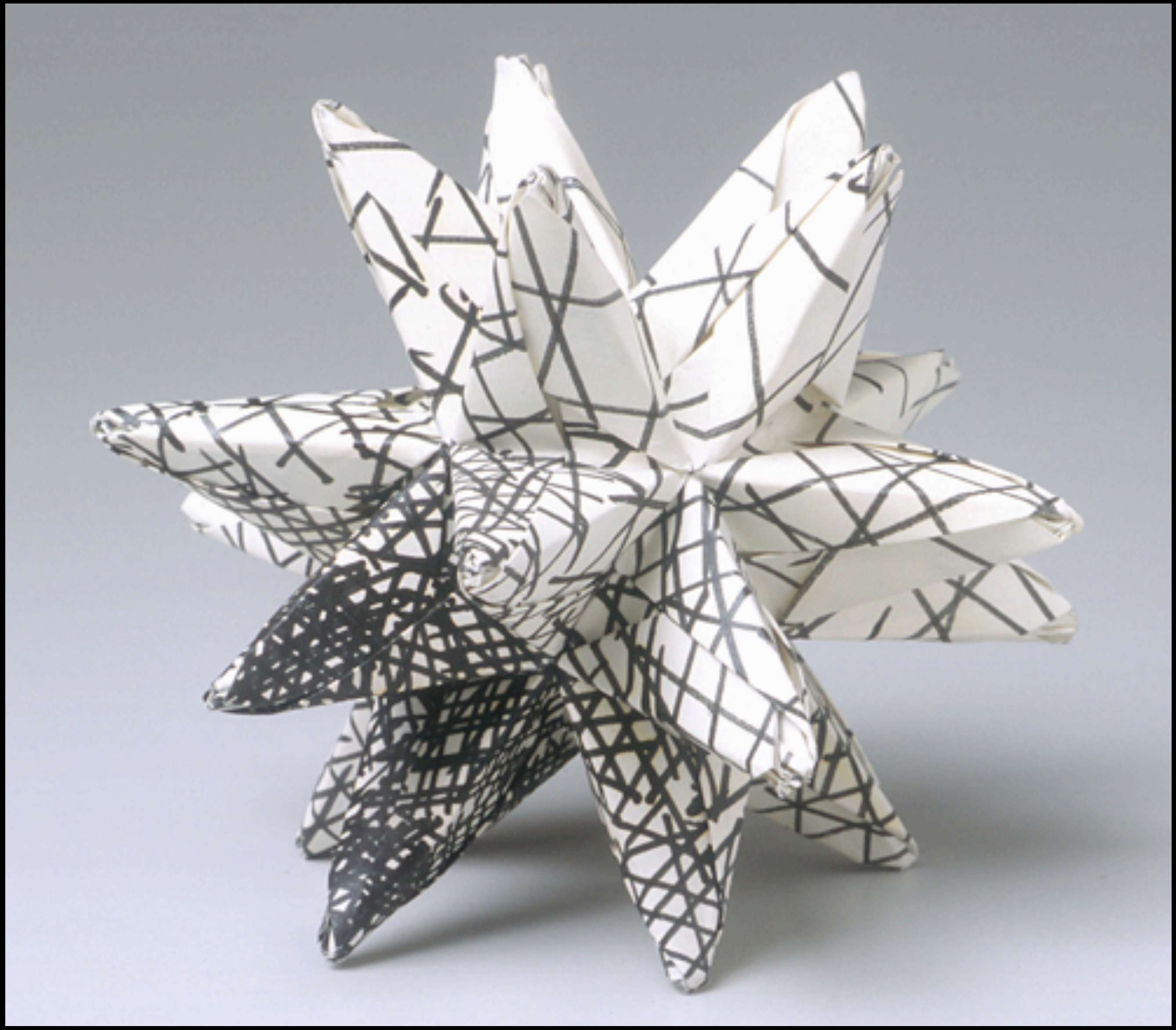
1+1+1(sto)+(rcl)+1

=7



a hierarchy of scales

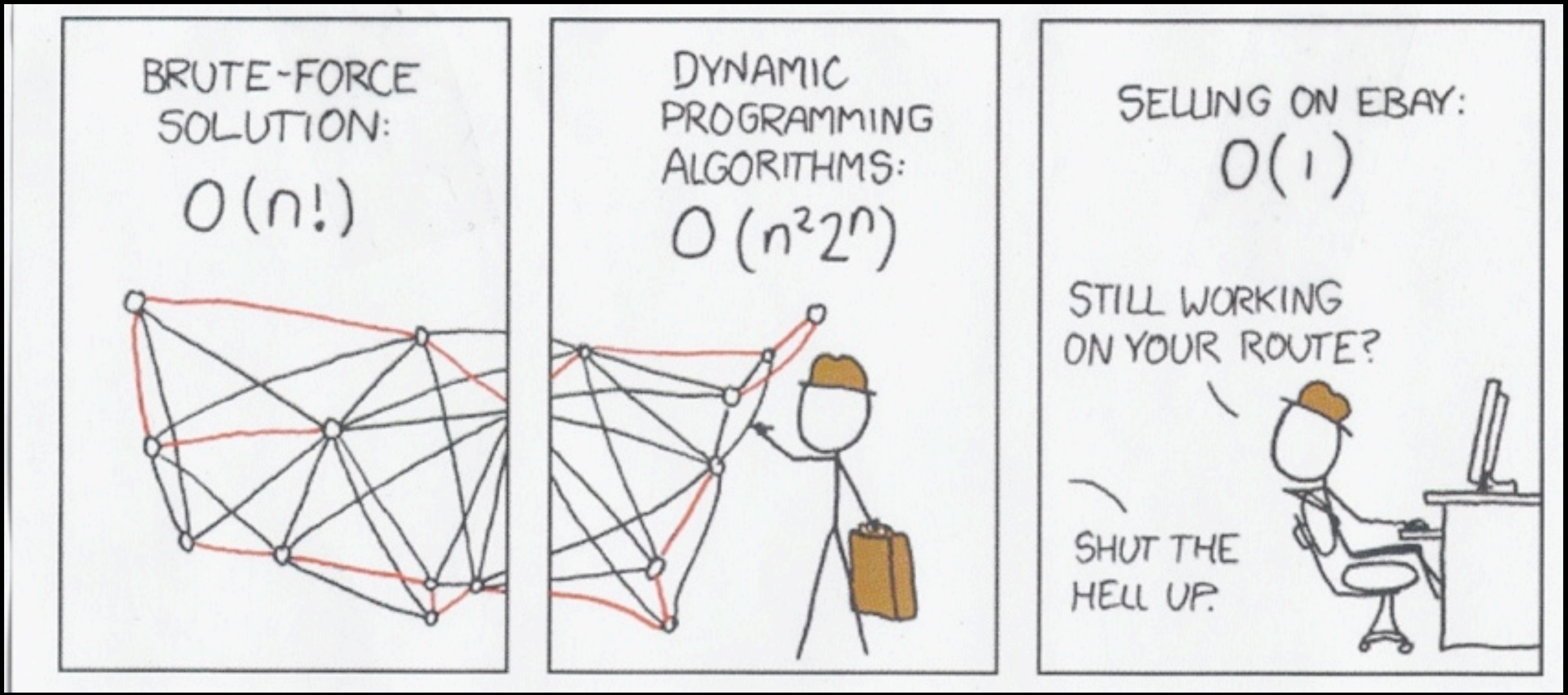
origami



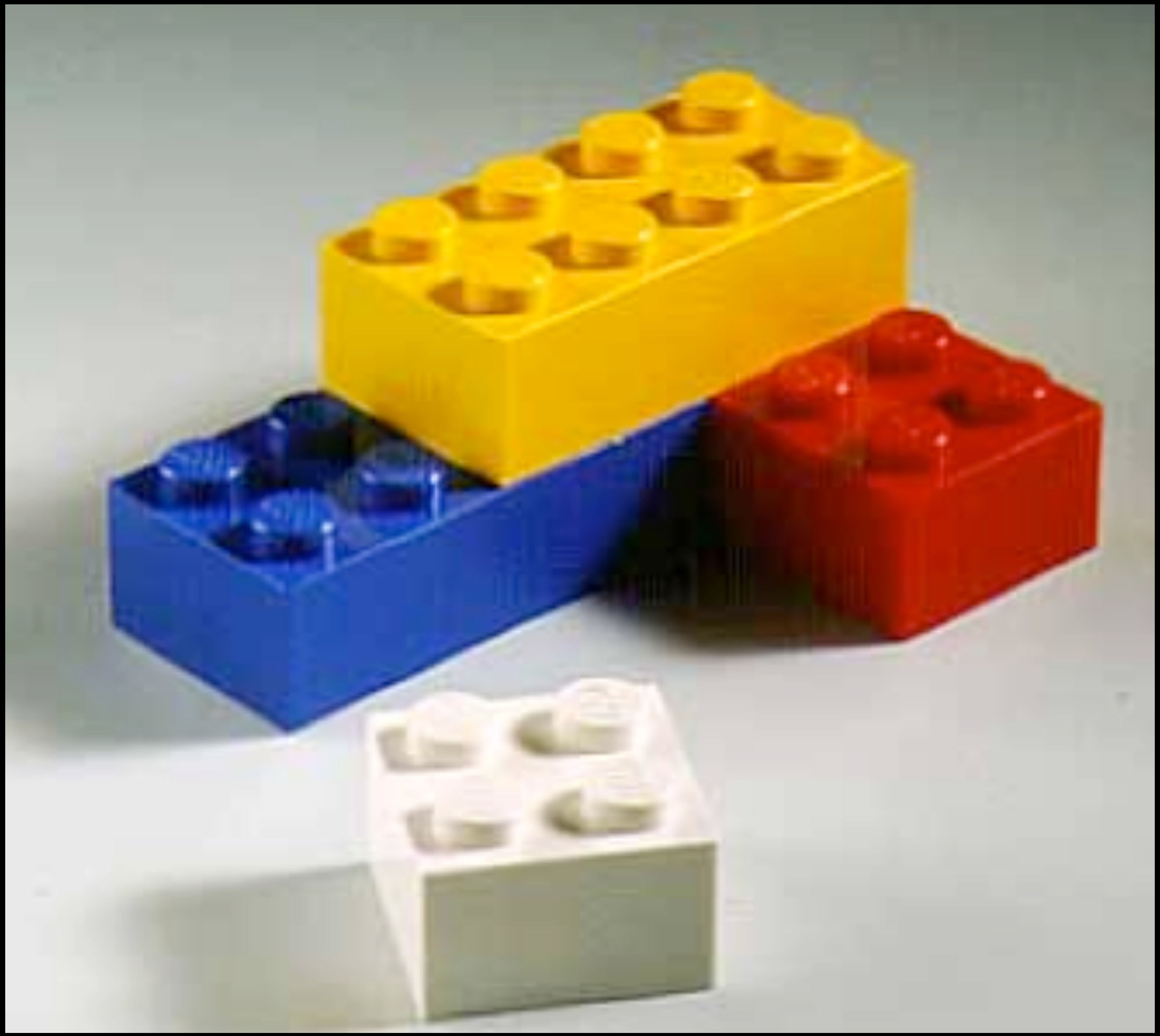
digital manufacturing

- current models are process poor
- combinatorics for information share
- sparse matrix theory for linkage
- respecting the question being asked

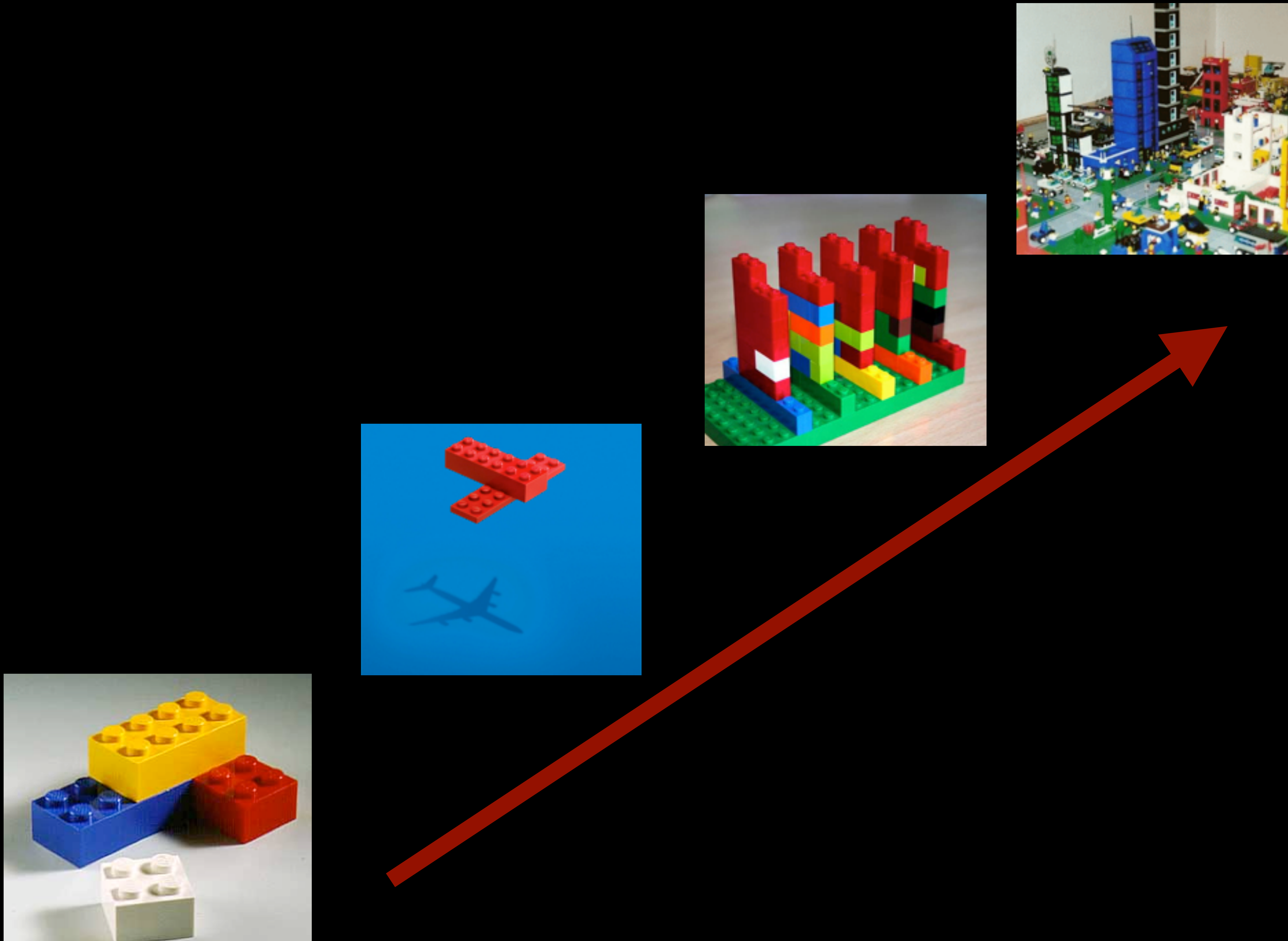
mathematical representation



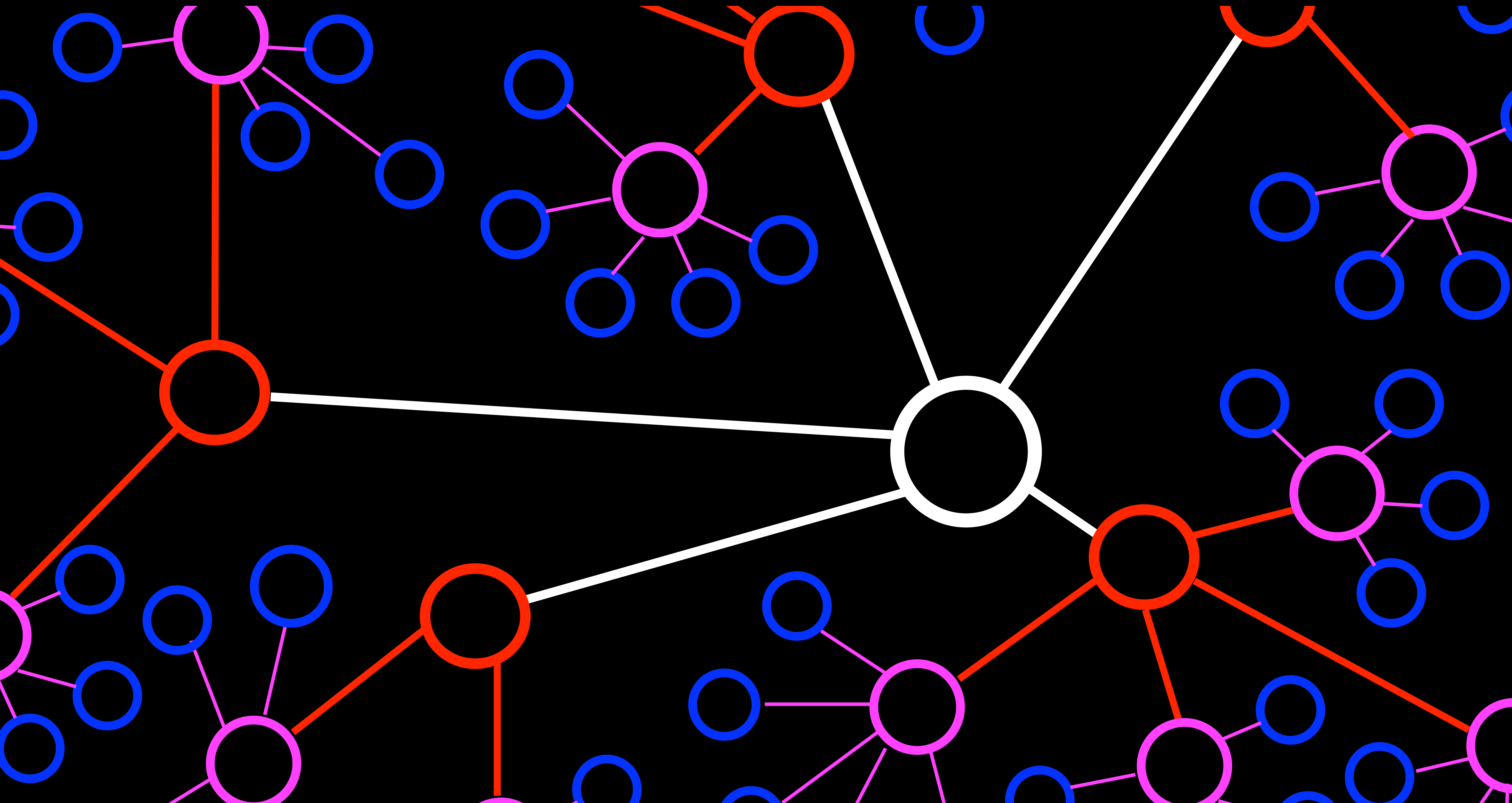
the traveling salesman problem



building blocks
(objects)



fully coupled, complex system management



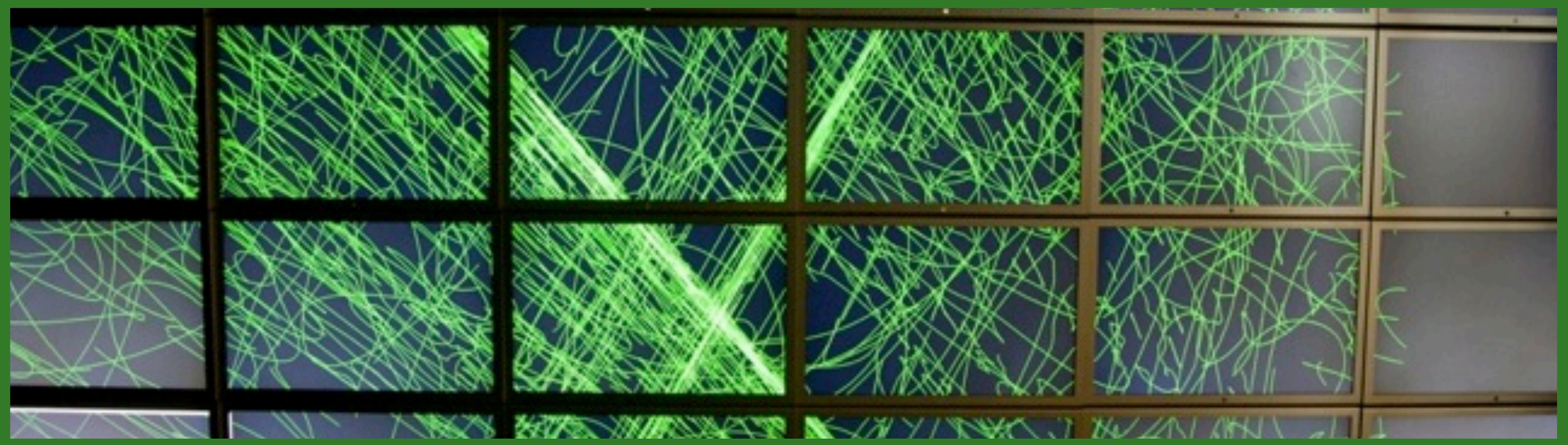
- visualization
- integrated computational environment
- design workbench
- merged environments for simulation & analysis

interaction with multiscale systems

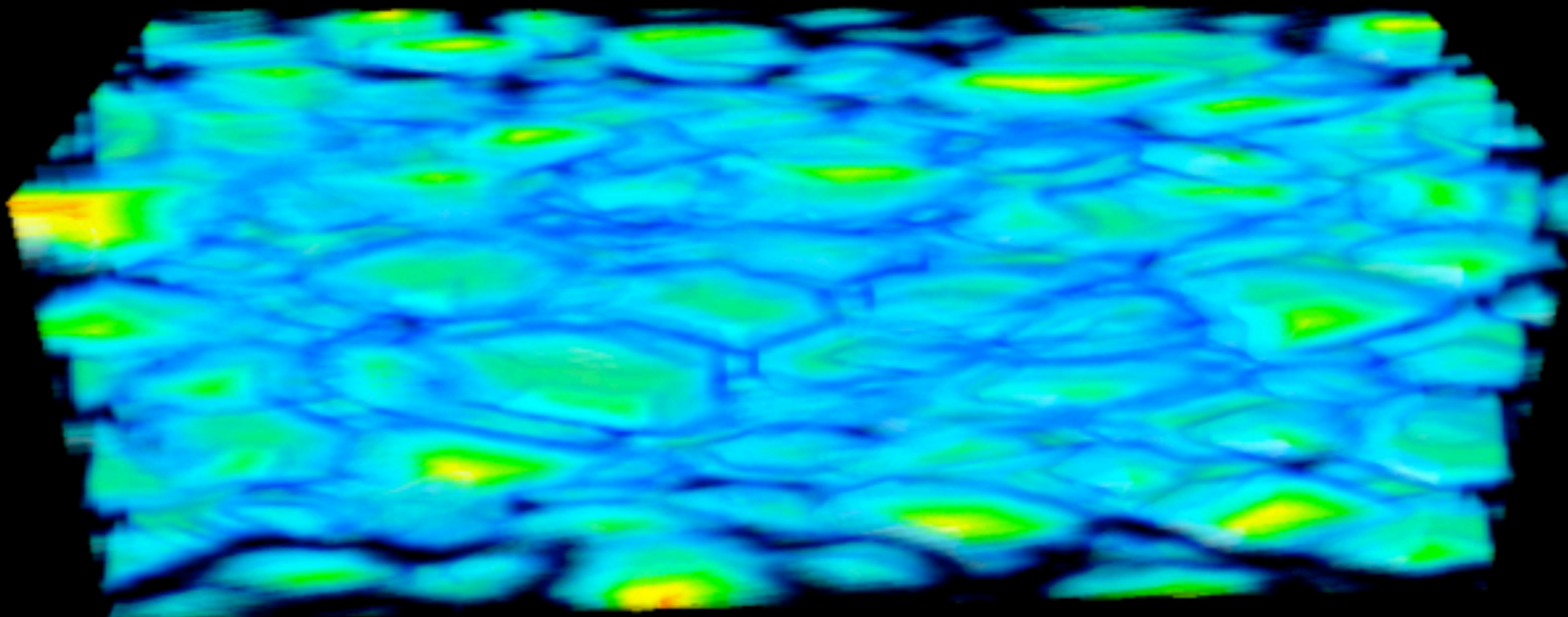
visualization needs

- render very large datasets interactively
- colorize and filter on any attribute set interactively

common sphere rendering techniques cannot achieve these goals

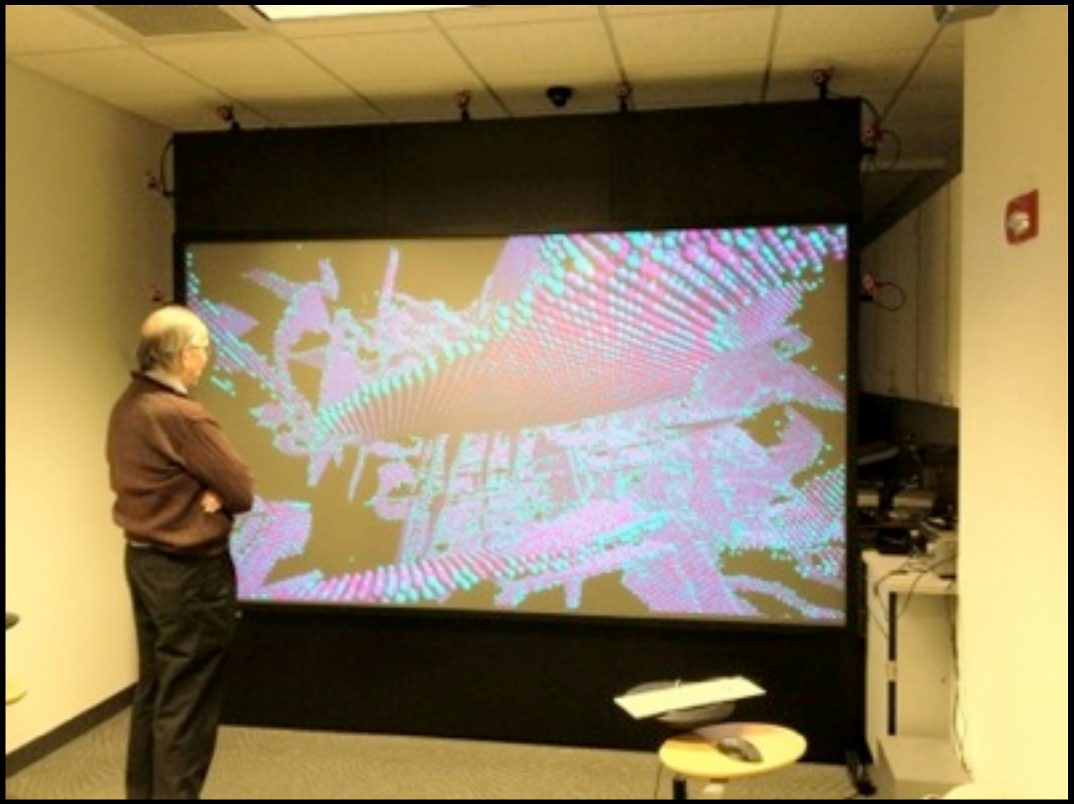


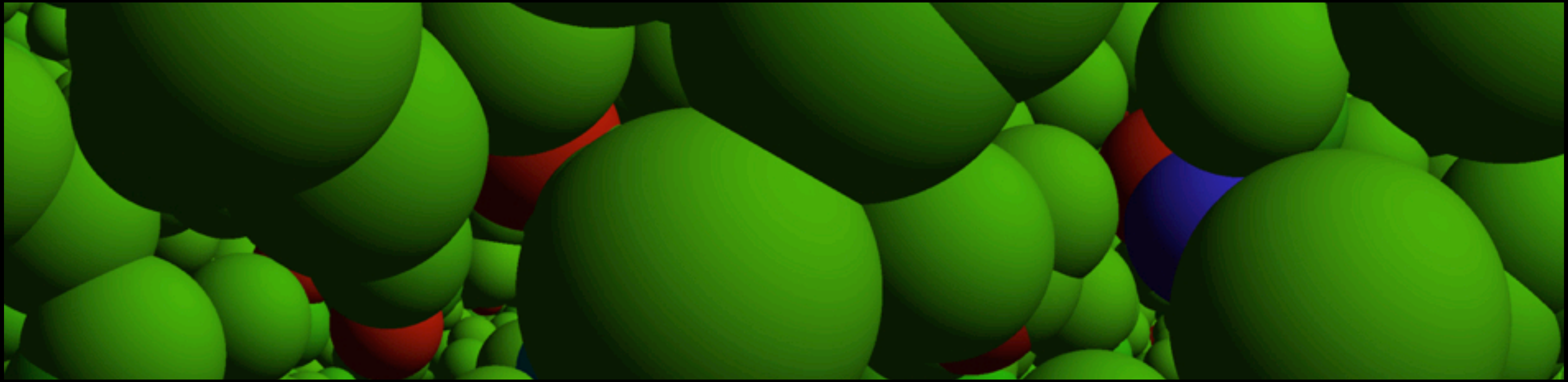
- 100+ million points
- any data source
- any visualization platform
- any compute platform



a multiscale design laboratory

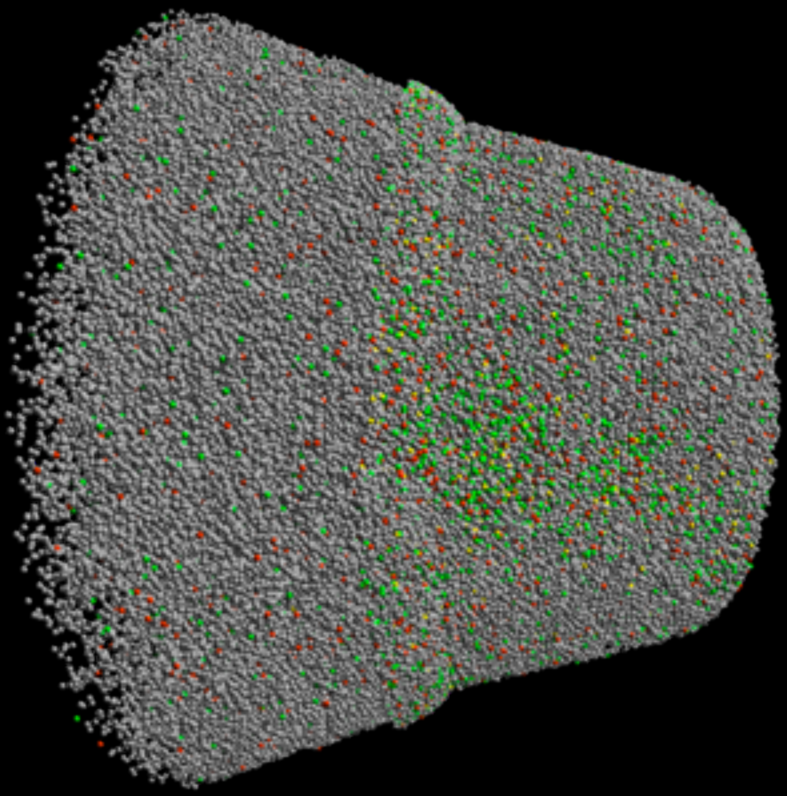
fostering collaborative design across scales



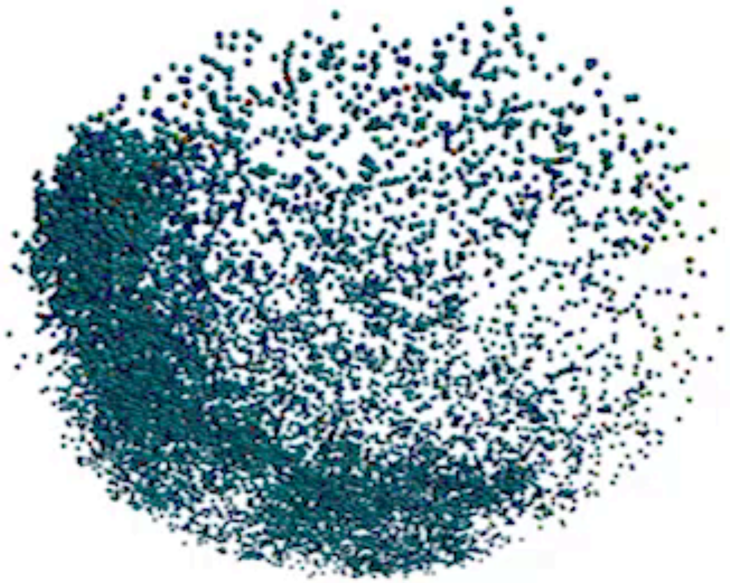


visualization of atomic systems

- experimental data, including atom probe tomography
- atomistic simulations
- render up to 10 million atoms *interactively* with current graphics cards (on a Macintosh)
- render 70+ M with new cards

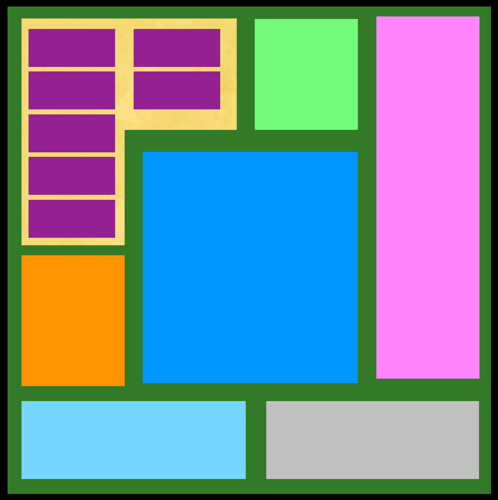


“replaying” atom probe data collection



design

... at the emerging intersection between information, computation, and complexity



questions