### Roadmaps to Nanotech and

J Storrs Hall



# Productive Nanosystems and



#### Productive Nanosystems

A Technology Roadmap





# Create a new technology

A **powerful** new technology One that could change the world as the Industrial Revolution did Improve health, lifespan Give average people access to things only elites had before Increase range, capability, and options

# How can we know it's possible?

There's a model in nature of a system that does the kind of thing we want We think that if we understand it deeply enough we will be able to build a version that is

More efficient Faster or more powerful Leave out design flaws Design for different ends

#### Example: airplanes

We observe heavier-than-air birds Study them and understand: The shape of the wing gives lift Flapping gives propulsion Wing-warping gives control We can separate these and use fixed wings, propellors, ailerons

# Similarly

For nanotech, we have the molecular mechanisms in the cell that make life itself work.

It uses positionallycontrolled chemistry and diffusive transport. For AGI, we have brains. They use imitation

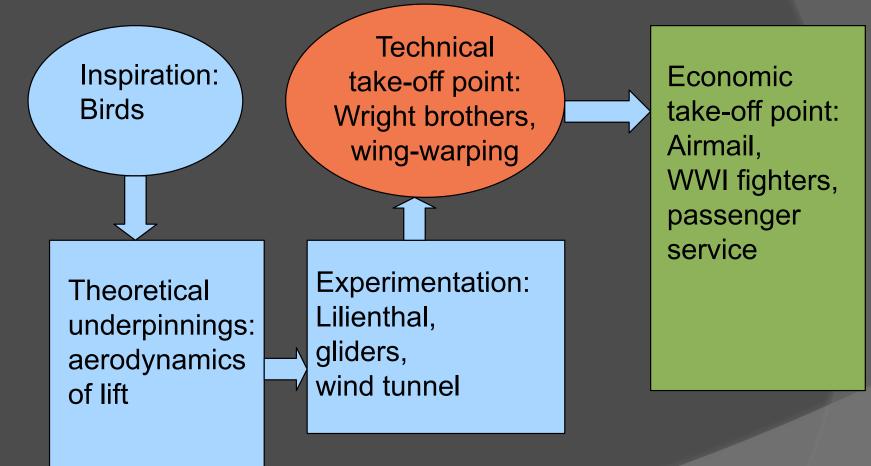
and feedback in a massively parallel computation and communications network.

#### Phases: Industrial Revolution

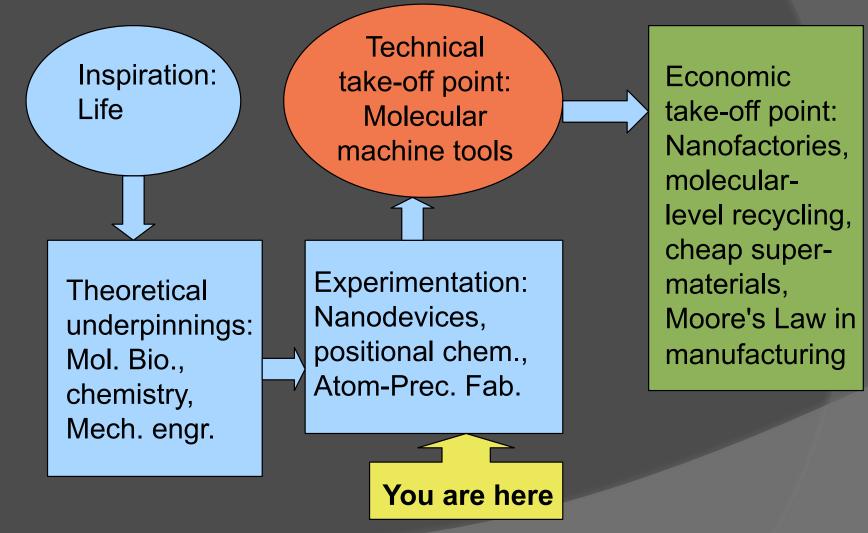
Inspiration: Horses Technical take-off point: Watt, Machine tools, High pressure

Theoretical underpinnings: discovery of the atmosphere Experimentation: Newcomen, valve control, coal-mine pumps Economic take-off point: Railroads, steamships, steam shovels, tractors, looms, factories.

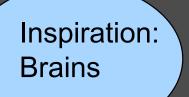
#### Phases: Air transportation



#### Phases: Nanotechnology



# Phases: General Al



Theoretical underpinnings: Computation, control theory, Neuro & psych Technical take-off point: Self-improving software

Experimentation: Computers, software, networks, complex systems

You are here

Economic take-off point: Robust, trainable AI; useful robots, robo-cars, natural language interfaces

### Technical takeoff

Embodies the **essential function** of the proposed technology Is proof that the concept works Focuses technical effort Is a vehicle for practical experience Attracts financial (etc) resources Forms a crack in the dam

## Getting to technical takeoff

Precise pathway doesn't matter so much Many approaches should be tried Everything afterward will be done differently anyway

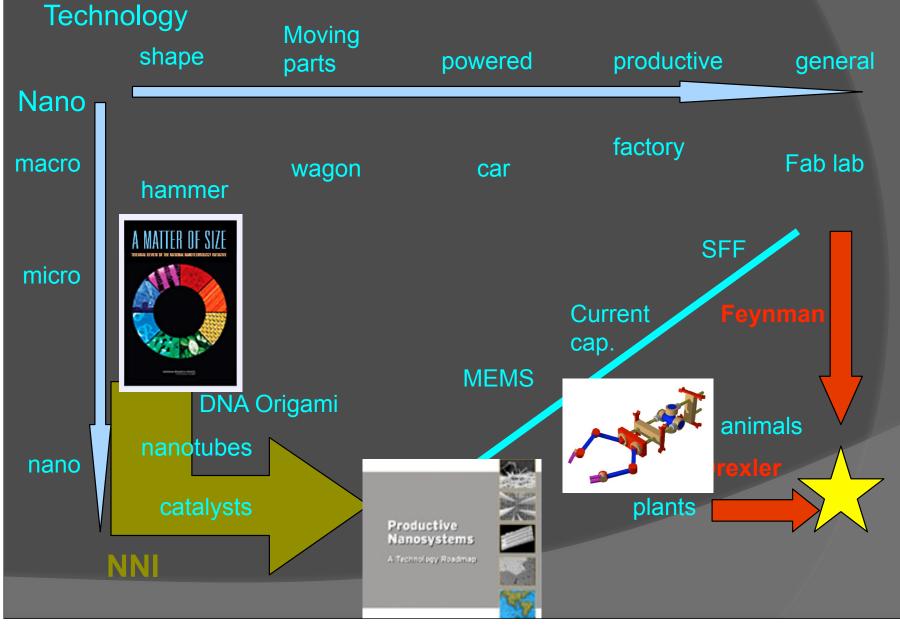
- The key is to understand instead the properties of the takeoff point
- For many technologies, autogeny is the key

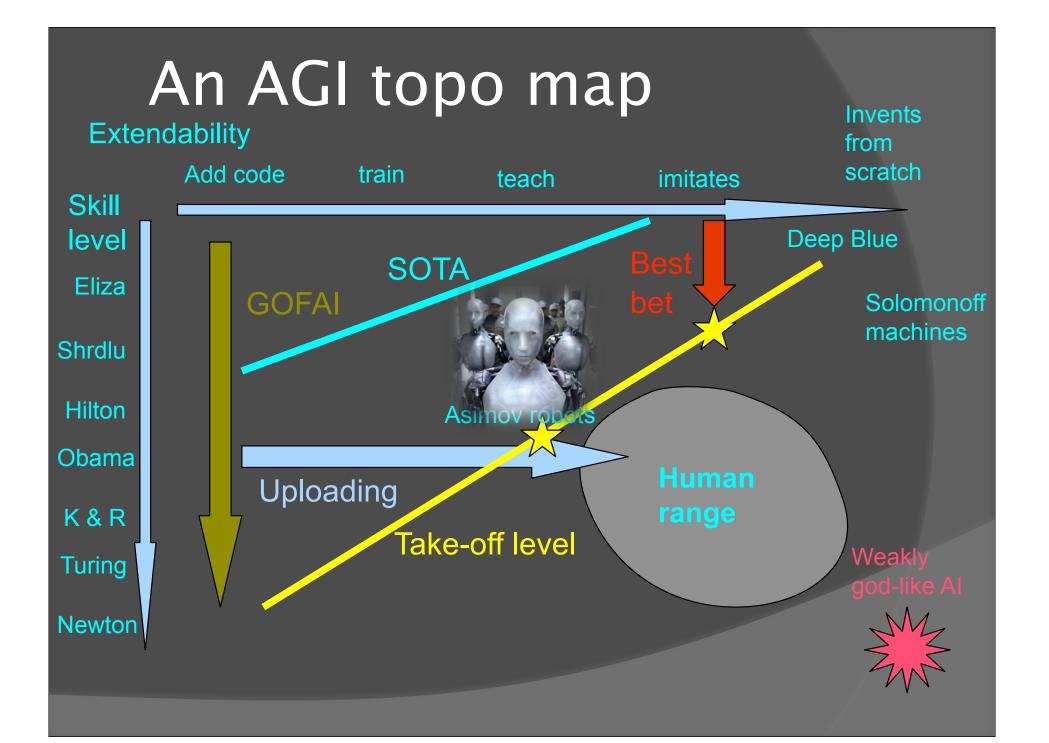
### Example: Computers

Inspiration: Manual calculation Technical take-off point: von Neumann arch: data=program

Theoretical underpinnings: Jacquard, Hollerith, Turing Experimentation: data processing, Norden bombsight, Eniac Economic take-off point: Computerized engineering, accounting, databases, process control

### A nanotech topo map





# Al/nanotech synergies

