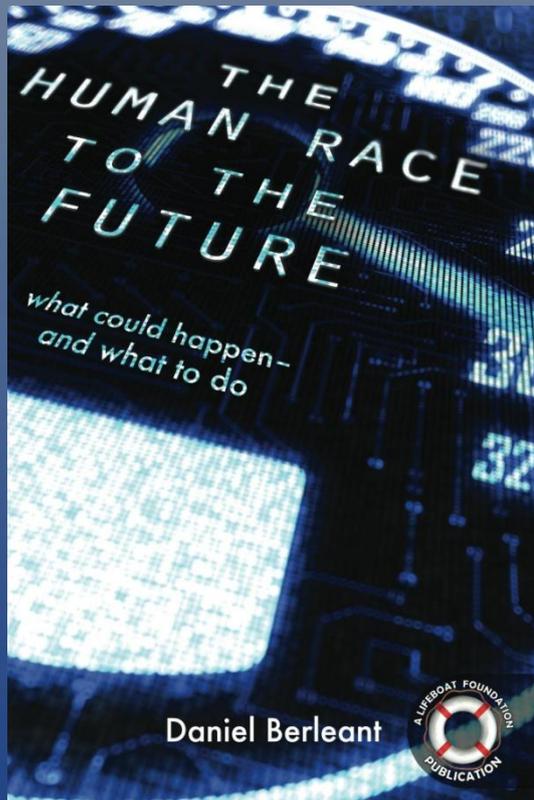
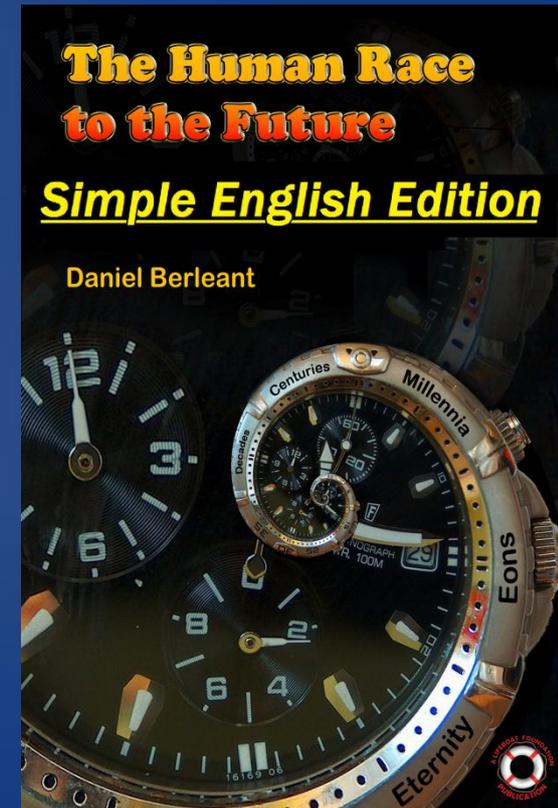


From  
Highly Centralized  
-to-  
Highly Decentralized  
Societies  
Daniel Berleant

WorldFuture 2013  
July 21, Chicago  
(updated 10/26/16)



(Artist: Jason Batt)



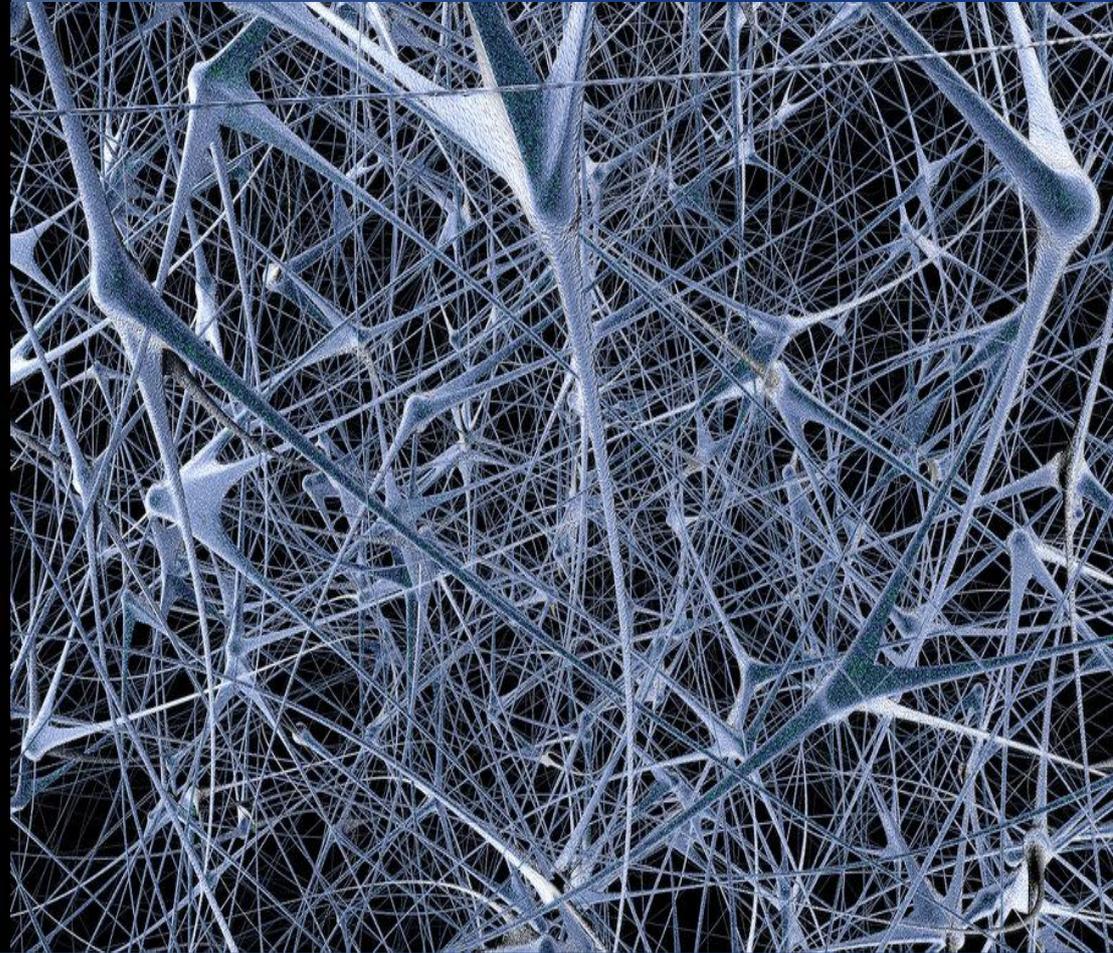
(Artists: Catherine Asaro  
and Francesco De Comit )

# A Tale of Two Futures



Source: [www.thepolisblog.org/2010/05/decentralization-for-development.html](http://www.thepolisblog.org/2010/05/decentralization-for-development.html)

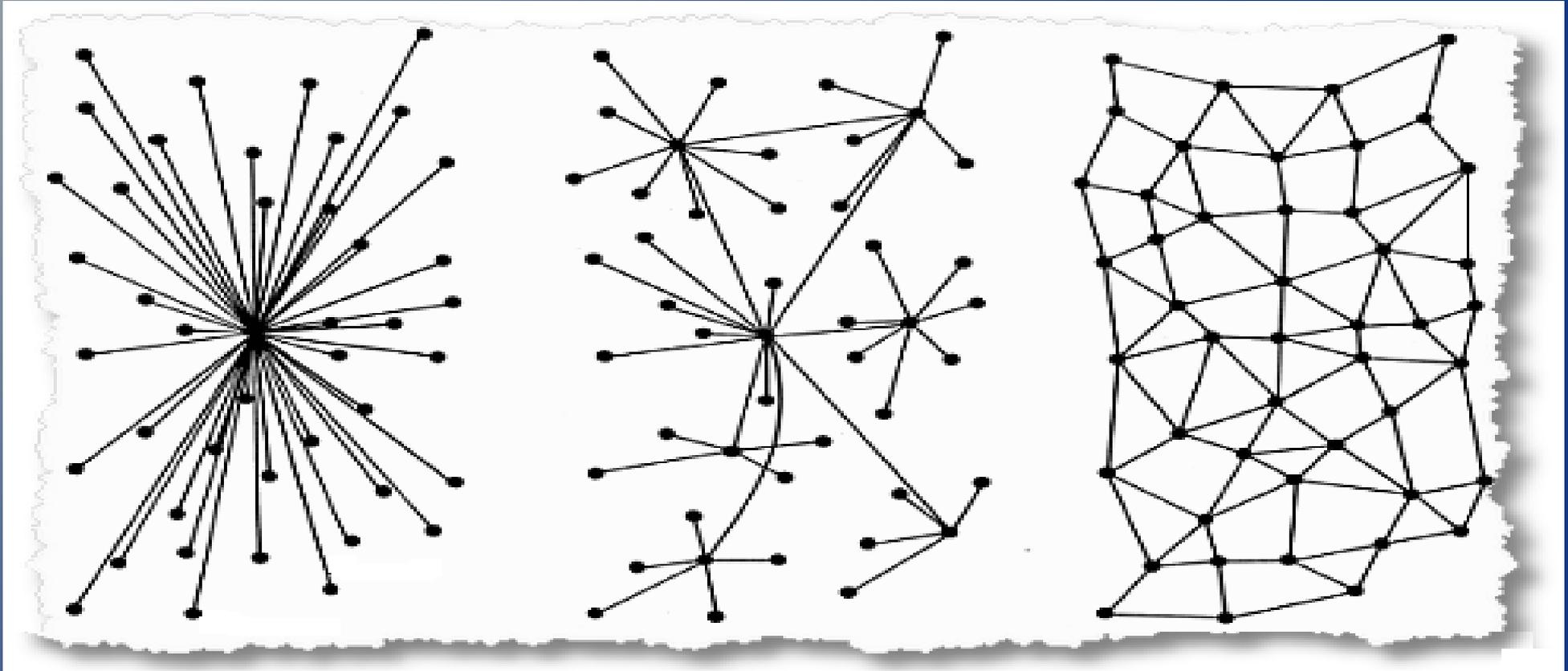
Centralization



Source: [marktattersall.com/wp-content/uploads/2013/02/neural\\_network\\_by\\_wieschoo-d5gyq2l.jpg](http://marktattersall.com/wp-content/uploads/2013/02/neural_network_by_wieschoo-d5gyq2l.jpg)

Decentralization

# Which is Better?



Slightly modified from: [www.kaushik.net/avinash/owns-web-analytics-framework-critical-thinking/](http://www.kaushik.net/avinash/owns-web-analytics-framework-critical-thinking/)

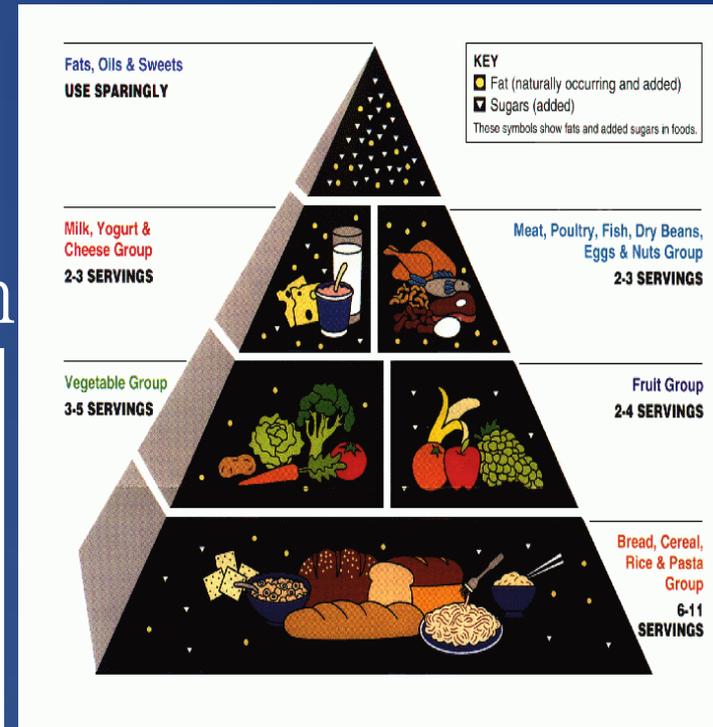
Centralization  Decentralization

# Outline

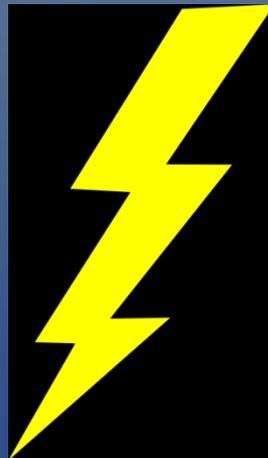
- Centralization, decentralization

- and:

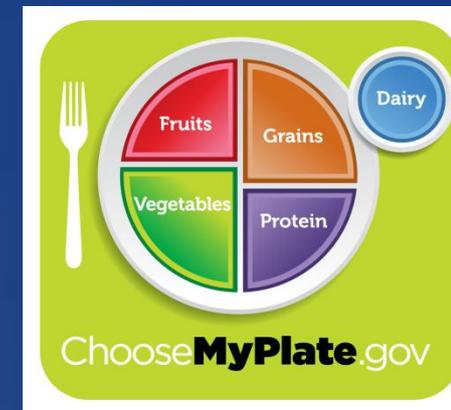
- Food



- Electricity:



- What else?



- Let's look at these more closely...

# Food

Centralized



Source: [orientalflovers.wordpress.com/category/nature-scenery-landscapes/hills](http://orientalflovers.wordpress.com/category/nature-scenery-landscapes/hills)

Source: [www.davidicke.com/headlines/80376-modern-colonialism-foreign-investors-buy-up-vast-amounts-of-developing-world-farmland](http://www.davidicke.com/headlines/80376-modern-colonialism-foreign-investors-buy-up-vast-amounts-of-developing-world-farmland)

Decentralized



Source: [www.teichgardensystems.com](http://www.teichgardensystems.com)

- What are the + 's and - 's of each?
  - Obvious ones
  - Hidden ones



# Food Production

Highly Centralized

Highly Decentralized

Long distance  
transportation

Required

Not required



# Food Production

Highly Centralized

Highly Decentralized

Long distance  
transportation:

Expensive

No expense



Rome (Tainter, p. 133)

Fuel

Trucks

Infrastructure capacity, maintenance

spoilage health variety . . . others?

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/truck.html

# Food Production

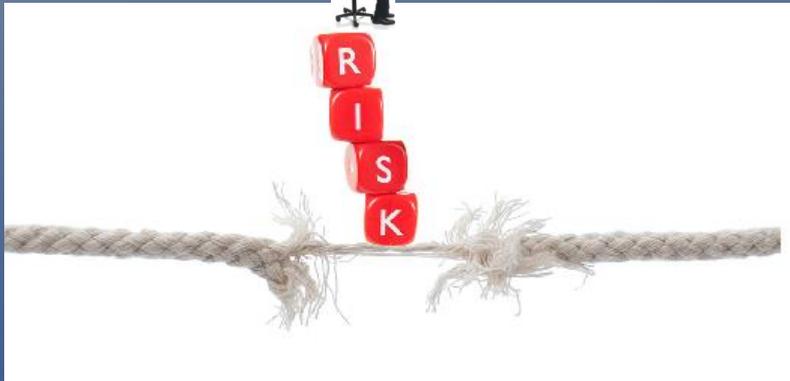
Highly Centralized

Highly Decentralized

Long distance  
transportation:

Risk of  
disruption

No risk



Sources: (t)  
[http://www.123rf.com/photo\\_8081287\\_isolated-studio-shot-of-a-businessman-sitting-using-a-laptop-computer-while-sitting-in-a-chair.html](http://www.123rf.com/photo_8081287_isolated-studio-shot-of-a-businessman-sitting-using-a-laptop-computer-while-sitting-in-a-chair.html); (b)  
[www.gfi.com/blog/wp-content/uploads/2012/08/BOYD-the-risk.jpg](http://www.gfi.com/blog/wp-content/uploads/2012/08/BOYD-the-risk.jpg).

Virus infection  
human  
computer

Road closure  
damage  
bandits

Any other  
risks?

# Food Production

Highly Centralized      Highly Decentralized

Government agricultural policies:

Special  
interest  
driven?

More

Less

Complexity

Higher

Lower

Cost

Expensive

Less so?



# How to Decentralize Food

- How to do it:



- We could "think-pair-shair"...



- Ag. tower plan
- 58 stories
- "Sky Farm"
- Toronto
- Gordon Graff
- 8 million sq. Feet
- 180 acres+
- 35,000 people (?)
- Image from [www.inspirationgreen.com/vertical-farms.html](http://www.inspirationgreen.com/vertical-farms.html)



## Plan

- Hydroponics
- +
- offices
  
- SOA Architects  
– (France)

- Image from  
[www.inspirationgreen.com/vertical-farms.html](http://www.inspirationgreen.com/vertical-farms.html)



- Rice can grow beside buildings
- roadways
- From Taiwan Cultural Portal, [travel.mediamatic.net/page/55990/en](http://travel.mediamatic.net/page/55990/en)

## THE SIDEWALK FARMER

IS SUSTAINABLE URBAN FARMING POSSIBLE? WELL, I'VE GIVEN MY FAMILY OF FOUR A CHALLENGE TO BE 100% SUSTAINABLE IN THREE YEARS OR LESS. THE ONLY LAND WE'LL HAVE TO GROW FOOD IS BETWEEN THE STREET AND THE SIDEWALK. WE MIGHT BE SUCCESSFUL, BUT WE HOPE TO INSPIRE YOU TO FARM YOUR SIDEWALK!



- Orange tree
  - (not doing well)
- Rhubarb
  - (doing fine)
- See
  - [sidewalkfarmer.blogspot.com](http://sidewalkfarmer.blogspot.com)

# Home farming: not for everyone

- It's great if you can make a go of farming your sidewalk, yard, etc. to support a family of four
  - But many of us want to work a regular job
    - So who has the time?
  - To really make it work requires an alternative . . .
    - Let's look at a couple of them

Highly decentralized food  
sourcing...  
a traditional practice  
among the very young!



Image: [www.relphbenefitadvisors.com/article/check-employee-handbook-nursing-mothers-law](http://www.relphbenefitadvisors.com/article/check-employee-handbook-nursing-mothers-law)

This is fine for babies. . .  
but won't work for everyone!  
Any alternatives?



Image: [www.relphbenefitadvisors.com/article/check-employee-handbook-nursing-mothers-law](http://www.relphbenefitadvisors.com/article/check-employee-handbook-nursing-mothers-law)

# Agribots



Artist: Christine M. Larsen. [www.thelittlechimpsociety.com/?s=larsen](http://www.thelittlechimpsociety.com/?s=larsen);  
see e.g. <http://shop.christinelarsen.com/product/robot-of-the-month-club>

# Robots are poised for takeoff!

Roombas work on floors



The outdoors has a floor

We call it the "ground"

# Robot precursors

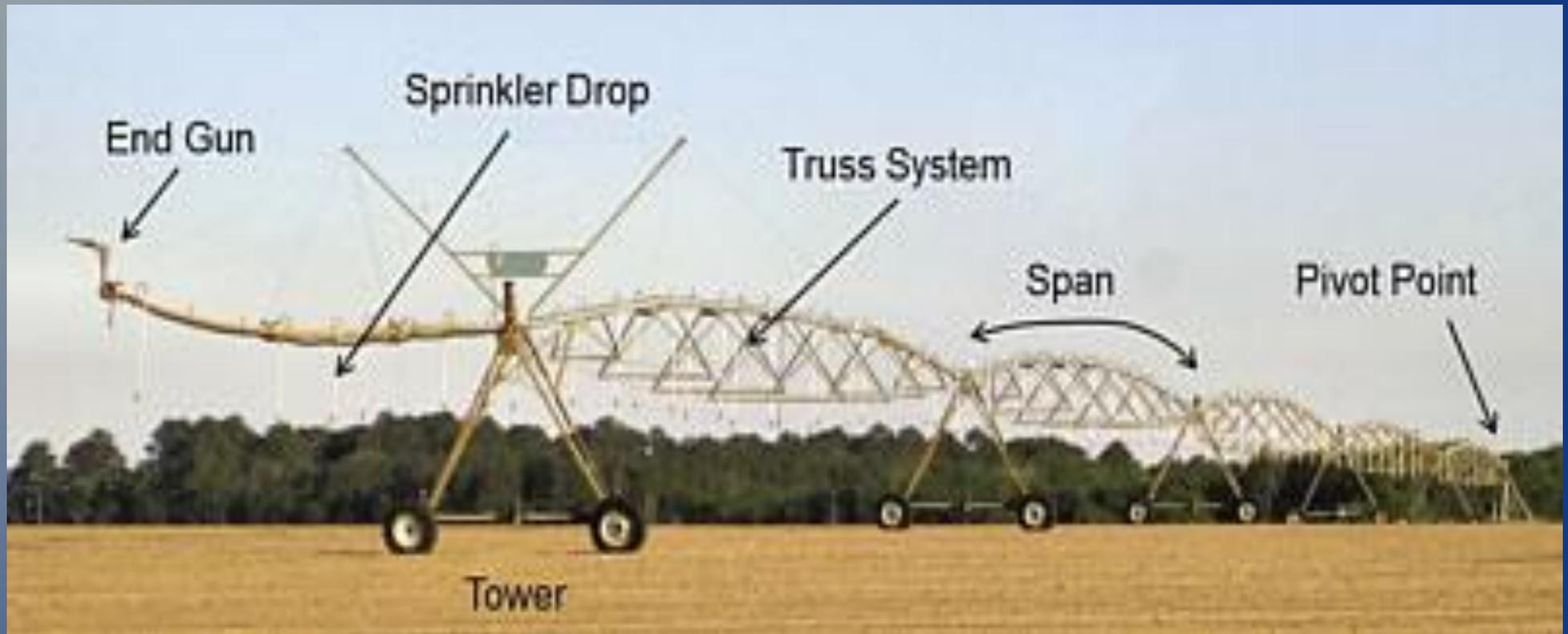
- Surface irrigation systems
  - E.g. furrow irrigation
- Center pivot irrigation systems
  - Often  $\frac{1}{4}$  mile, almost  $\frac{1}{2}$  km long
  - Among the longest machines in existence
  - They make “crop circles”
- Lateral move irrigation systems
  - Can be 1 km long
  - Mostly mobile
- Pics next...



<http://nrcca.cals.cornell.edu/soil/CA3/CA0324.php>



[crossingthesky.blogspot.com/2011/01/western-kansas-tells-and-smells.html](http://crossingthesky.blogspot.com/2011/01/western-kansas-tells-and-smells.html)



[www.cottoninc.com/fiber/AgriculturalDisciplines/Engineering/Irrigation-Management/Irrigation-Systems-Overview/](http://www.cottoninc.com/fiber/AgriculturalDisciplines/Engineering/Irrigation-Management/Irrigation-Systems-Overview/)

## Lateral irrigation systems:

Look similar

How are they more complex than center pivot?

# Toward next generation agbots

- From floorbots
- to groundbots
- From simpler to more sophisticated irrigation
  - Saves water
  - Why not give each plant
    - exactly what it needs
    - no more, no less

# Grass farming

- Robot lawnmowers:
  - primitive grass farming bots!



# Grass farming

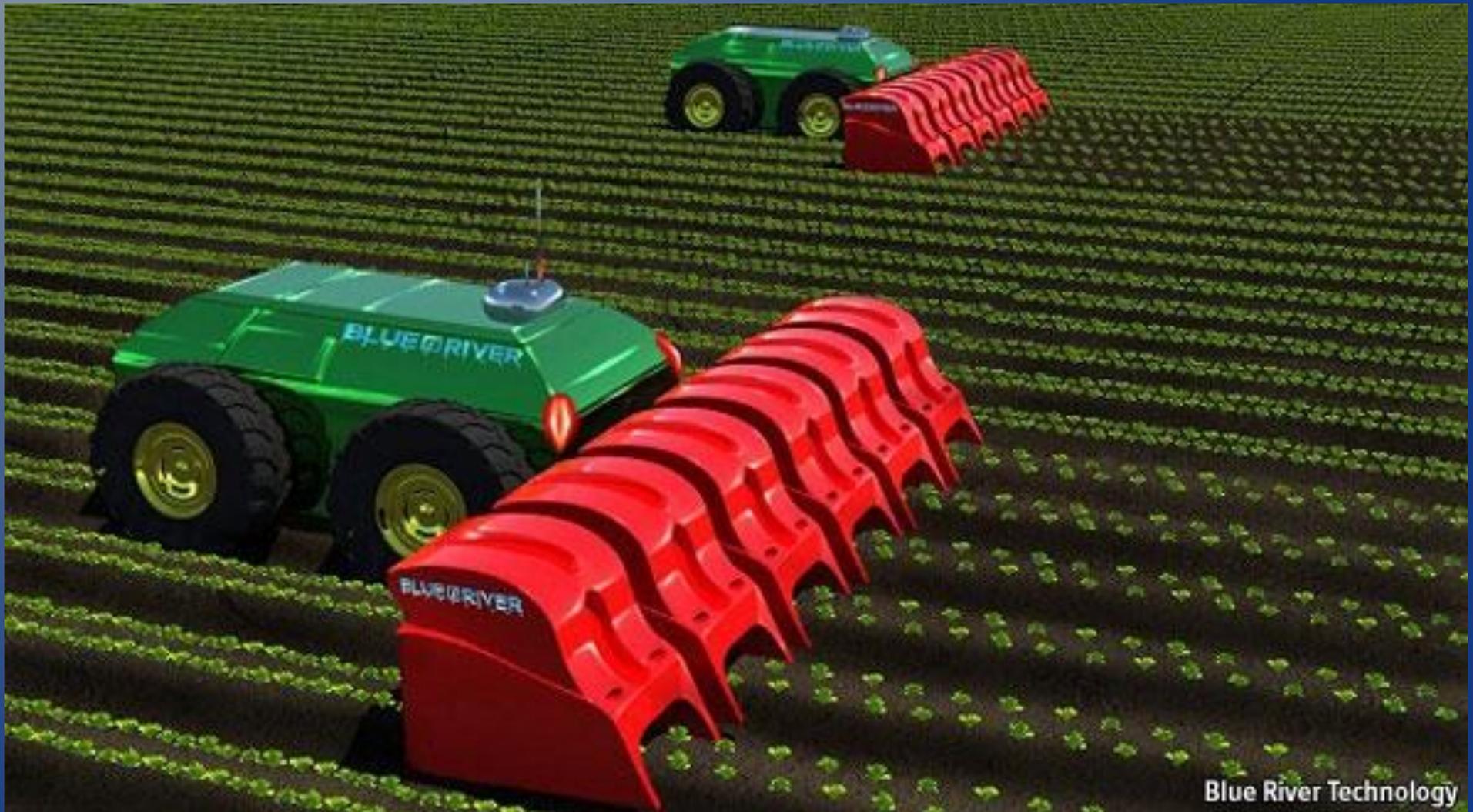
- Robot lawnmowers
  - Taking care of your lawn is grass farming
    - But they can get better
  - Sense and destroy weeds
    - Clever lettucebot idea:
      - use a jet of steam or liquid fertilizer
  - Dispense and plant seeds in bare patches
  - Expert system to diagnose and recommend
  - Operate sprinklers (should be easy)
  - Sprinkle fertilizer
- One step at a time: We're already on the way

**Sod  
providers:  
Pro grass  
farmers**



# Farming more than grass

- Tractor? No. . . *Lettuce Bot*!
  - What direction is it going?



# Farming more than grass

- Lettuce Bot
  - Kills weeds, with
    - steam (an organic solution)
    - or
    - concentrated fertilizer
  - Thins the field when needed
  - High powered computer vision system
  - \$3 million in venture funding

# Tomato Bots



# Tomato Bots

- The Roomba-like vehicle is
  - Well... Roomba-like
    - Made by the same company
    - Appears to be mostly Roomba – vacuum
    - Vacuum mechanism is expensive!
      - Robot vehicle costs around \$130
        - Roombas are quite a bit more
- Tomato bots are experimental
  - Commercial ones? Why not?

# You and your neighbors



[www.parade.com/news/2010/05/02-meet-the-neighbors.html](http://www.parade.com/news/2010/05/02-meet-the-neighbors.html)

- Let's say you have a broccobot
- Your neighbor has a
  - raspberrybot
- Work out a trade!
  - Broccoli is a healthy vegetable
    - But "man does not live by bread alone" (or broccoli)
- Neighbors helping, trading, interacting with neighbors. . .
  - . . . building communities . . . with **growbots!**



[www.cityofyukonok.gov/city-departments/emergency-management/family-disaster-plan/neighbors-helping-neighbors/](http://www.cityofyukonok.gov/city-departments/emergency-management/family-disaster-plan/neighbors-helping-neighbors/)

# From here to . . . ?

- Mowers, Lettuce Bots, tomato bots are
  - single-crop bots
- A reasonable technical path
  - Mowbots
    - Single crop, single action
  - Mowbot 2.0s, Lettuce Bots, tomato bots
    - Single crop, multiple action
  - Growbots that can handle... whatever
    - Multiple crop, multiple action

# Back to decentralization

- What if:
  - everyone had enough land to grow their food
    - ...with robots (no human labor)
- Living in the middle of a cornfield:
  - Less convenient than living next to a grocery store
  - We want to retain the pluses of urban living!



L: [thesentinelproject.org/san-francisco-roundup-concept-paper-tapping-wisdom-of-smart-crowd/](https://thesentinelproject.org/san-francisco-roundup-concept-paper-tapping-wisdom-of-smart-crowd/)

R: [visitpak.com/chali-rait-wala-popcorn-and-corn-in-pakistan/sweet-corn-field/](https://visitpak.com/chali-rait-wala-popcorn-and-corn-in-pakistan/sweet-corn-field/)

# Retaining Urban + 's



# Retaining Urban + 's

- Cities\$\$\$ create economic vigor!
  - Keep the vigor without the problematic density...
- Commodity robocars
  - Very small (w. tall flags)
  - Send'em shopping with shopping lists
    - It's worth paying 10% to human shelf pickers
- Skypification of life
- Telecommuting; telepresence robots
- **"This class could, in theory, be a teleconference"**
  - **What do you think?**

# Retaining Urban + 's



From Left: AnyBots QB, RoboDynamics TiLR, Gostai Jazz Connect, Mantaro's Mantaro Bot, and VGo

# Why decentralize?

- Decentralization serves the precautionary principle
  - **“Better safe than sorry”**
- Society is too dependent on long distance transportation
  - Electromagnetic pulses could disable vehicles
  - Societal breakdown could cripple transportation
    - Hunger Games
    - Earth 2100
- **Collapse has happened before, but... “we're different”**
  - **Hopefully so, but prudent risk management is good**

abc NEWS

# earth2100

TO CHANGE OUR FUTURE,  
FIRST WE MUST IMAGINE IT.



MPI

DVD

MAY THE ODDS BE EVER IN YOUR FAVOR



## THE HUNGER GAMES

2012

[THEHUNGERGAMESMOVIE.COM](http://THEHUNGERGAMESMOVIE.COM)

© 2012 LIONSGATE

[ALICECULLEN88.DEVIANTART.COM](http://ALICECULLEN88.DEVIANTART.COM)



# Social collapse: No way, or some day?

- **Why is ours the lone survivor?**

- **We're special!**



- **or maybe . . .**

- **Chaos just hasn't happened yet**

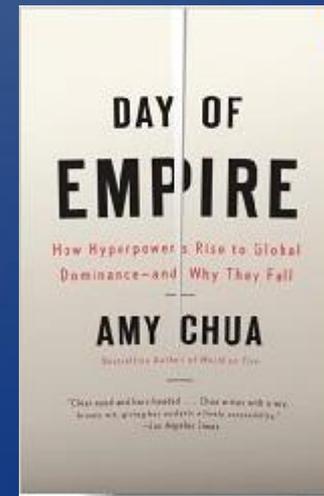
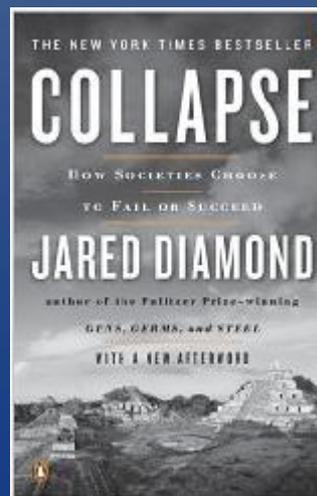
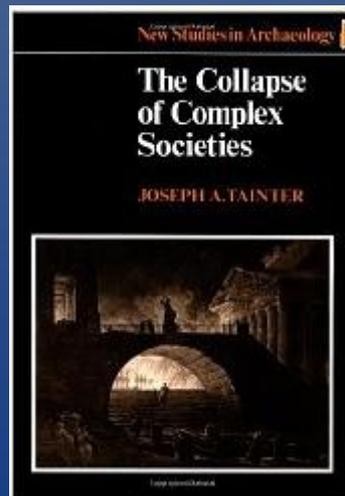


- **Prudent risk management:**

- **Decentralize where possible**

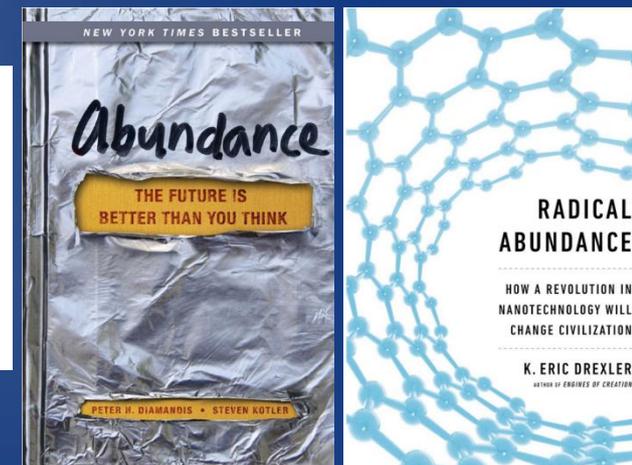
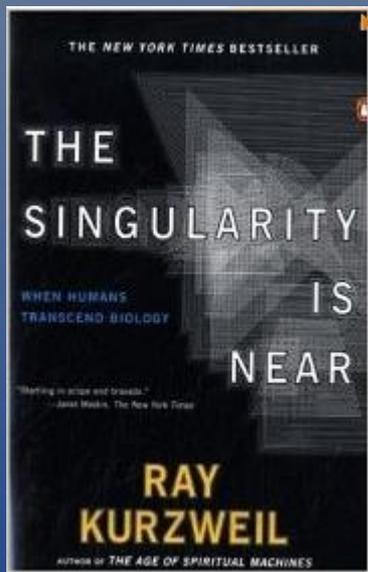
# Why Civilizations Rise and Fall

- Numerous theories, including:
  - Environmental overshoot (e.g. Jared Diamond)
  - Immigration policy (e.g. Amy Chua)
  - Sociopolitical complexity (e.g. Joseph Tainter)
    - *The Collapse of Complex Societies*
    - University of Cambridge Press, 1988



# Why civilization won't fall

- Transhumanism, the singularity . . .
  - Ray Kurzweil, Singularity University, and many others
  - A modern social movement and belief system



... and many more!

How about robotics?

# Accelerating vs. Decelerating Change

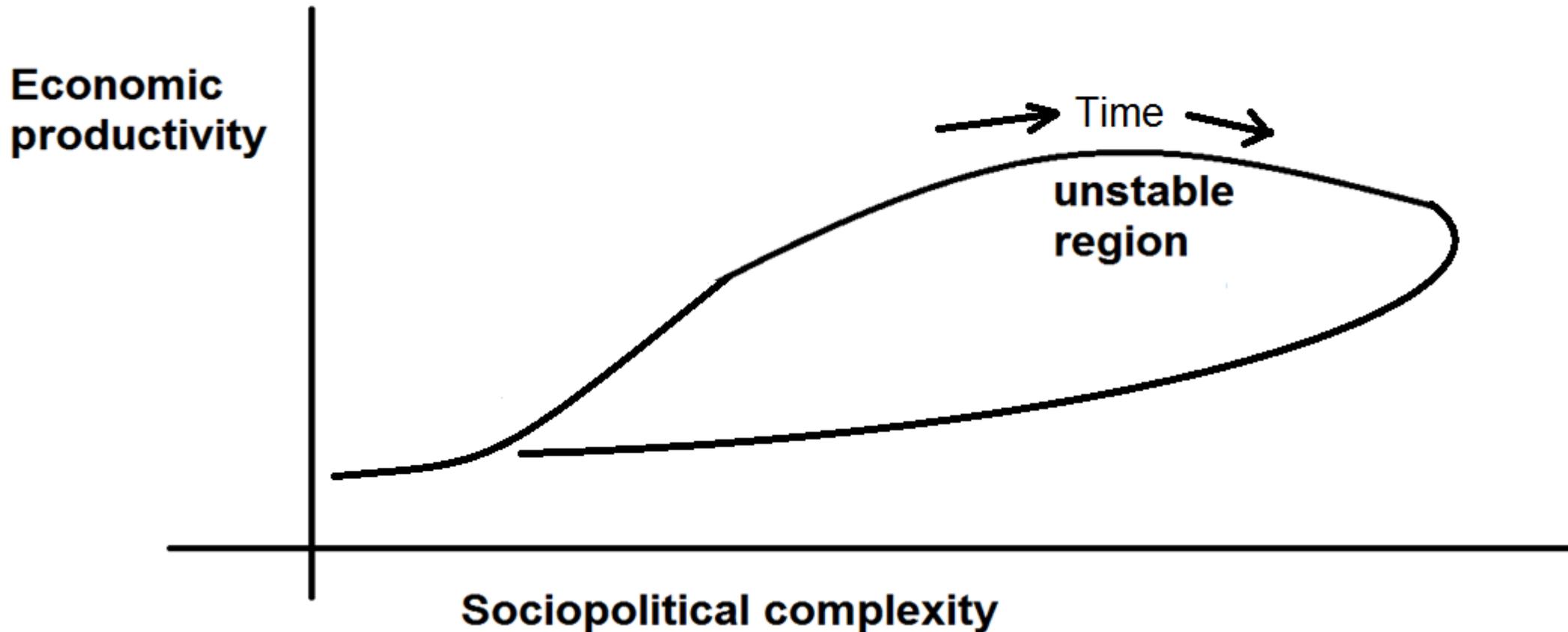
- Accelerating change (Kurzweil)
  - Change accelerates as a function of time
- Decelerating change (Tainter)
  - Change decelerates as a function of sociopolitical complexity
- Kurzweil shortchanges sociopolitical complexity
- Tainter shortchanges time
  - (Both tend to shortchange other theories)

# Accelerating vs. Decelerating Change

- Accelerating change (Kurzweil)
  - Change accelerates as a function of time
- Decelerating change (Tainter)
  - Change decelerates as a function of sociopolitical complexity
- Kurzweil shortchanges sociopolitical complexity
- Tainter shortchanges time
  - So there is no direct contradiction!
    - This makes truth elusive, but so it goes

# Decelerating change

- Tainter cites food production in the Roman Empire (for example)



# Decelerating change

- Decentralization:
  - Can reduce sociopolitical complexity
  - Can protect in case of deterioration
    - . . . addressing the risk problem

