TEACHING HUMAN DIGNITY SERIES:

Are There Too Many People in the World?

What Economics Can Tell Us

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Population Worries: Today

- "As the population grows—and demand for water and land increases—it will be difficult to increase food production in a sustainable way. Furthermore, climate change will contribute to more erratic and extreme weather patterns, such as unprecedented droughts and floods that reduce available farm land, and will create more challenges for farming."

A Practical Guide to Population and Development
(Population Reference Bureau, 2014)

Population Worries: 1968

- "The battle to feed all of humanity is over. In the 1970's hundreds of millions of people will starve to death in spite of any crash programs embarked upon now."

The Population Bomb
(Paul Ehrlich, 1968)

Population Worries: 1923

- US population by 1964 would reach 214 million—which would be “beyond the maximum agricultural possibilities”
- Unless checked, world population would reach an unsupportable 3 billion by 2000

Mankind at a Crossroads
(Edward East, 1923)

Population Worries: 1866

- "Now population, when it grows, moves with a certain uniform impetus…it must outstrip all physical conditions and bounds; and the longer it continues, the more severely must the ultimate check be felt…*I do not say that the failure of our coalmines will be the only possible check*. Changes here, or in other parts of the world, may, even before the failure of our mines, reduce us to a stationary condition, and bring upon us at an earlier period the sufferings and dangers incident to our position. But such a grievous change, if it does not come before, must come when our mines have reached a certain depth."

The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of our Coal Mines
(Stanley Jevons, 1866)

Thomas Robert Malthus

- Economist, father of population economics
- Anglican priest
- Prophet of doom -- the “Dismal Science”

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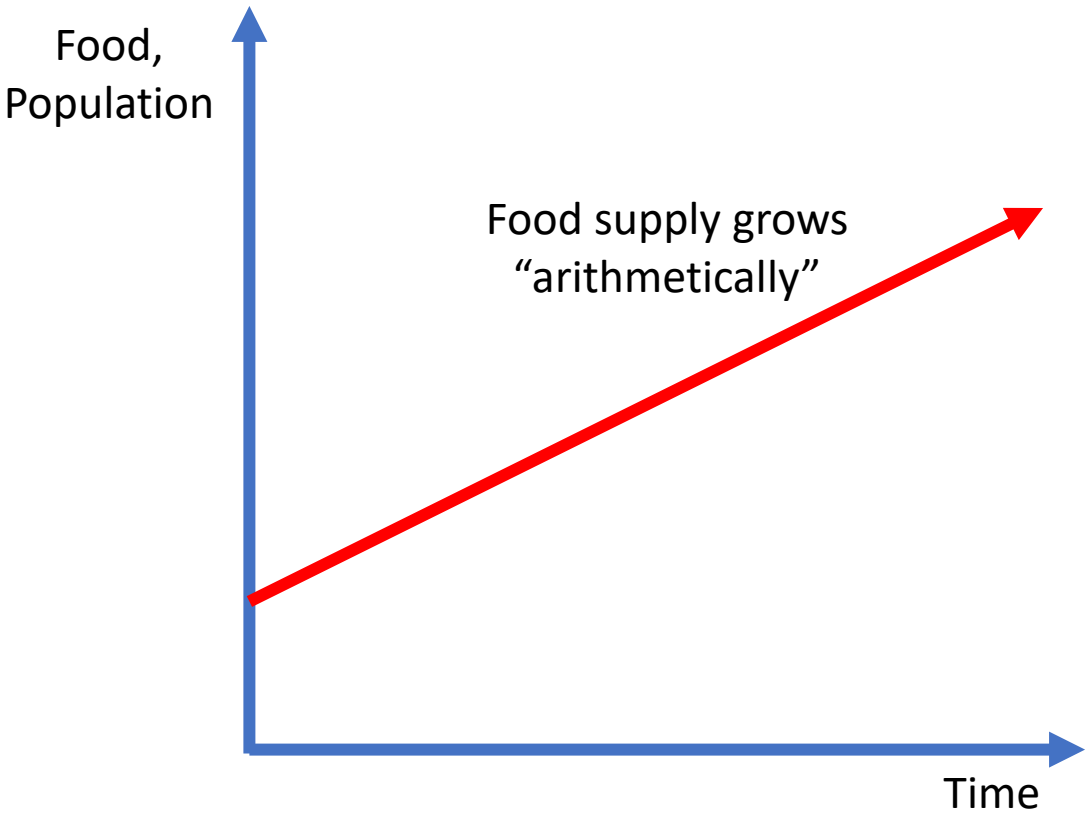
- Perhaps the first, and most well known, of many erroneous predictions by economists!

Why? Malthus' "Famous Nonsense"



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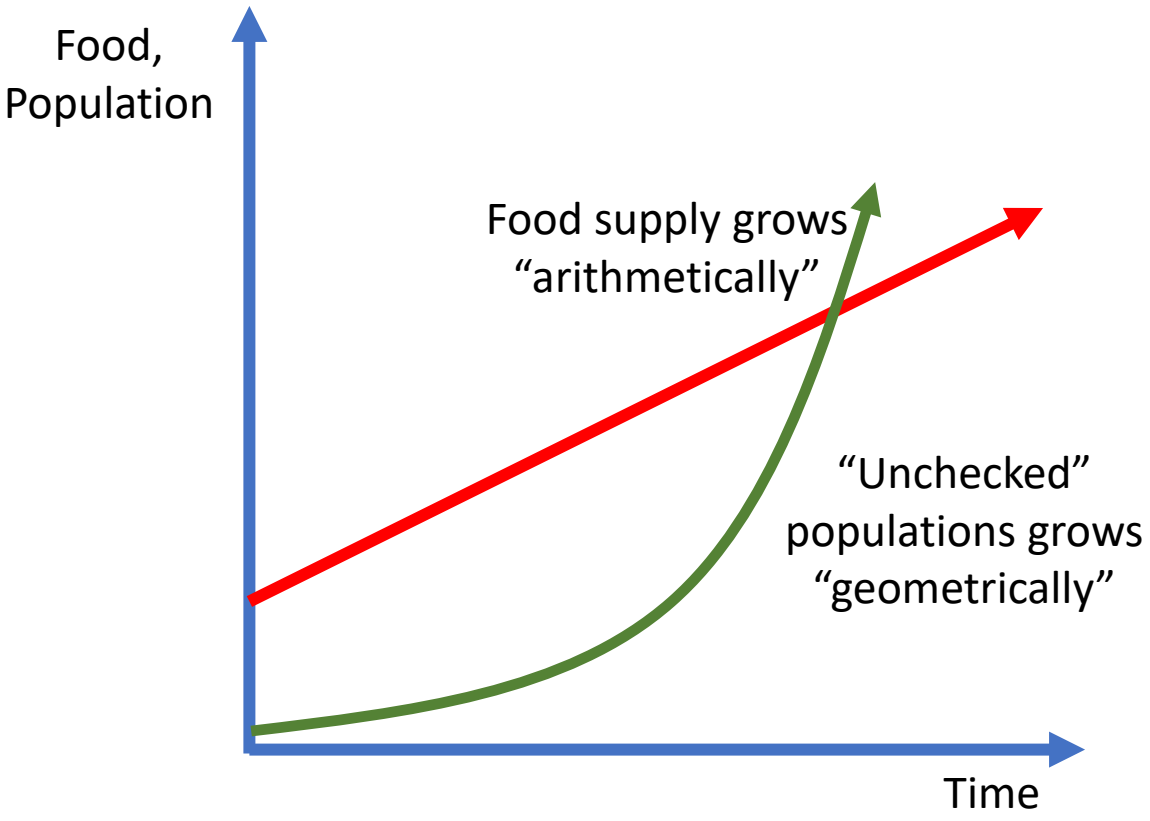
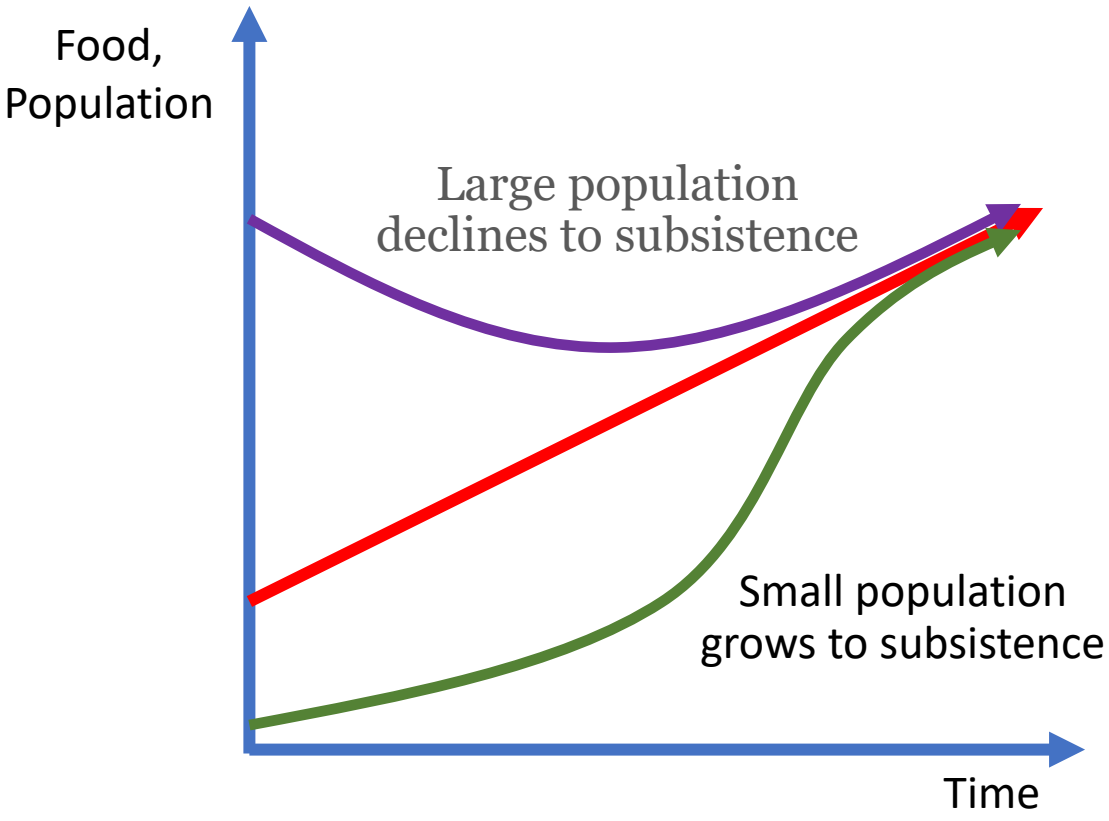
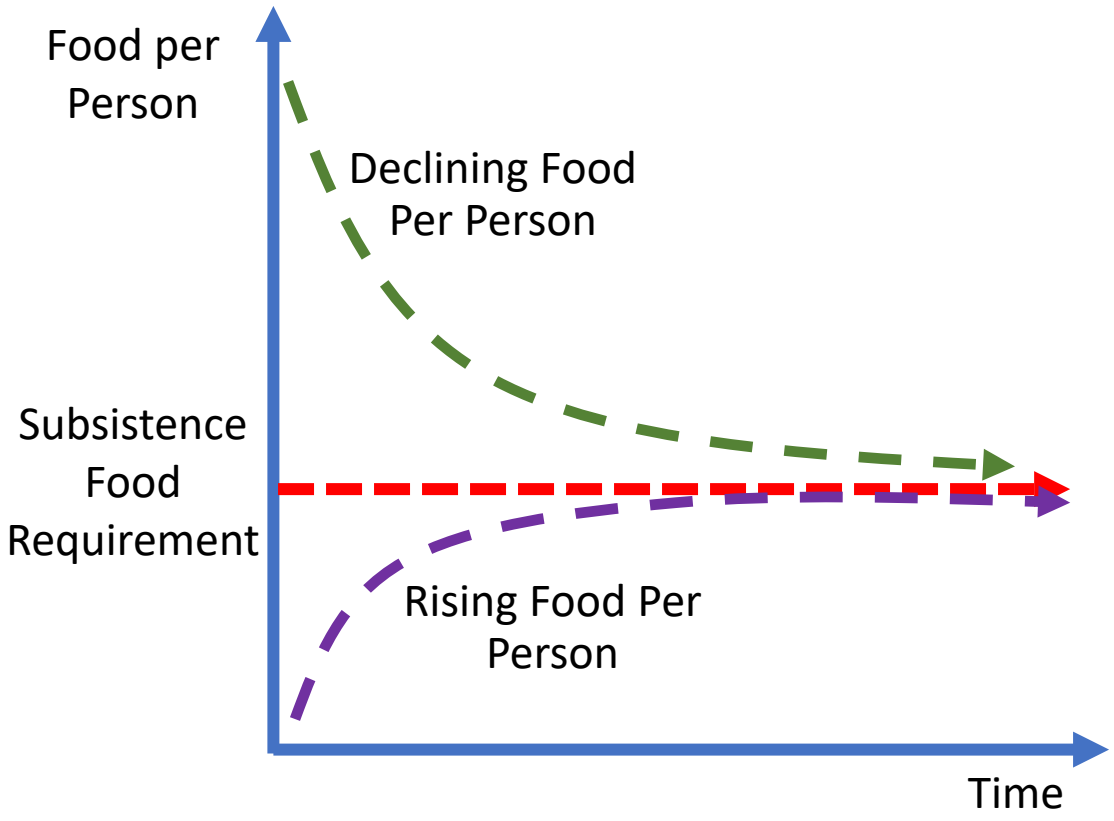
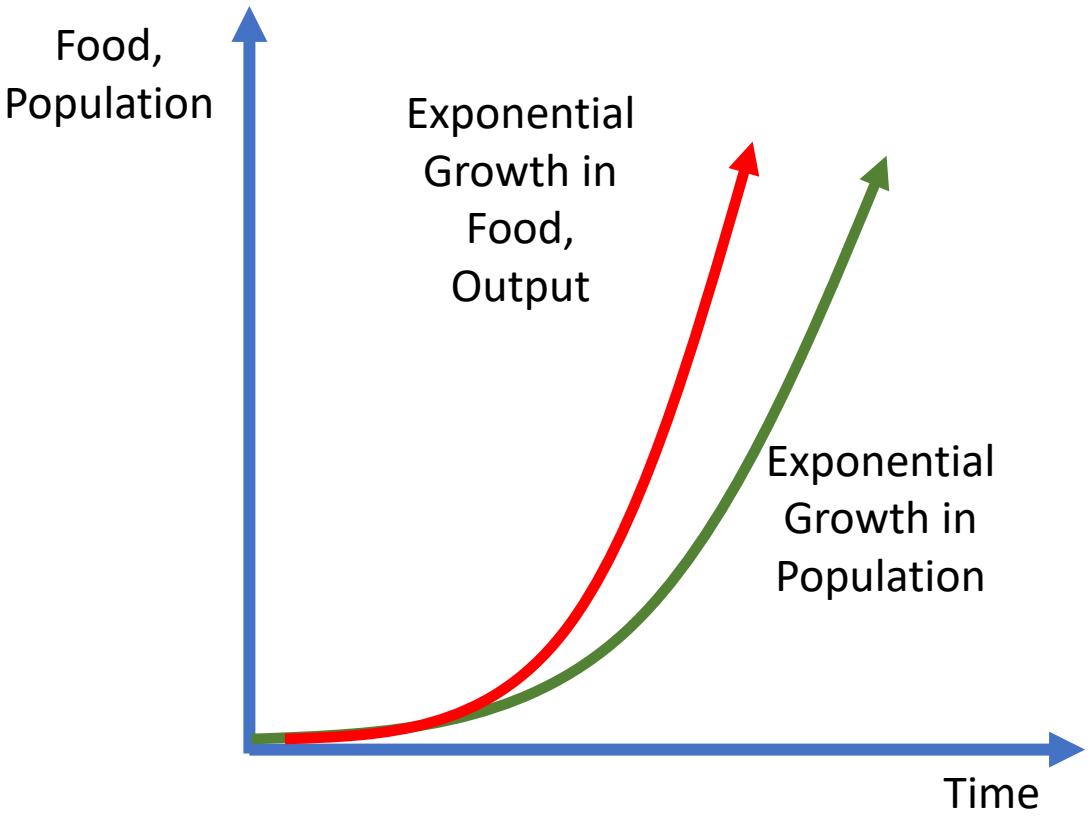


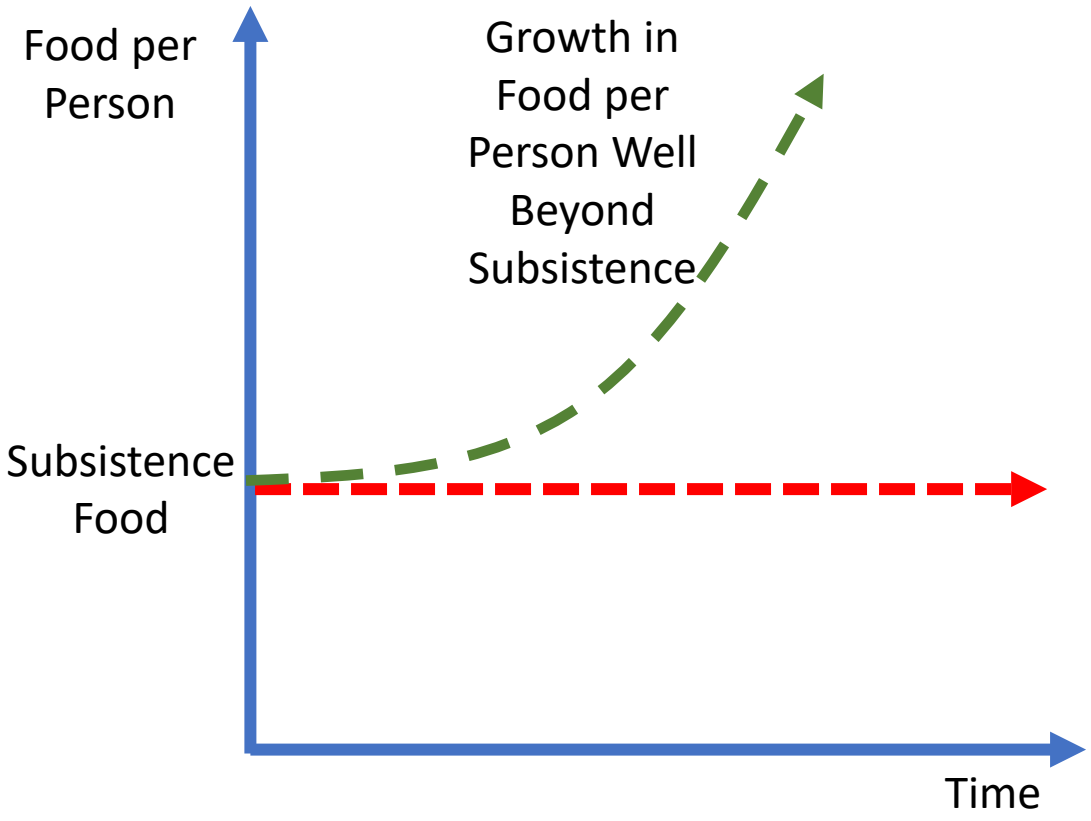
Checks on Population



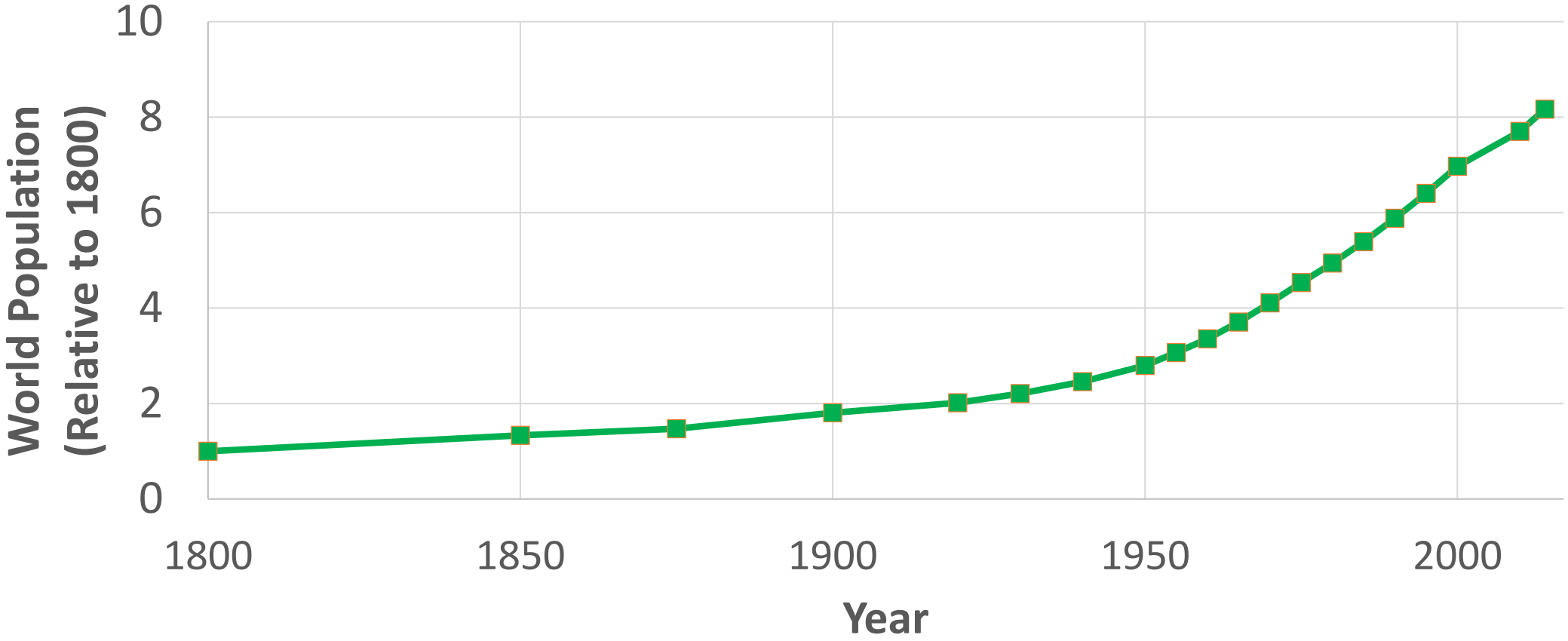


What Really Happened Since Malthus?



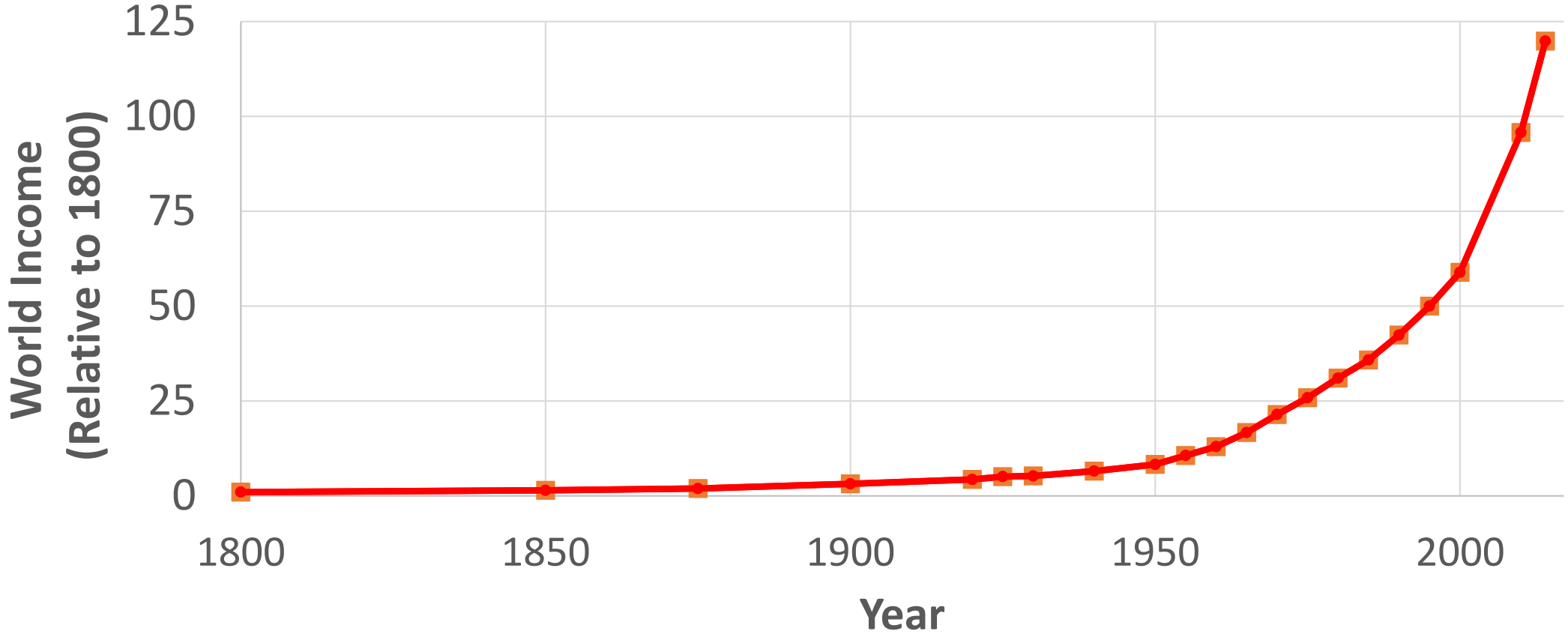


8-Fold Increase in World Population



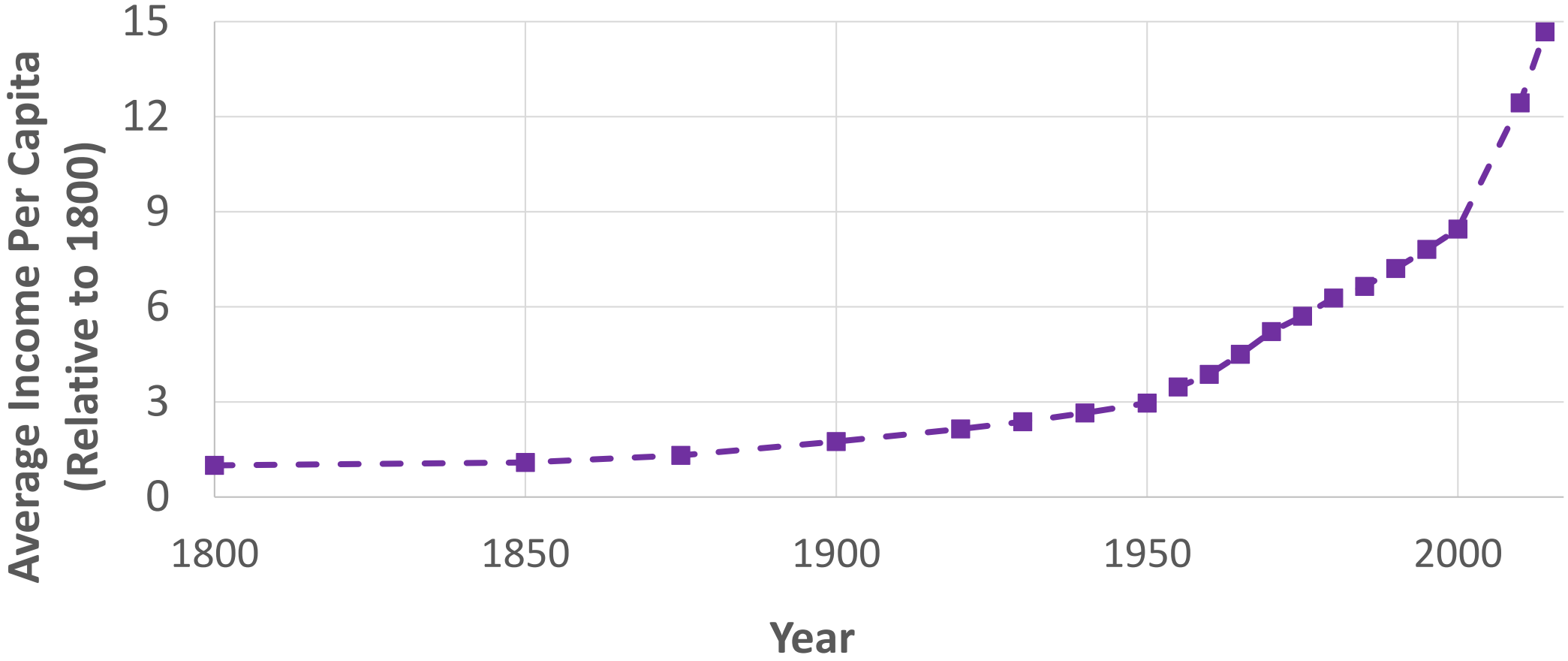
Sources: DeLong (1998) and United Nations (*World at Six Billion*, 2016)

120-Fold Increase in World Income



Sources: DeLong (1998) and CIA (World Factbook, 2016)

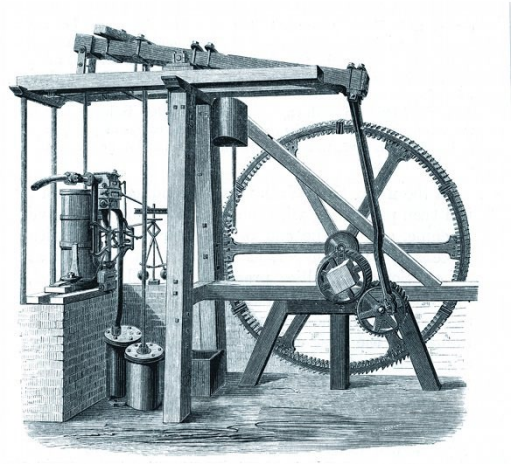
15-Fold Increase in Average Income

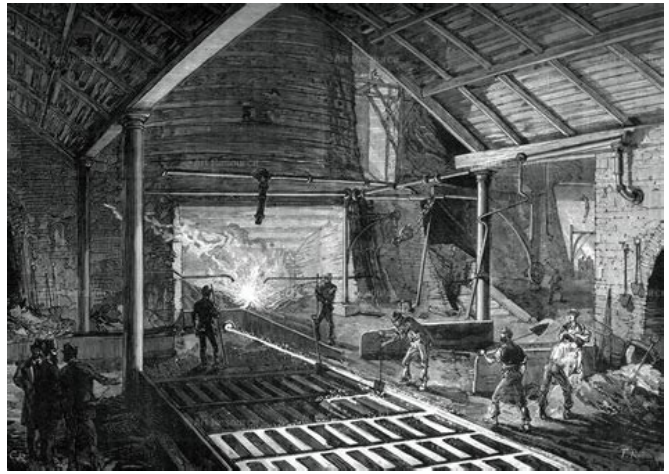


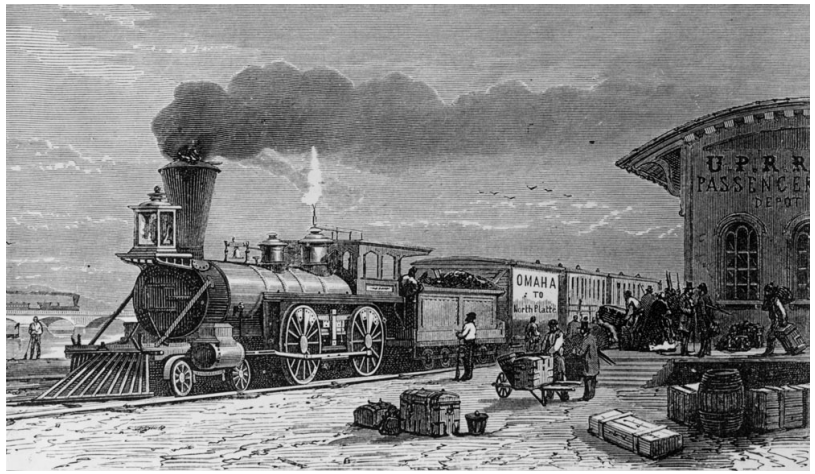
Note: Calculated from previous sources.

Why Was Malthus Wrong?

New Technologies from the Industrial Revolution…

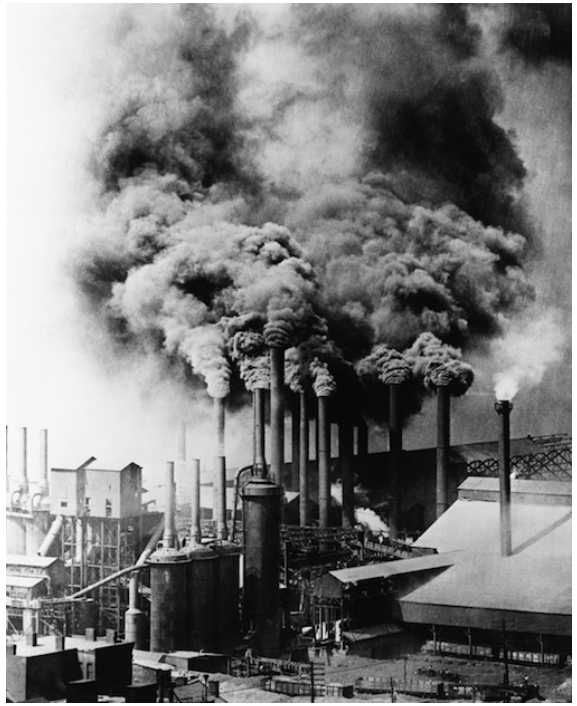






… and the Agricultural Revolution

Dirty and Clean Technologies



Comparing Countries Reveals…

GDP/person			
Infant Mortality			
Life Expectancy			
% Farming			
Primary Schooling			

Comparing Countries Reveals…

	Chad		
GDP/person	$1,600		
Infant Mortality	9.7%		
Life Expectancy	48 years		
% Farming	80%		
Primary Schooling	40%		

Comparing Countries Reveals…

	Chad		
GDP/person	$1,600	$2,700	
Infant Mortality	9.7%	23%	
Life Expectancy	48 years	40 years	
% Farming	80%	58%	
Primary Schooling	40%	63%	

Comparing Countries Reveals…

	Chad		US
GDP/person	$1,600	$2,700	$46,300
Infant Mortality	9.7%	23%	0.8%
Life Expectancy	48 years	40 years	78 years
% Farming	80%	58%	3%
Primary Schooling	40%	63%	98%

Comparing Countries Reveals…

	Chad	US in 1850	US
GDP/person	$1,600	$2,700	$46,300
Infant Mortality	9.7%	23%	0.8%
Life Expectancy	48 years	40 years	78 years
% Farming	80%	58%	3%
Primary Schooling	40%	63%	98%

The Importance of Growth

- Every single country that has high average living standards today was poor in 1850
- These countries all improved their average living standards by experiencing a century or more of per capita economic growth

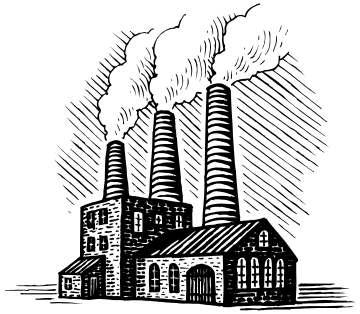
$$per\ capita\ economic\ output = \frac{economic\ output}{total\ population}$$

- None of these countries attained per capita economic growth merely through long-term population reductions (reducing the denominator). Something deeper happened to increase the numerator.

What Makes Economies Grow?

- Economic growth = growth in economic output per person
- What makes economies grow? Is it more physical capital (factories)?

Capital and Growth



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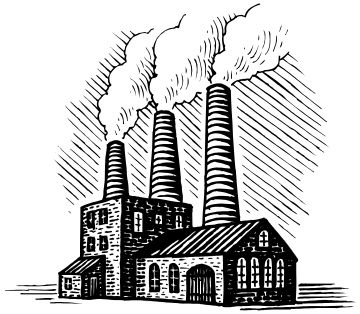

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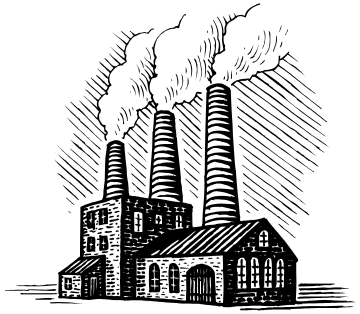

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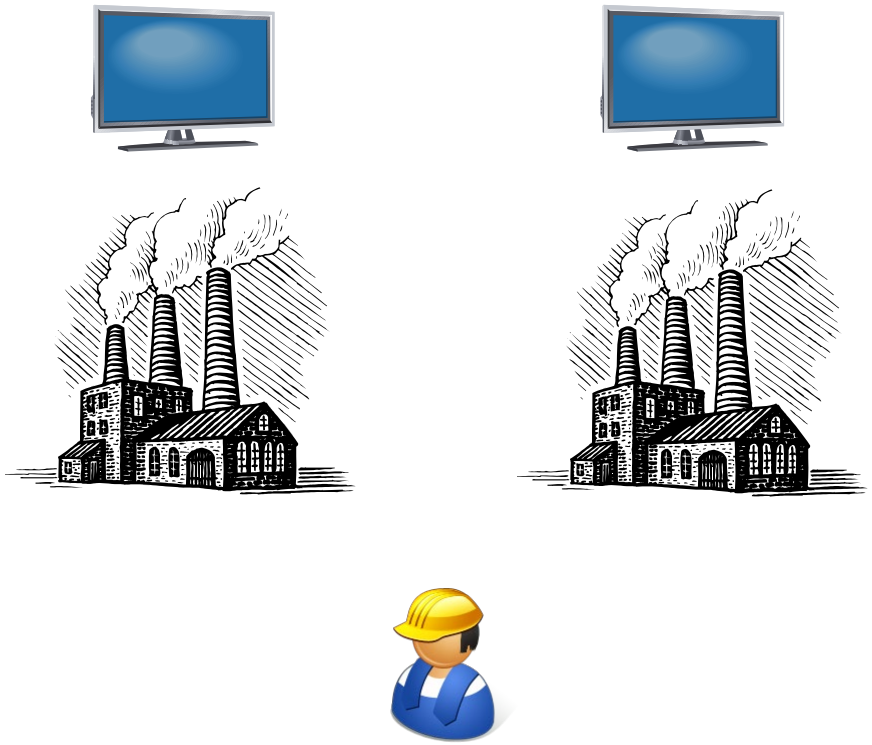

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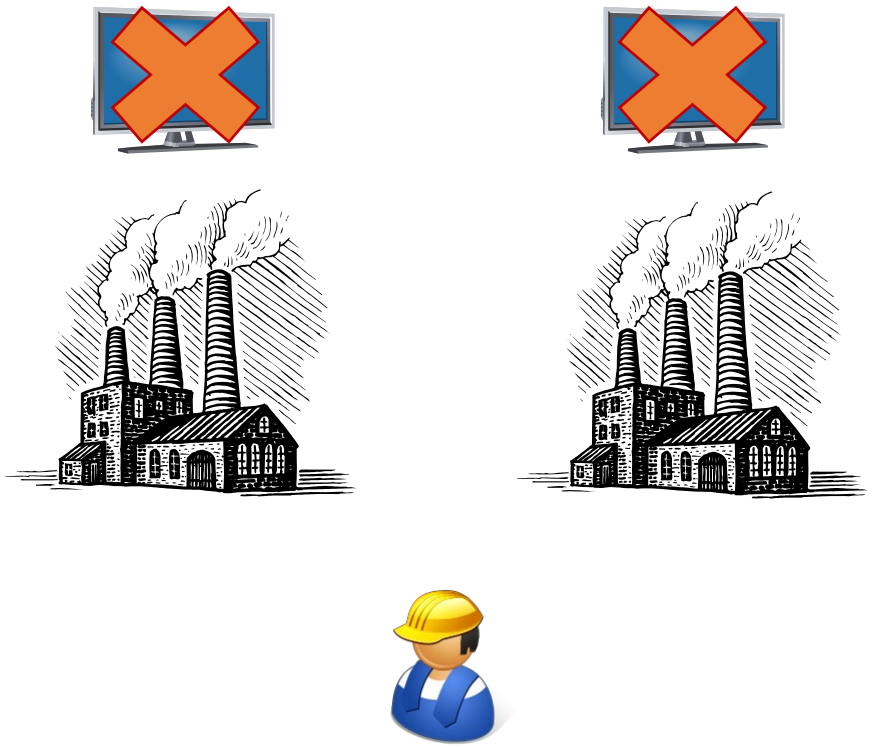

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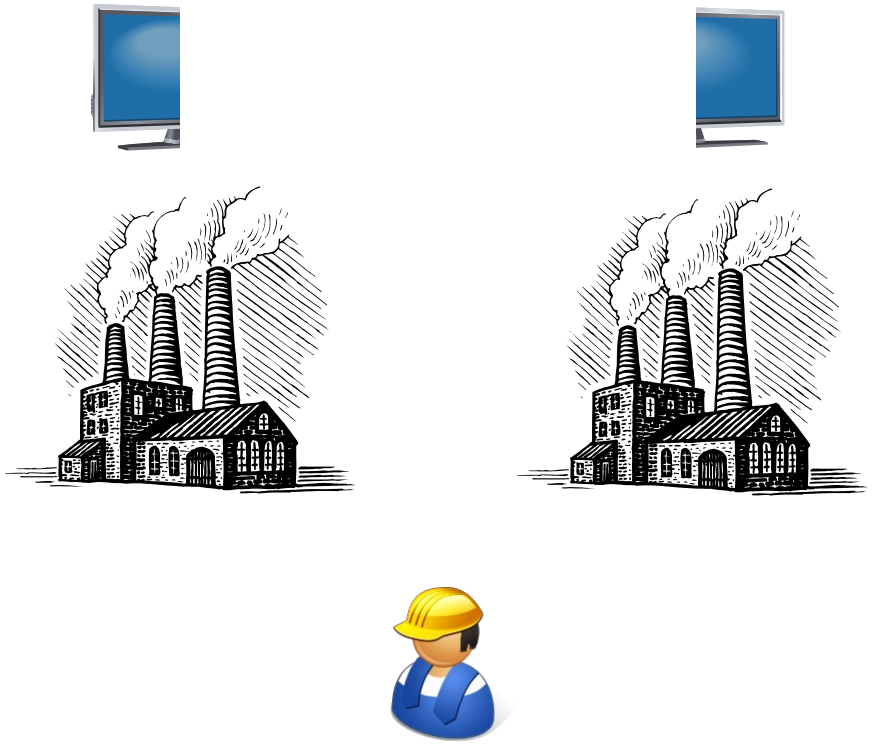

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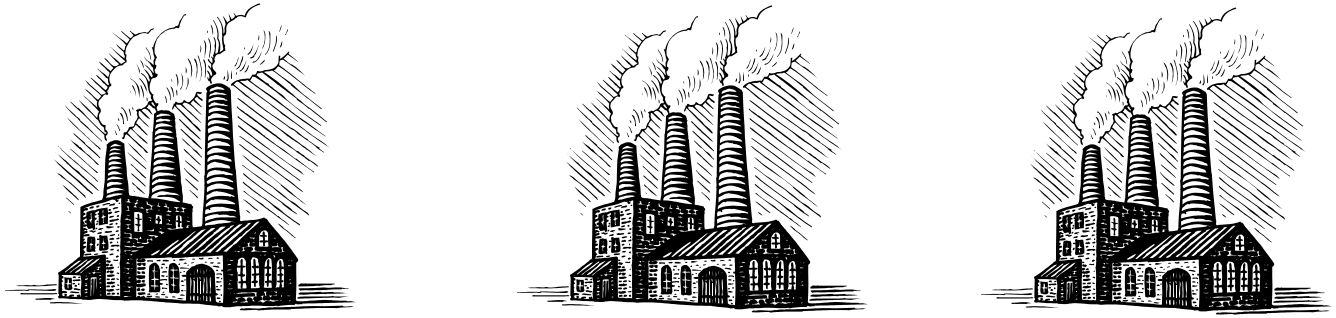

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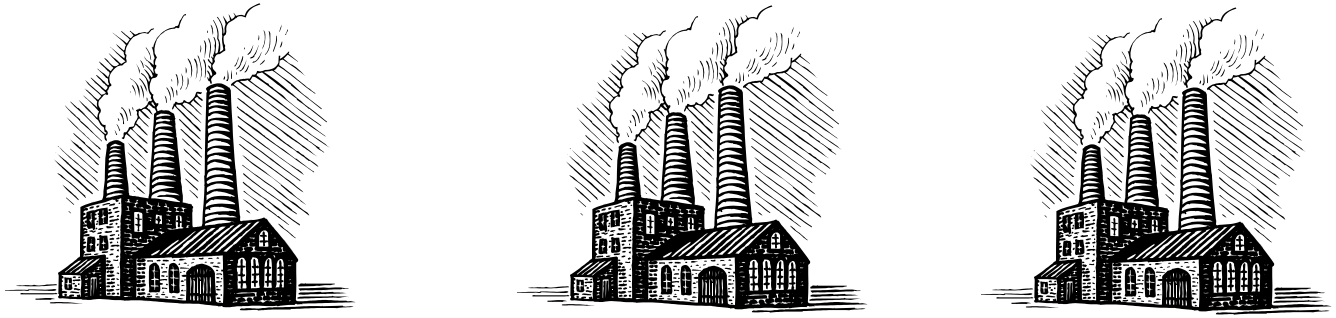

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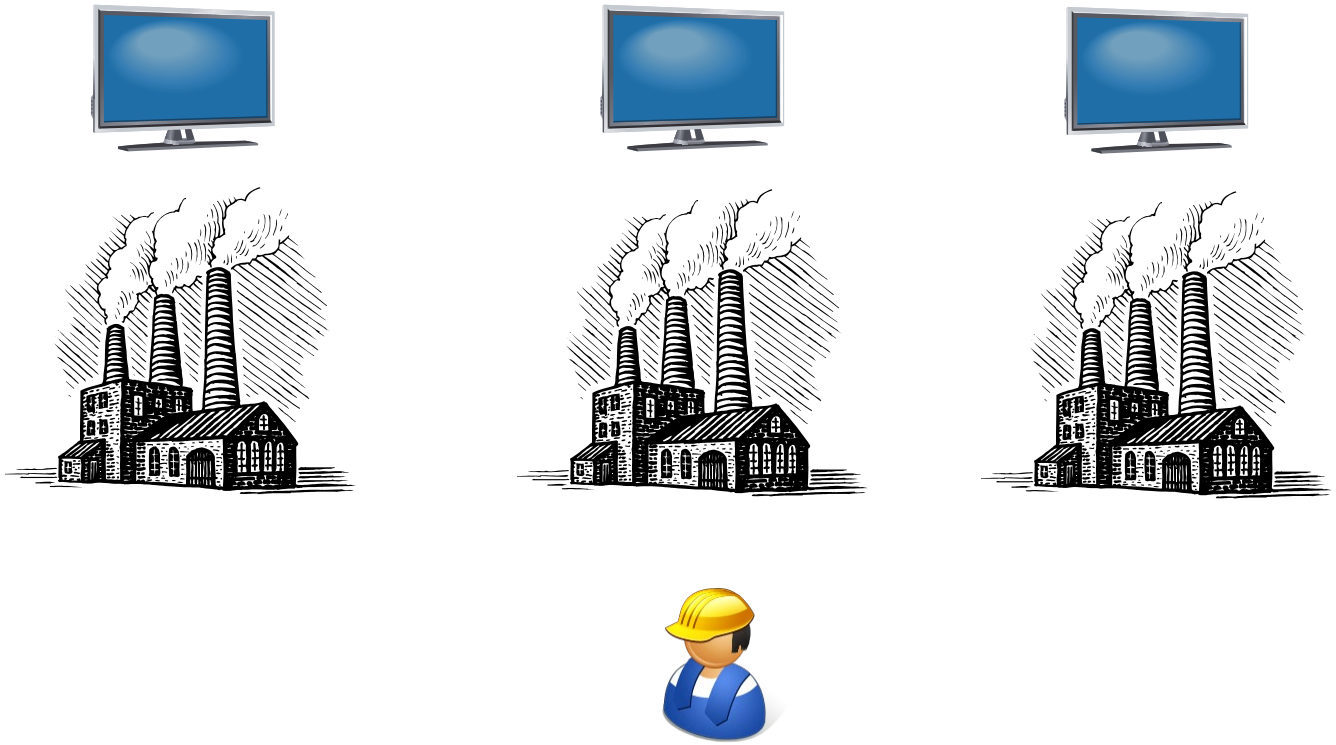

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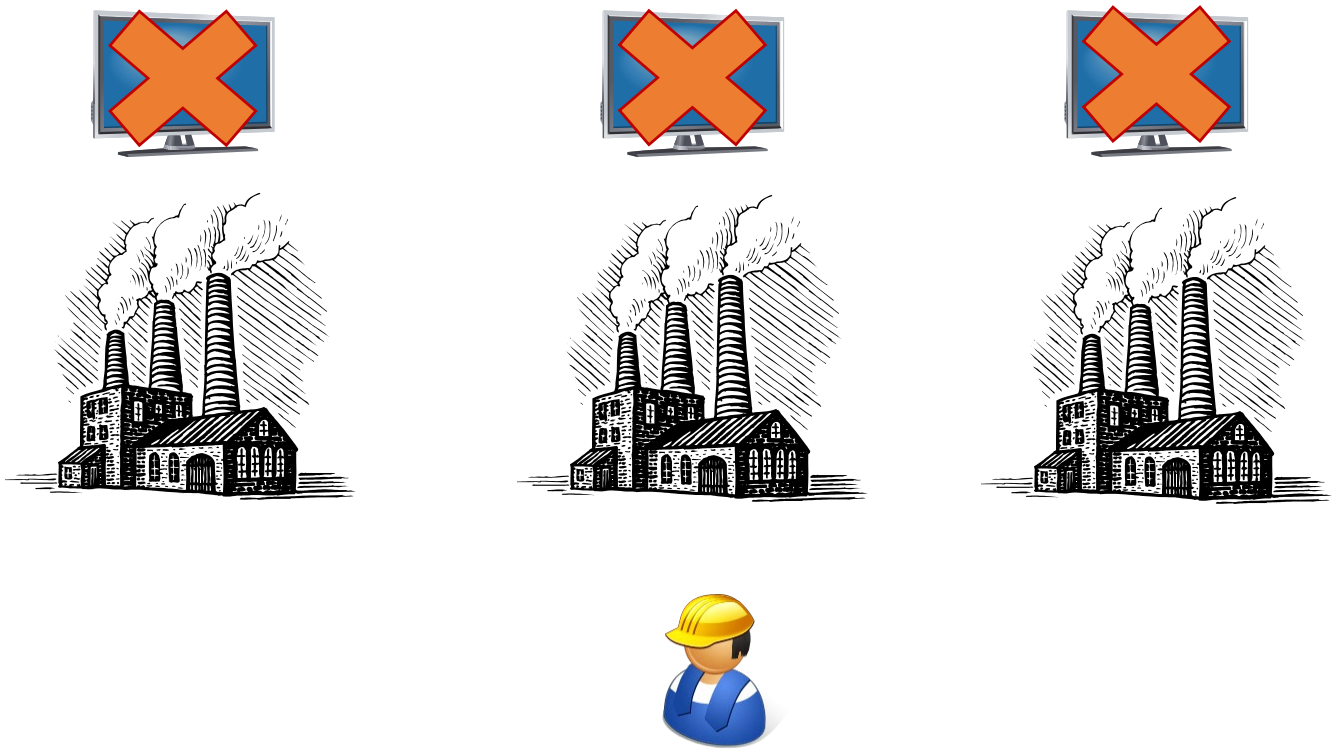

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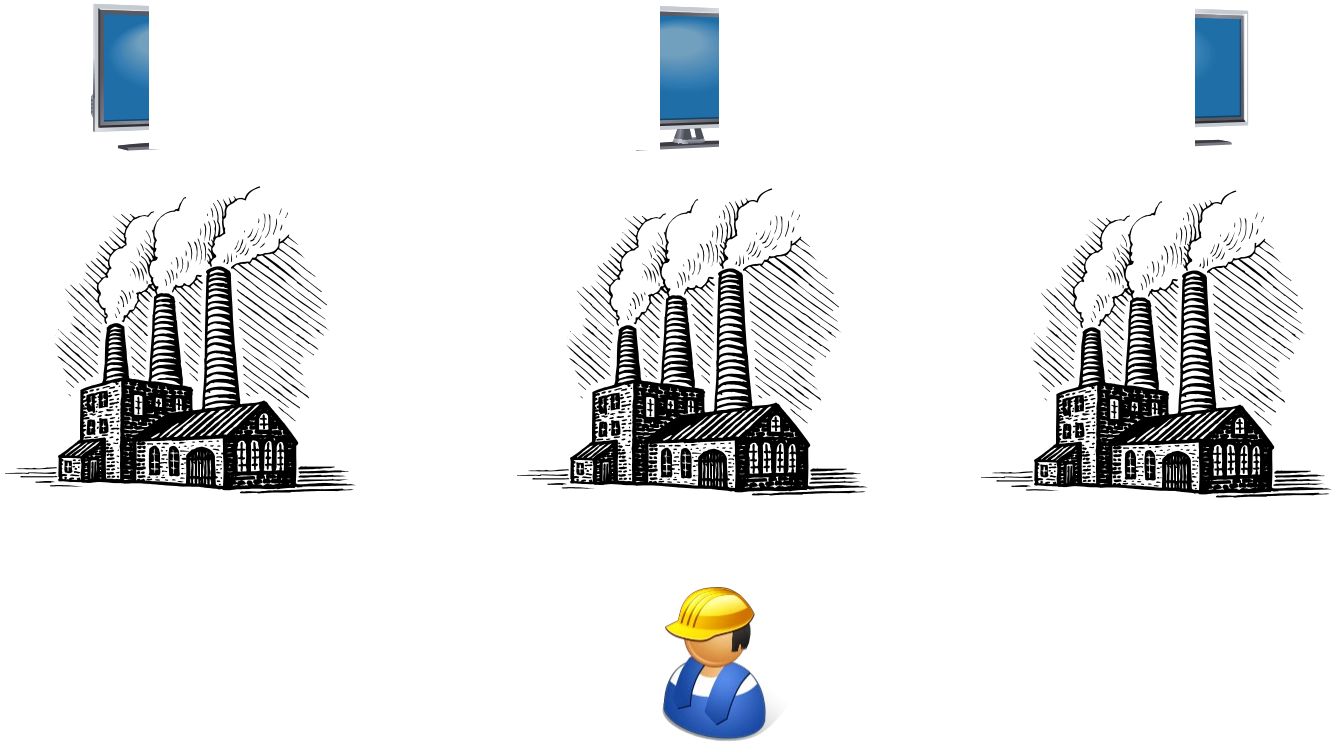
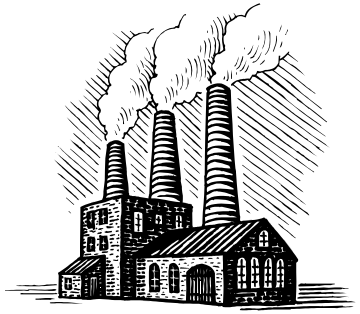


Capital and Growth

- When labor is fixed, each extra unit of capital produces a smaller increase in output
- This is called *diminishing marginal returns*, and it is one of the most empirically-verified phenomena in all of economics
- We also call it *decreasing returns to scale:* as the scale of our factories doubles, our output less than doubles

Capital and Labor Together



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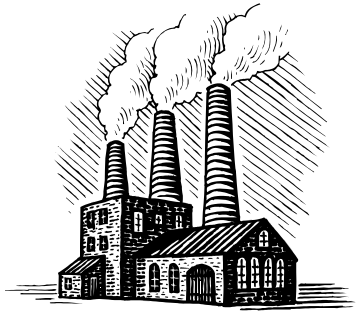

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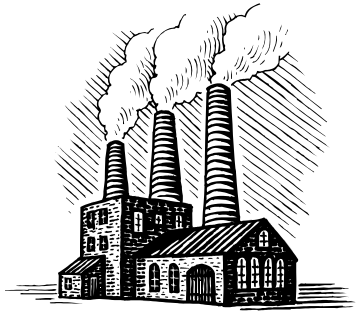

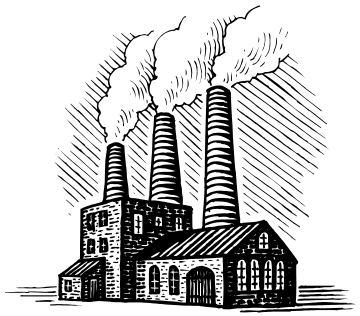

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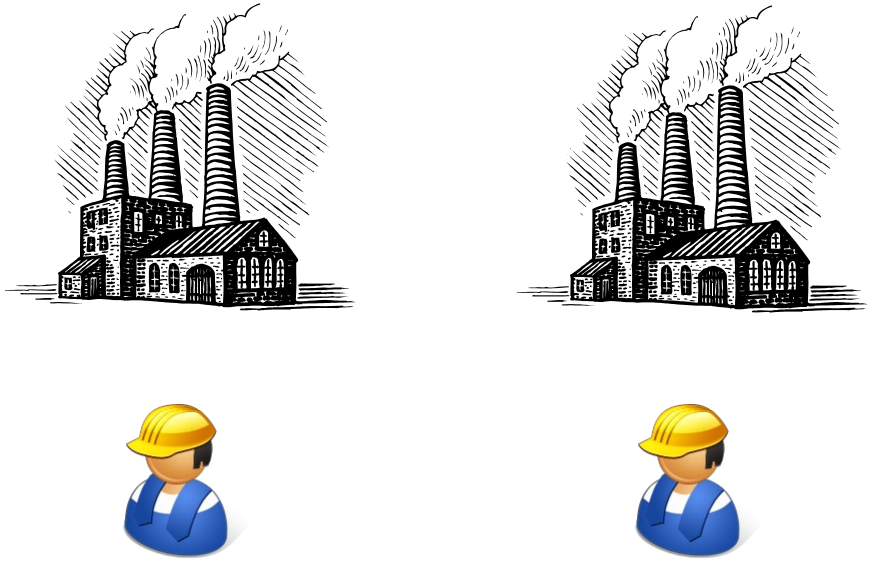

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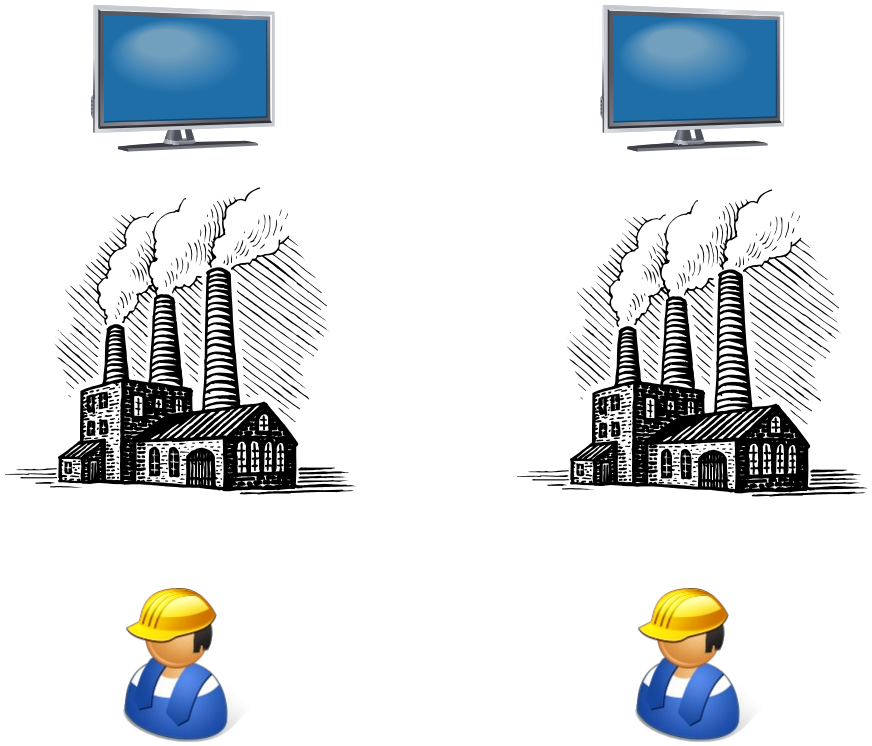

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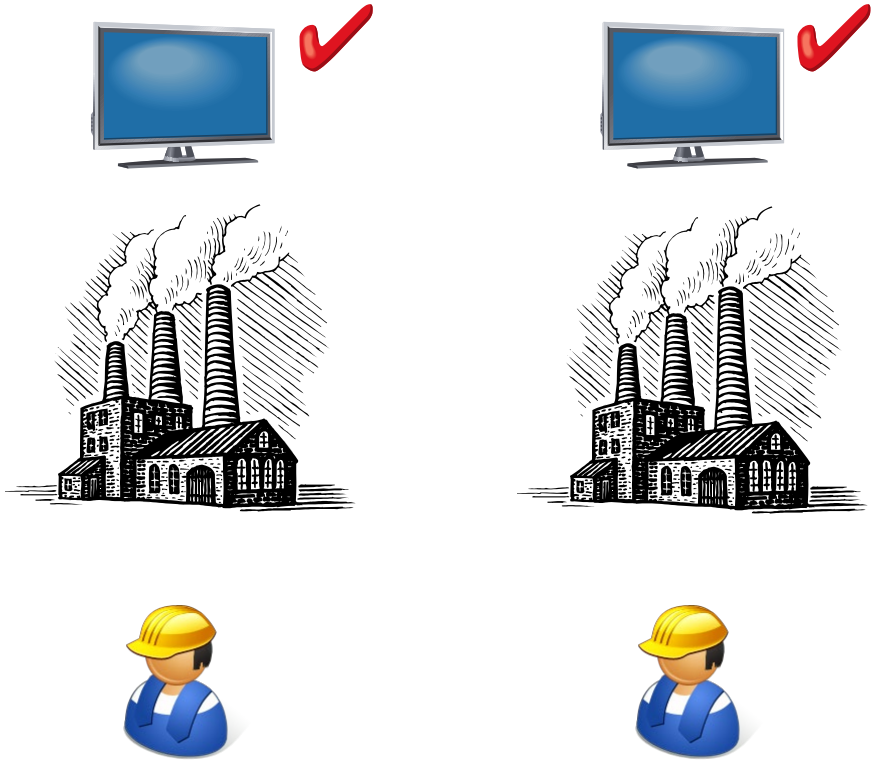

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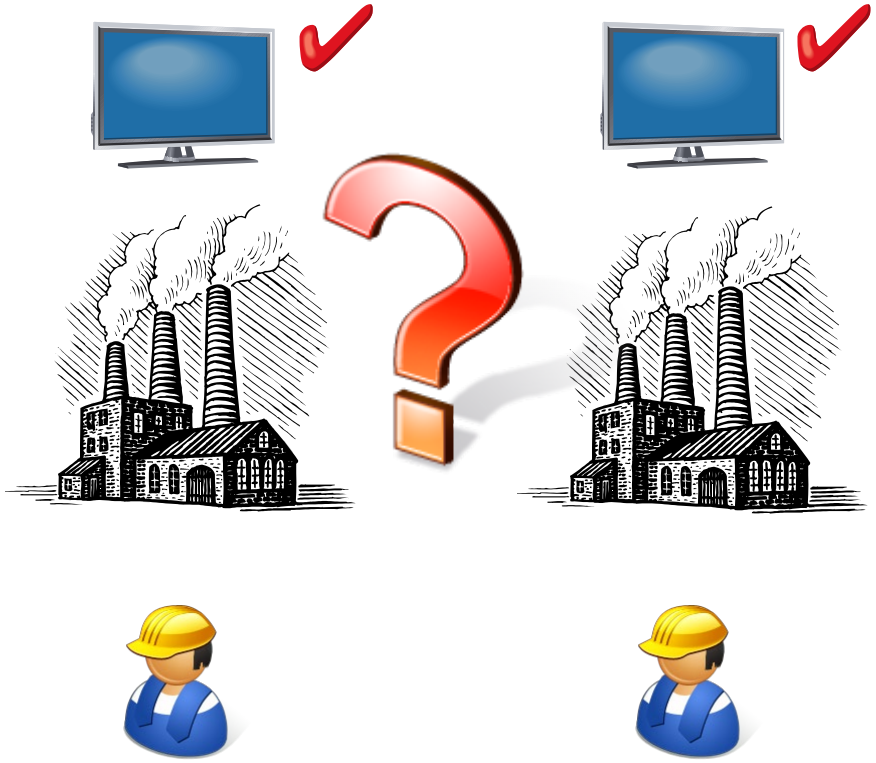


Capital and Labor Together

- If we increase both capital and labor, then the best we can do is *constant returns to scale*
- We double our inputs, and we get double our output

Constant Returns to Scale and Growth

- In a world of constant returns to scale, we can't have *per capita* economic growth
- The best we can do in that world is to match any increases in population by a proportionate increase in production: per capita is constant
- Maybe we need *increasing returns to scale* to get per capita economic growth

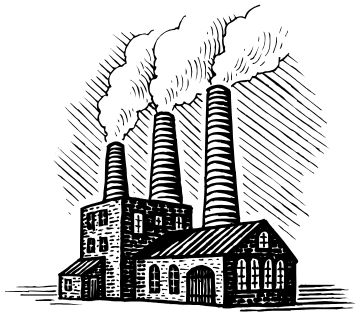
Increasing Returns to Scale

- Under increasing returns to scale, if we double all of our inputs, we more than double our outputs.
- That means that each worker gets more then they used to
- That means long-term economic growth!

Knowledge

- Maybe there's another input to production we've forgotten, that gives increasing returns
- We've covered the physical *stuff* that goes into production (raw materials, factories, etc).
- We've covered the *labor* that manipulates that physical stuff
- What about the *instructions* for manipulating that stuff? What about *knowledge*?

Knowledge and Growth



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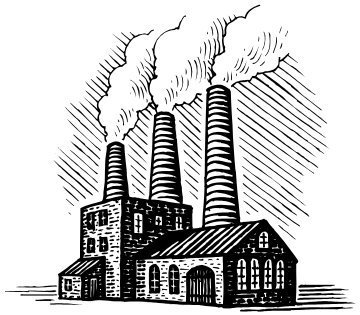

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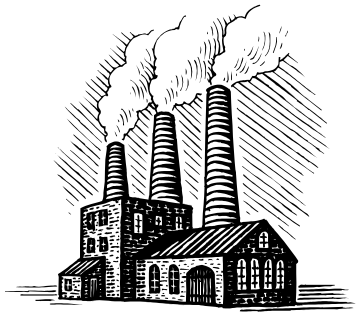

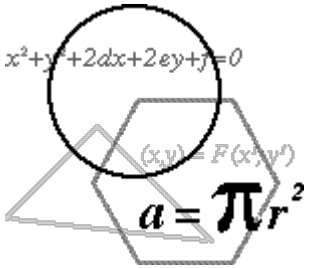

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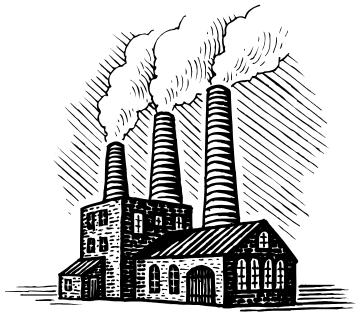

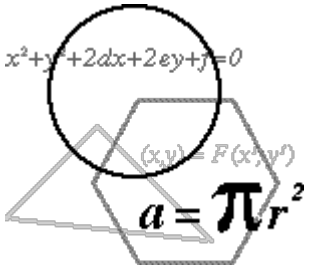

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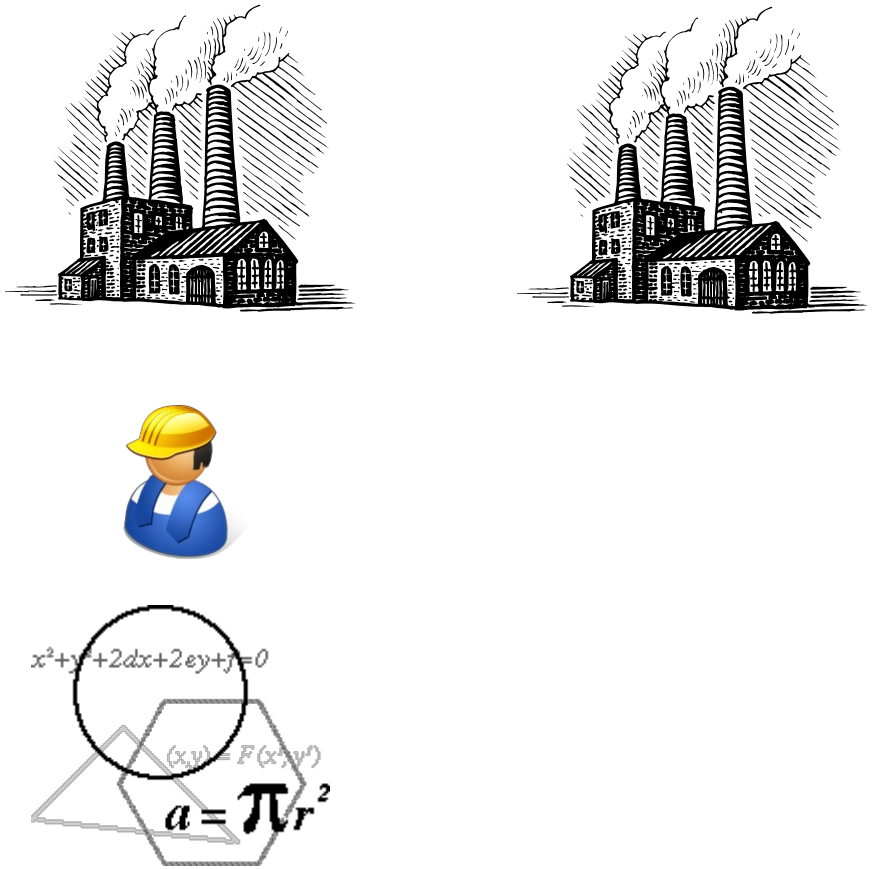

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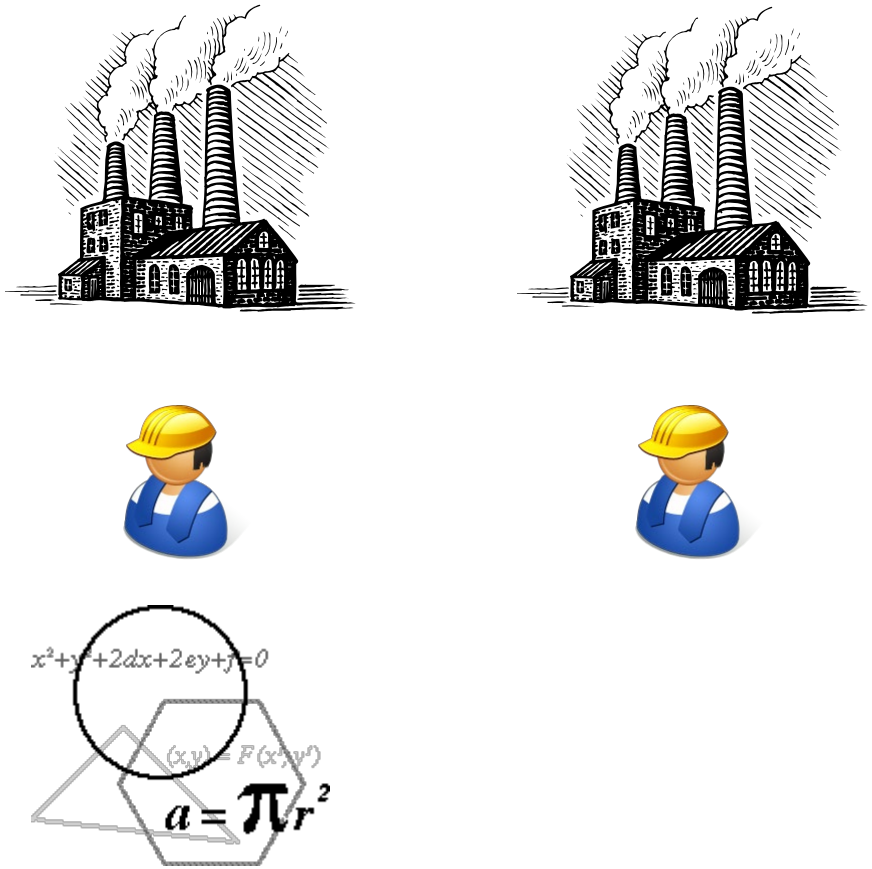

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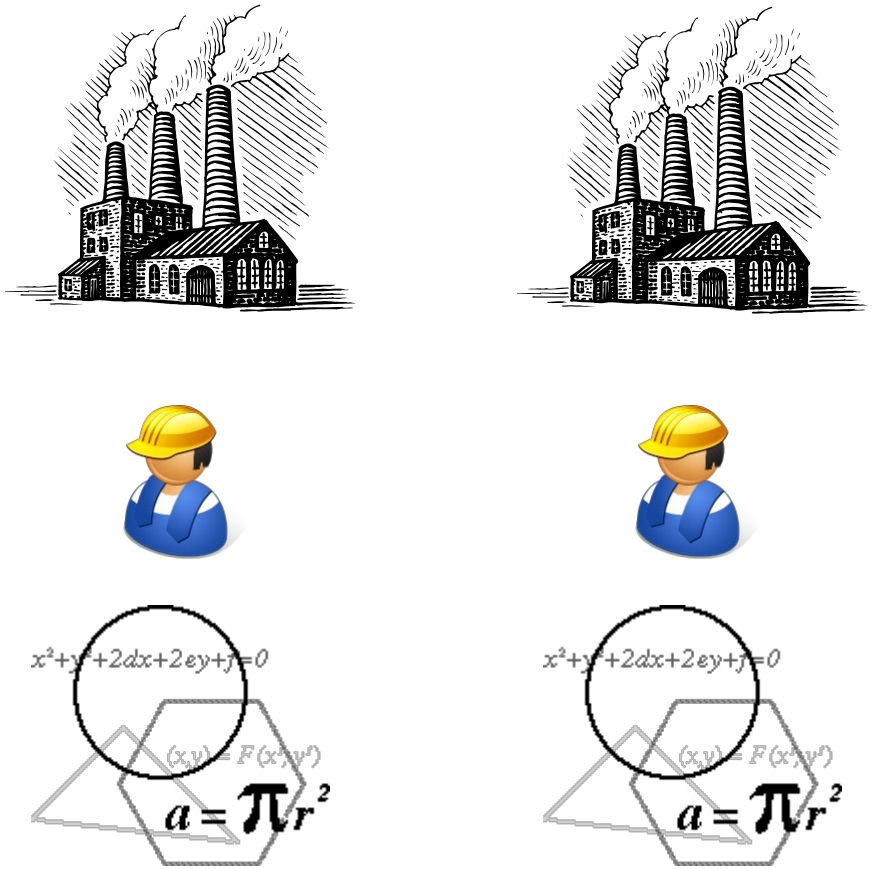

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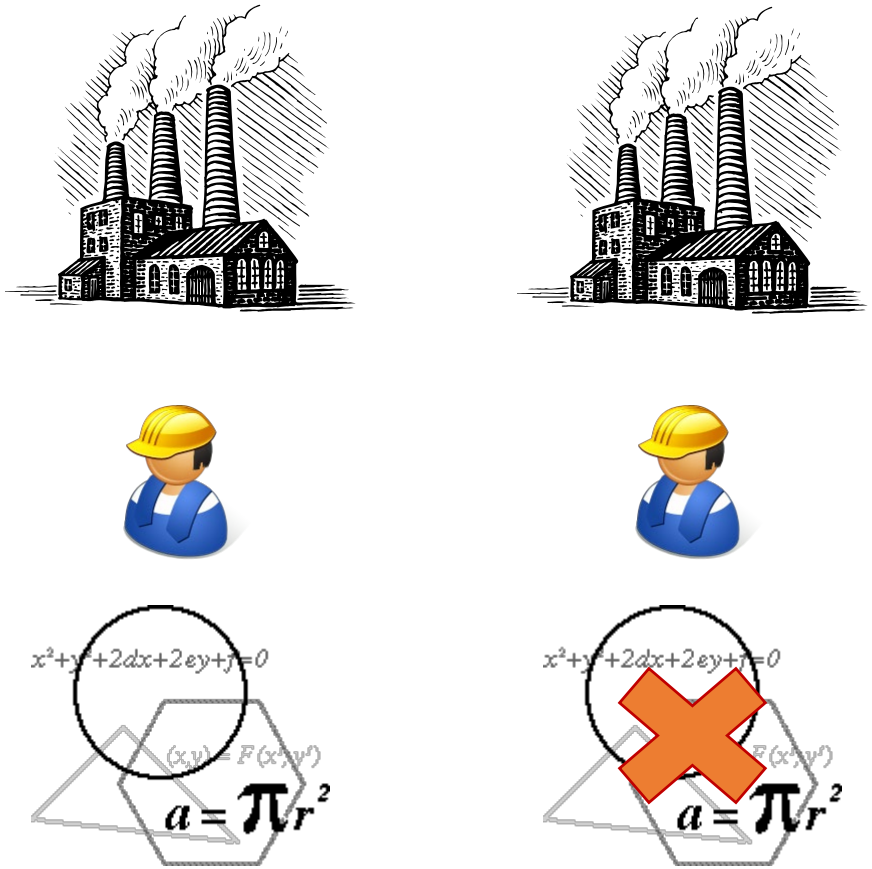

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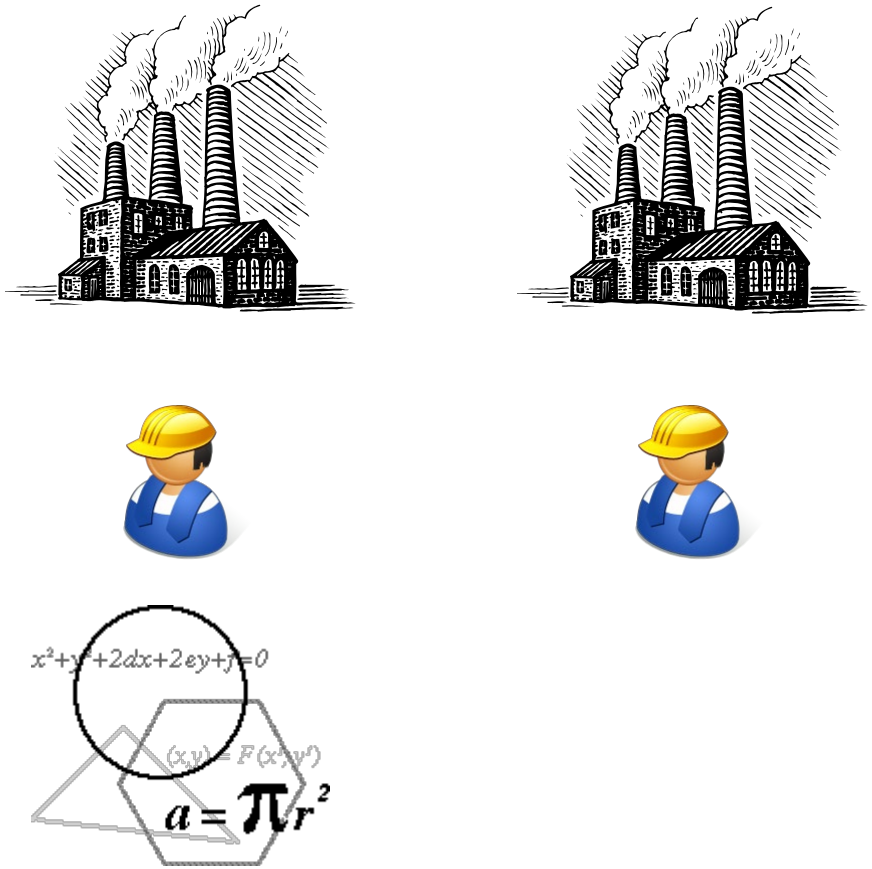

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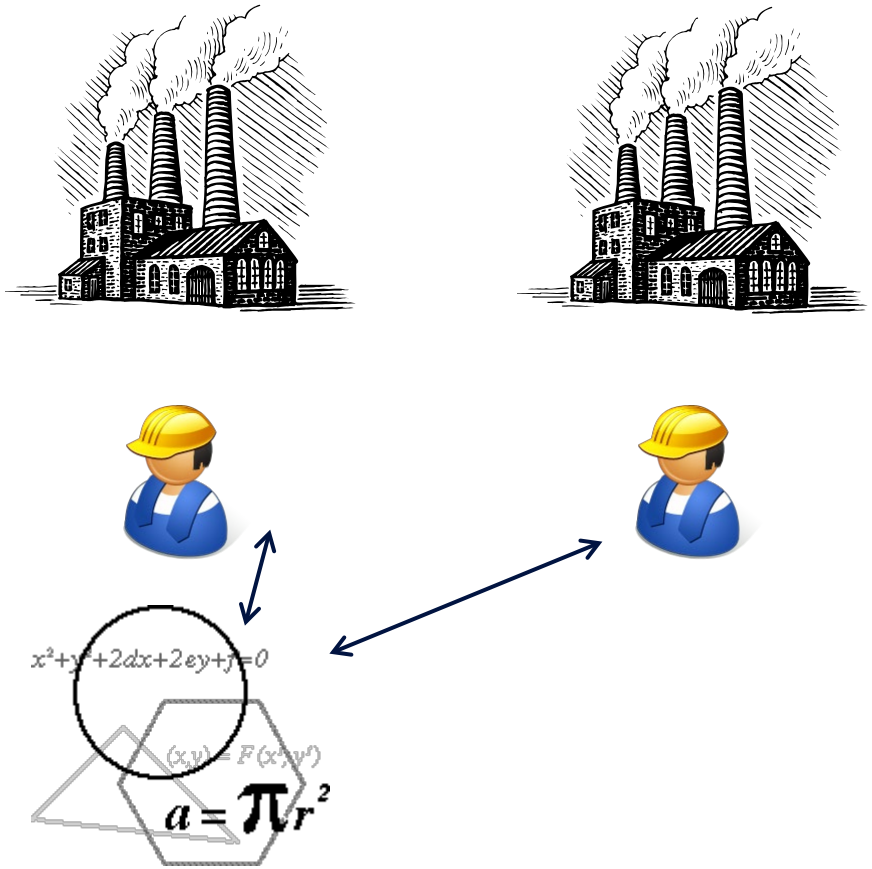

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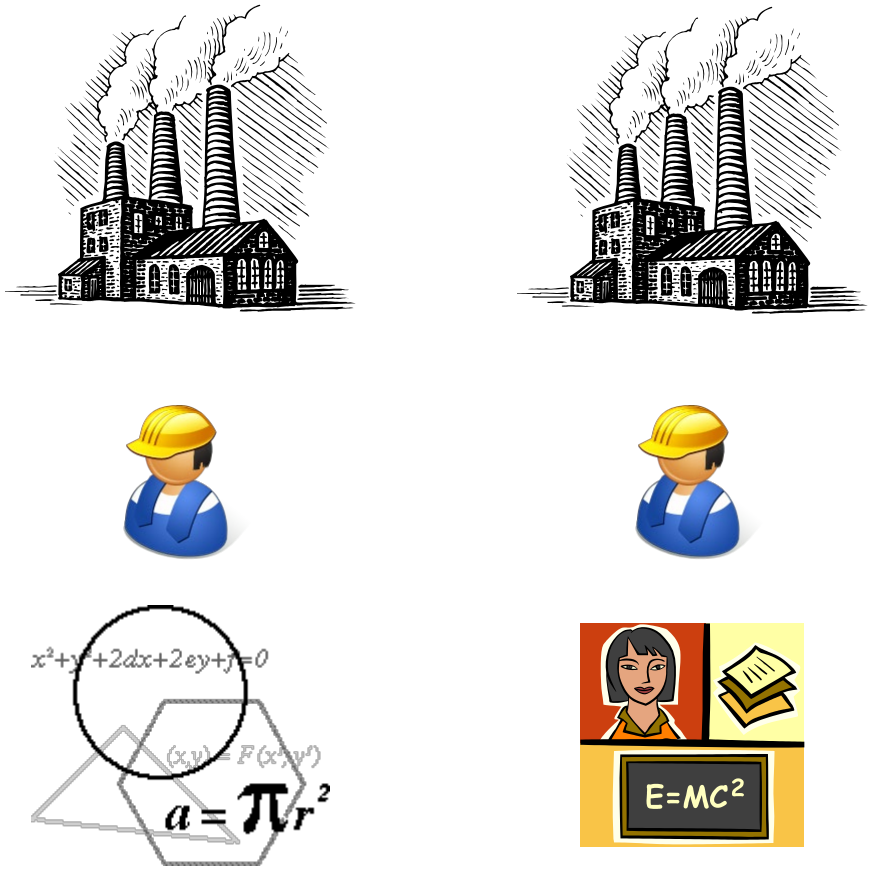

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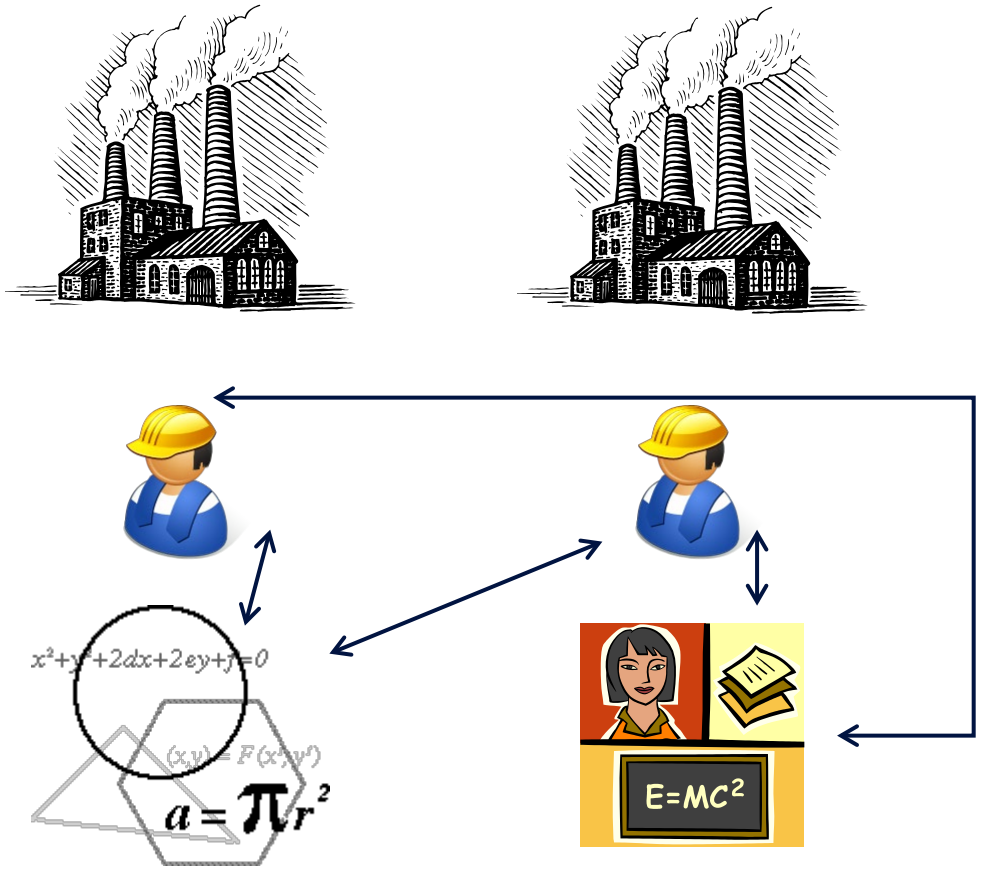

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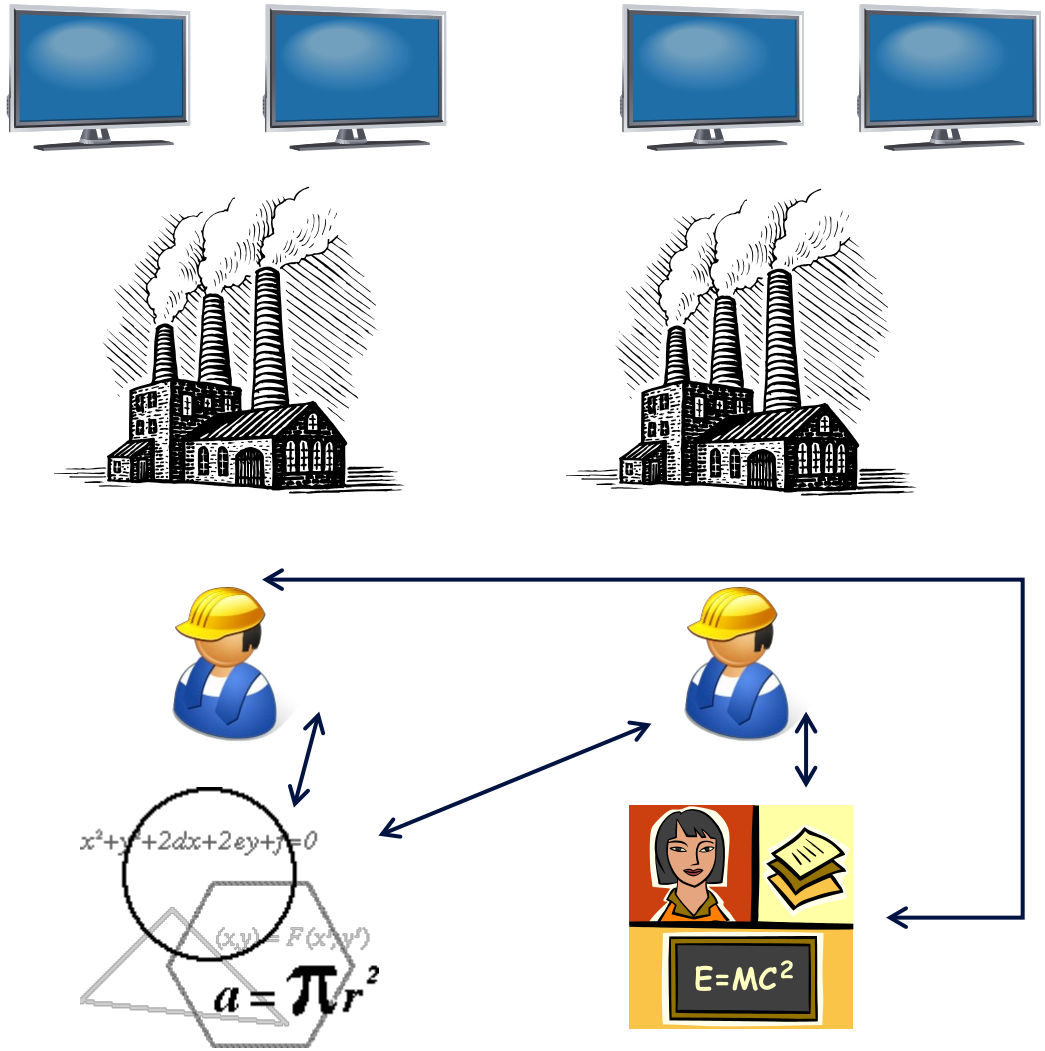


Knowledge is Non-rival

- Thomas Jefferson on Knowledge:
  - “It’s peculiar character. . . is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine receives light without darkening me.”

How do We Produce More Knowledge?

How do We Produce More Knowledge?

- Maybe important knowledge comes when a genius has a "Eureka!" moment.
- In that case, we can produce more knowledge by making sure there are more geniuses.

How do We Get More Geniuses?

“As for the Arts of Delight and Ornament, they are best promoted by the greatest number of emulators. And it is more likely that one ingenious curious man may rather be found among 4 million than 400 persons.”

William Petty, 1682

“One can hardly imagine, I think how poor we would be today were it not for the rapid population growth of the past to which we owe the enormous number of technological advances enjoyed today… If I could re-do the history of the world, having population size each year from the beginning of time on some random basis, I would not do it for fear of losing Mozart in the process.”

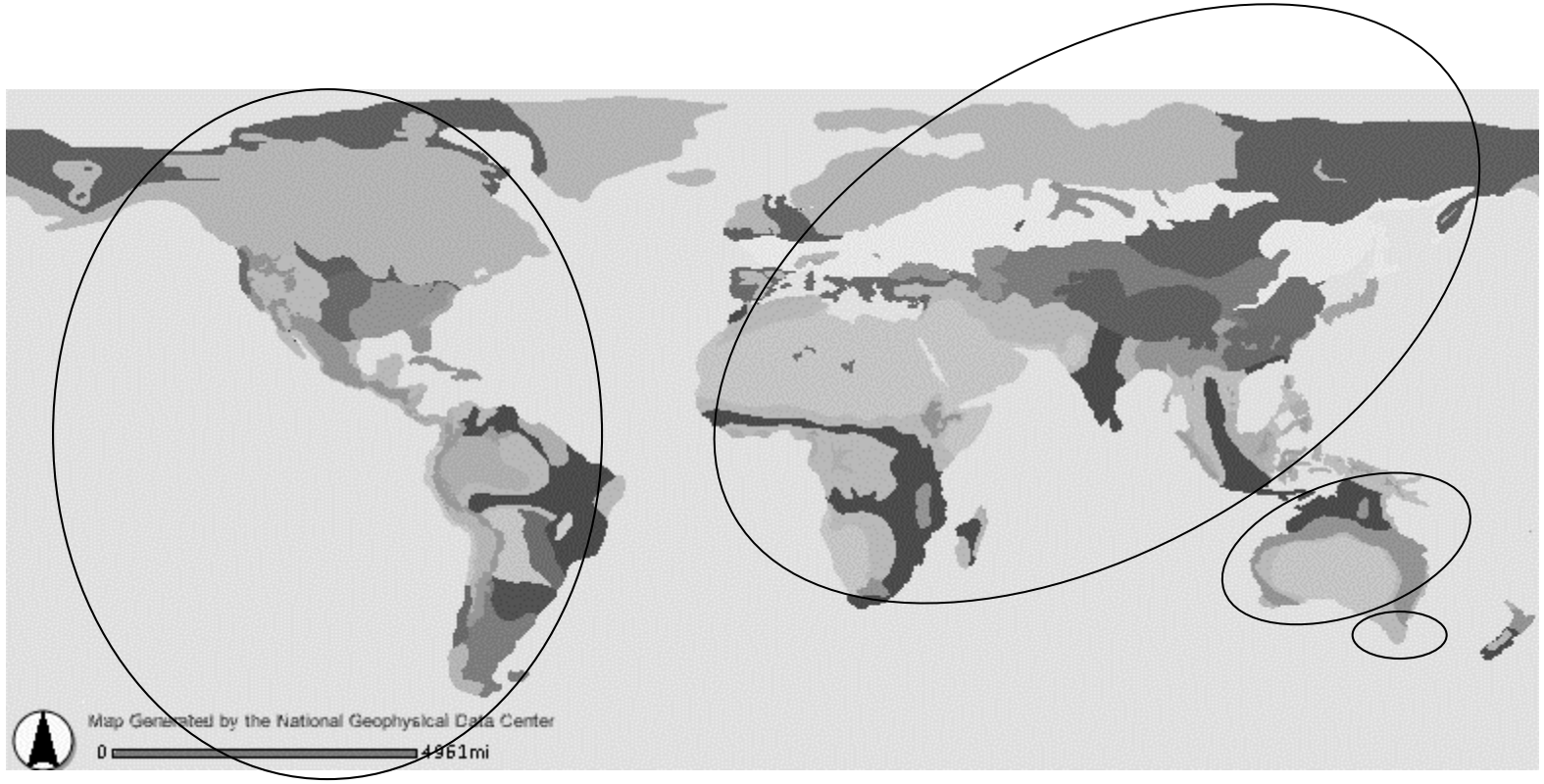
E.S. Phelps, 1968

A Natural Experiment

- We need a natural experiment:
- Several areas start with the same technology
- But they have different initial populations
- We let them develop over the long-term
- Then, after a few thousand years, we drop in and see whether the places that started with higher populations now have better technology, or worse technology

110,000BC – 8,000BC

- Last Ice Age
- Ice Bridges and Land Bridges
- 4 Connected Regions
- Population density everywhere: 0.03 people per square kilometer
- Technology everywhere: stone-age technology



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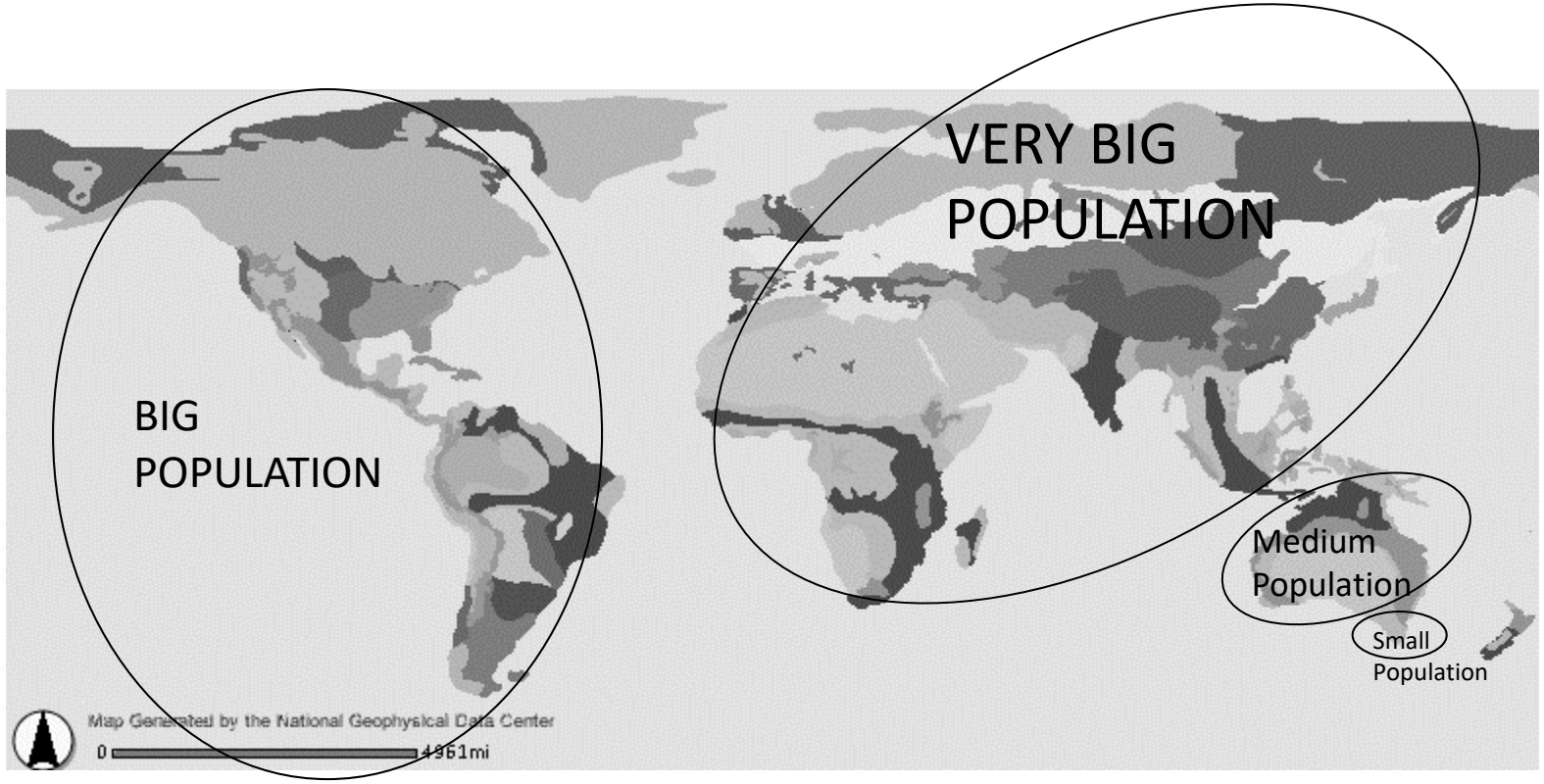
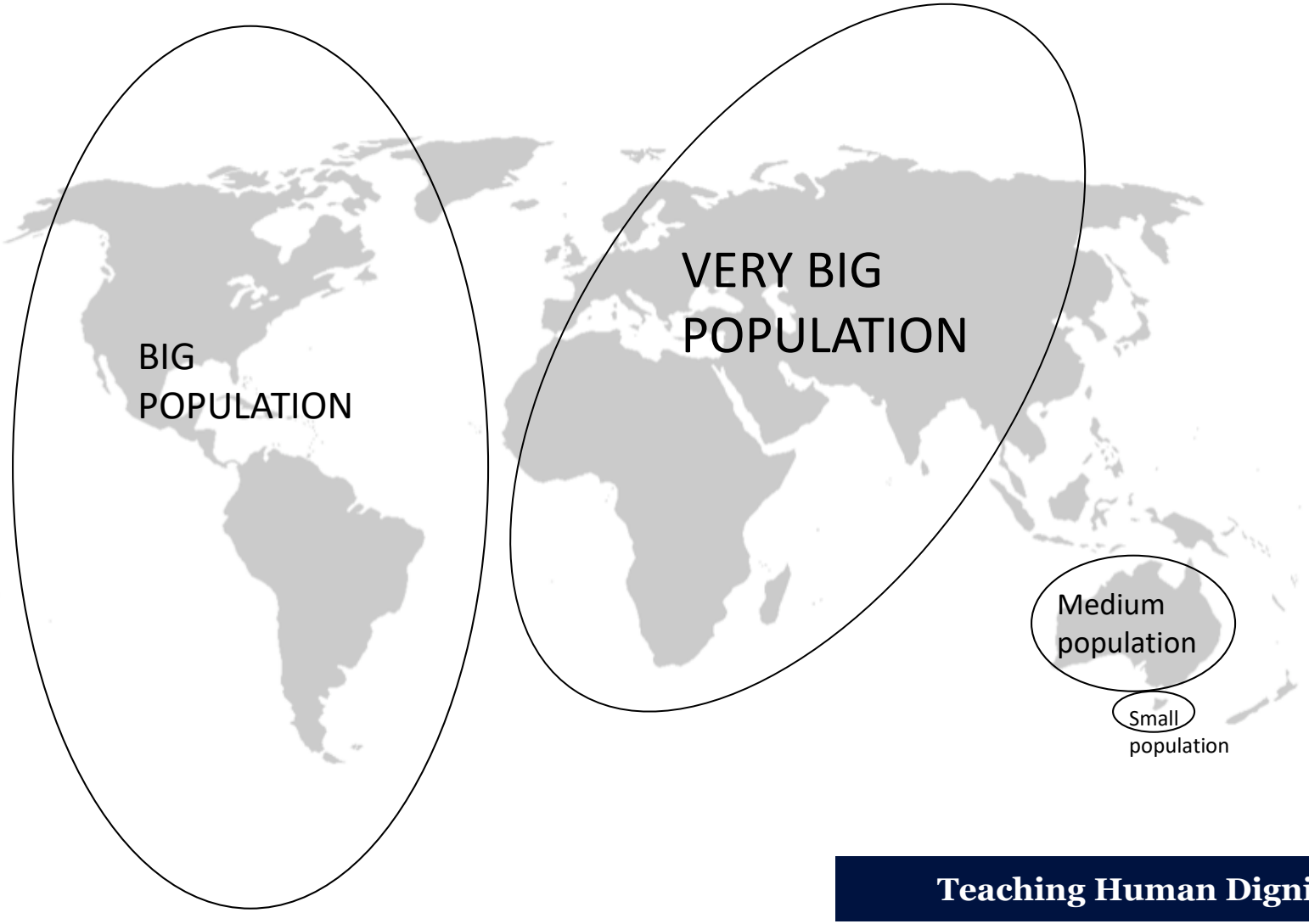


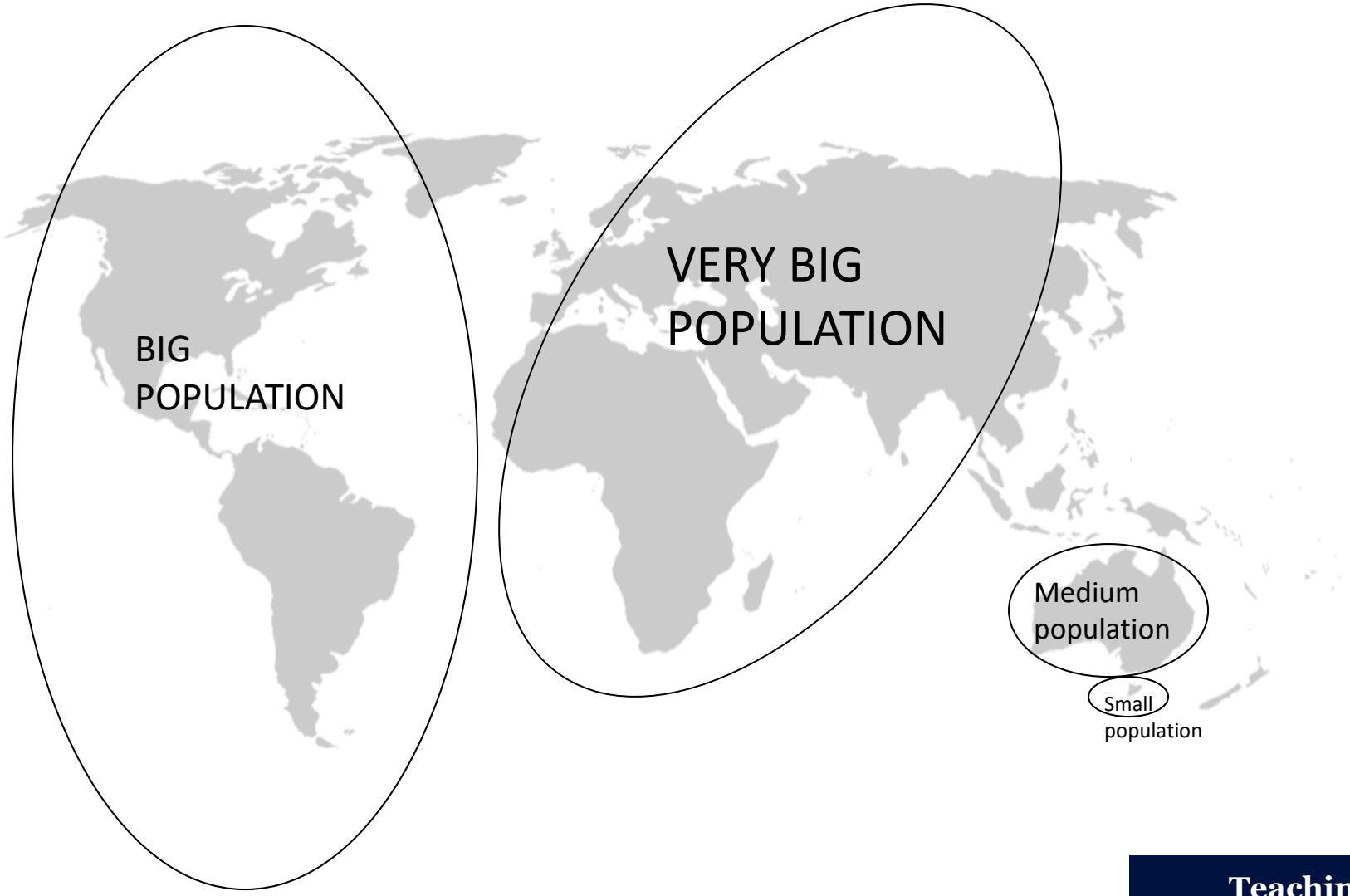
8,000BC

- Ice Bridges Melt
- Sea Levels Rise
- Land Bridges Drown
- 4 Separated Regions

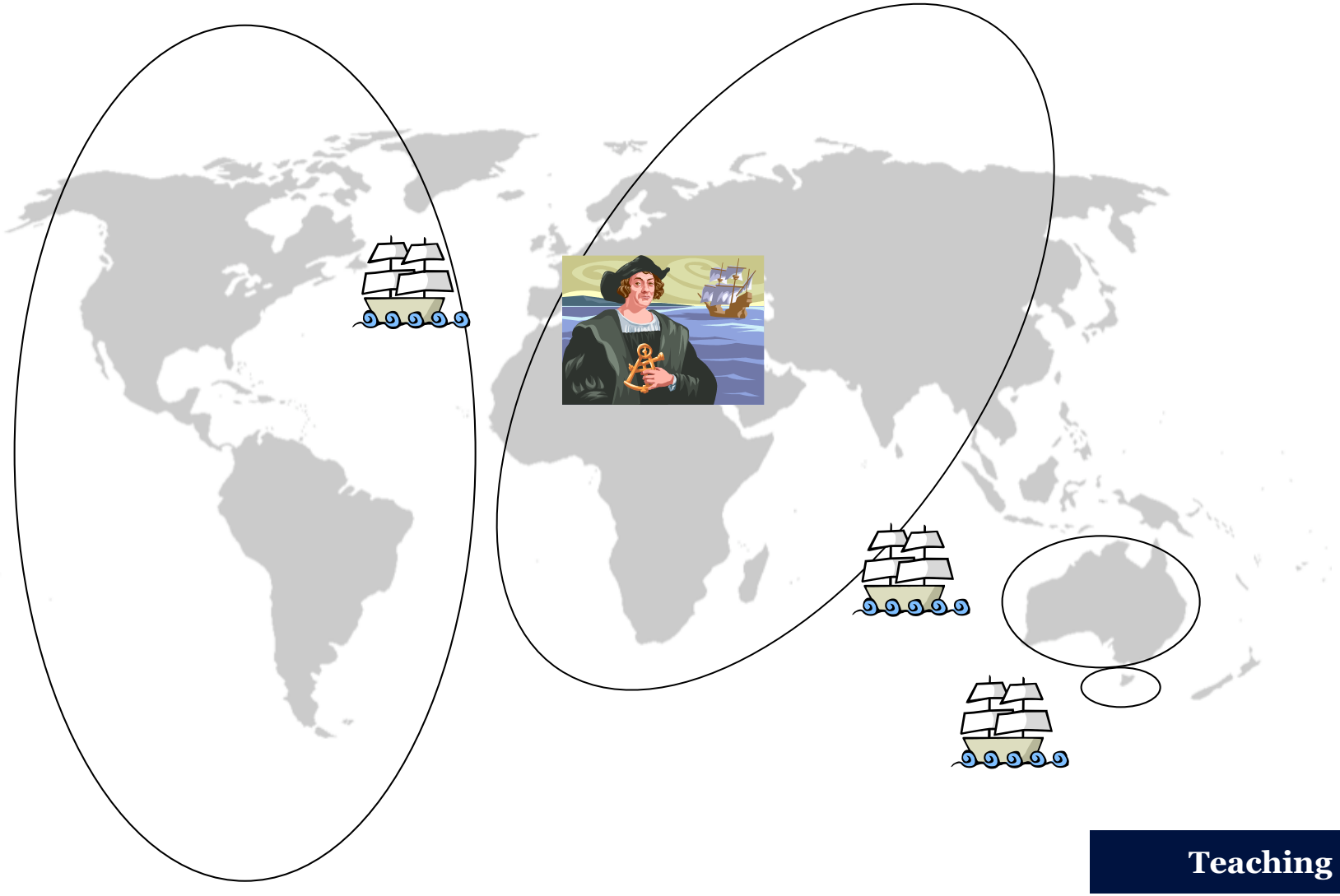


The Experiment Begins…

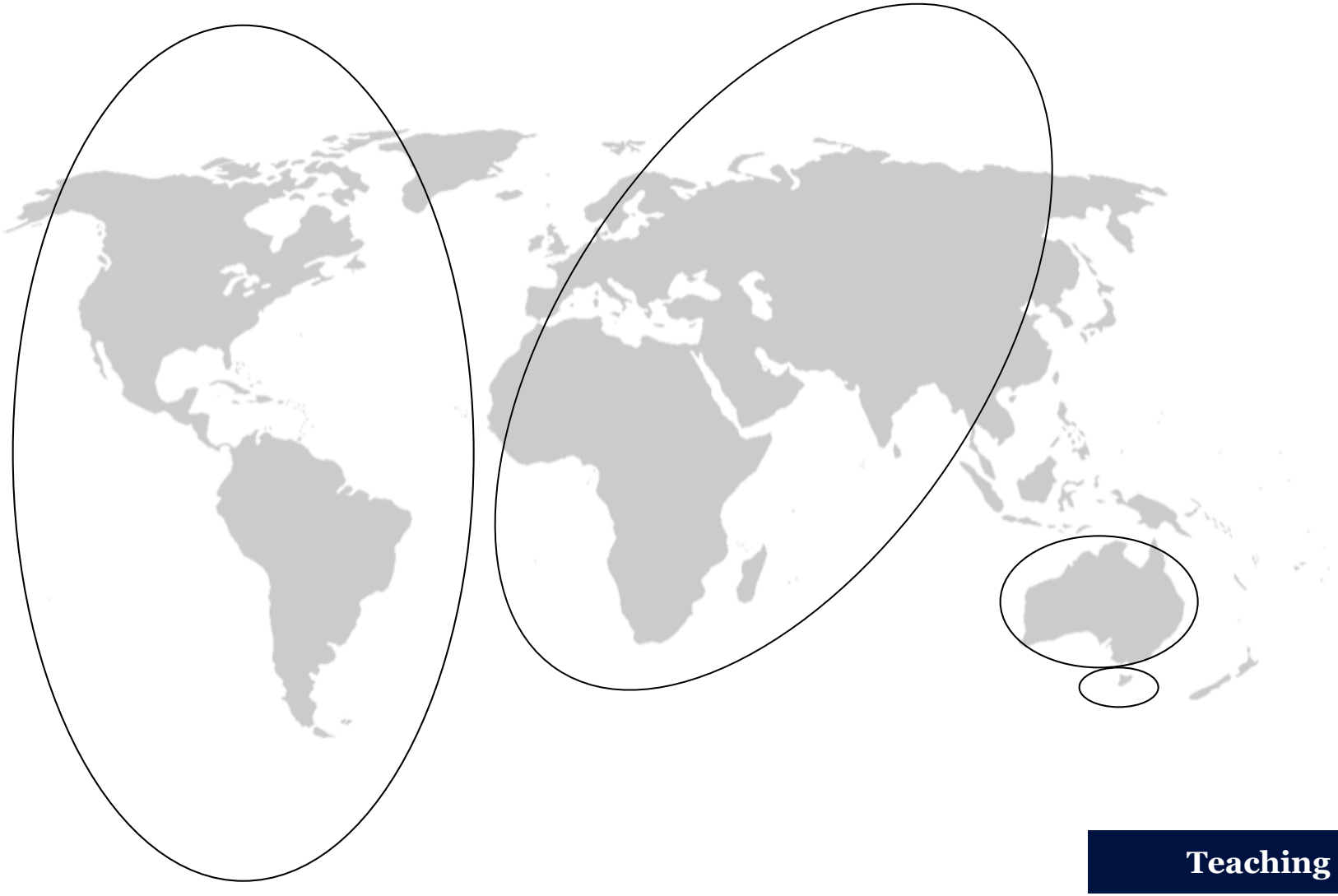
Regions Develop Technology for 9,500 Years



1500 AD: 4 Connected Regions Again!



Who Has the Best Technology?



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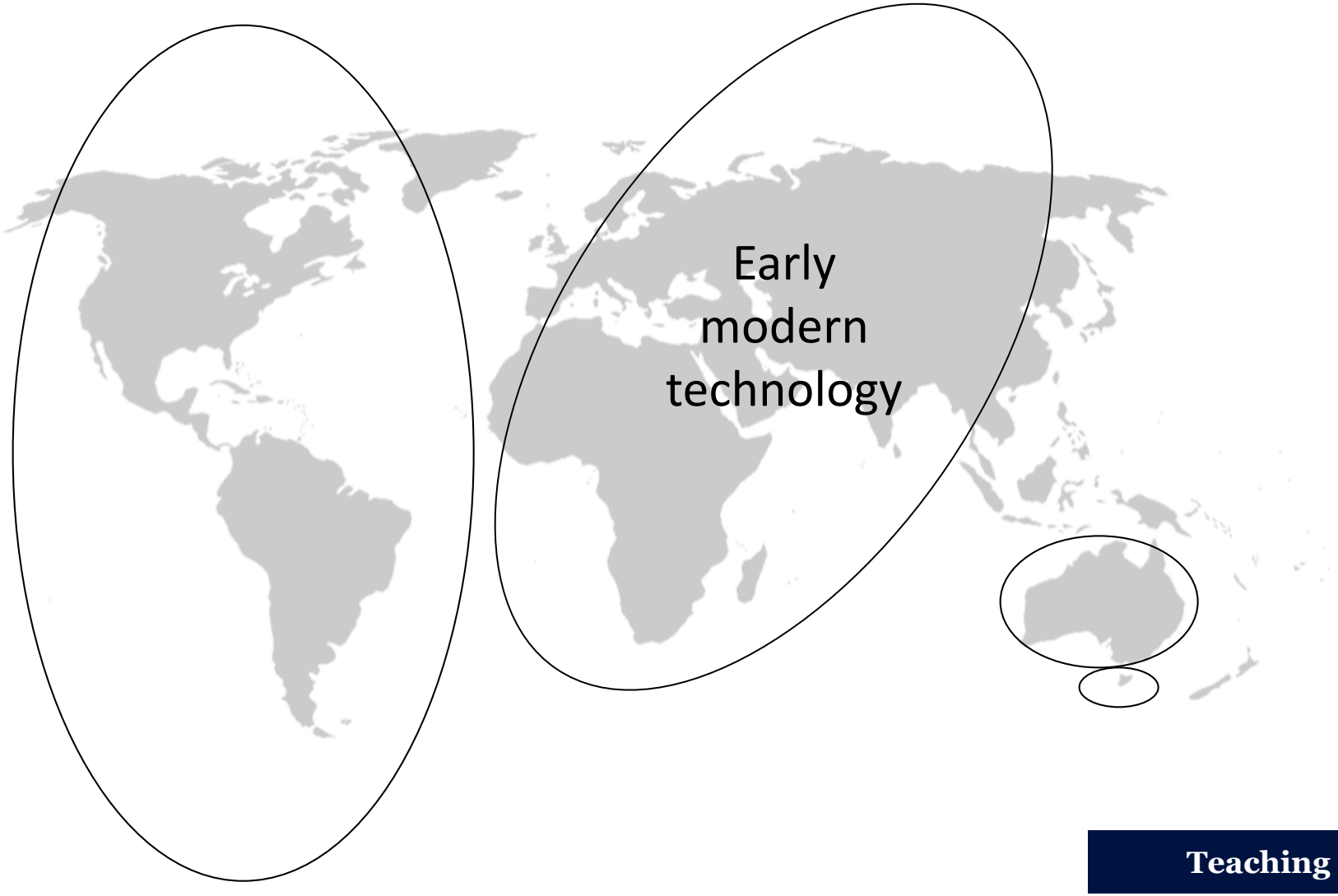

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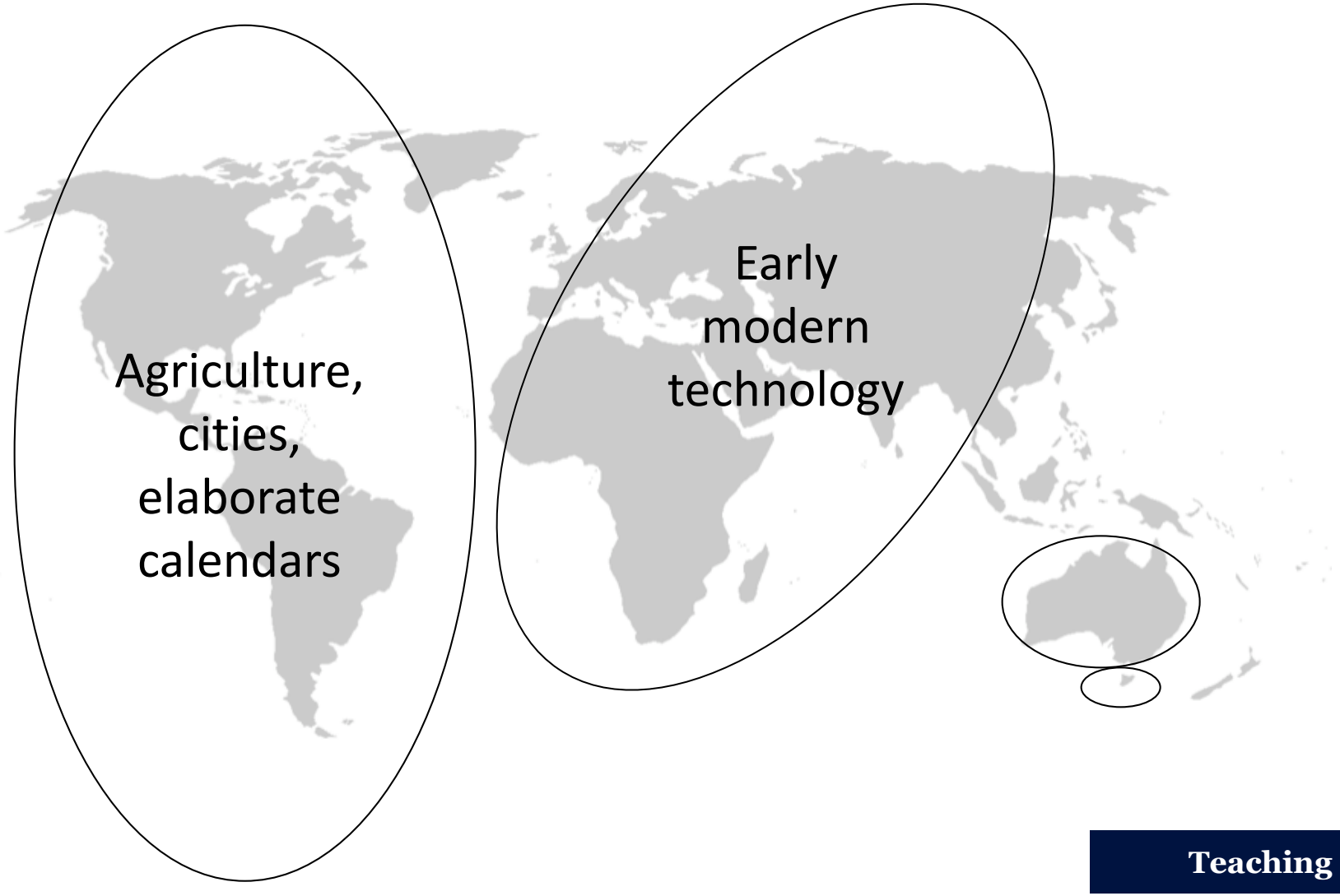

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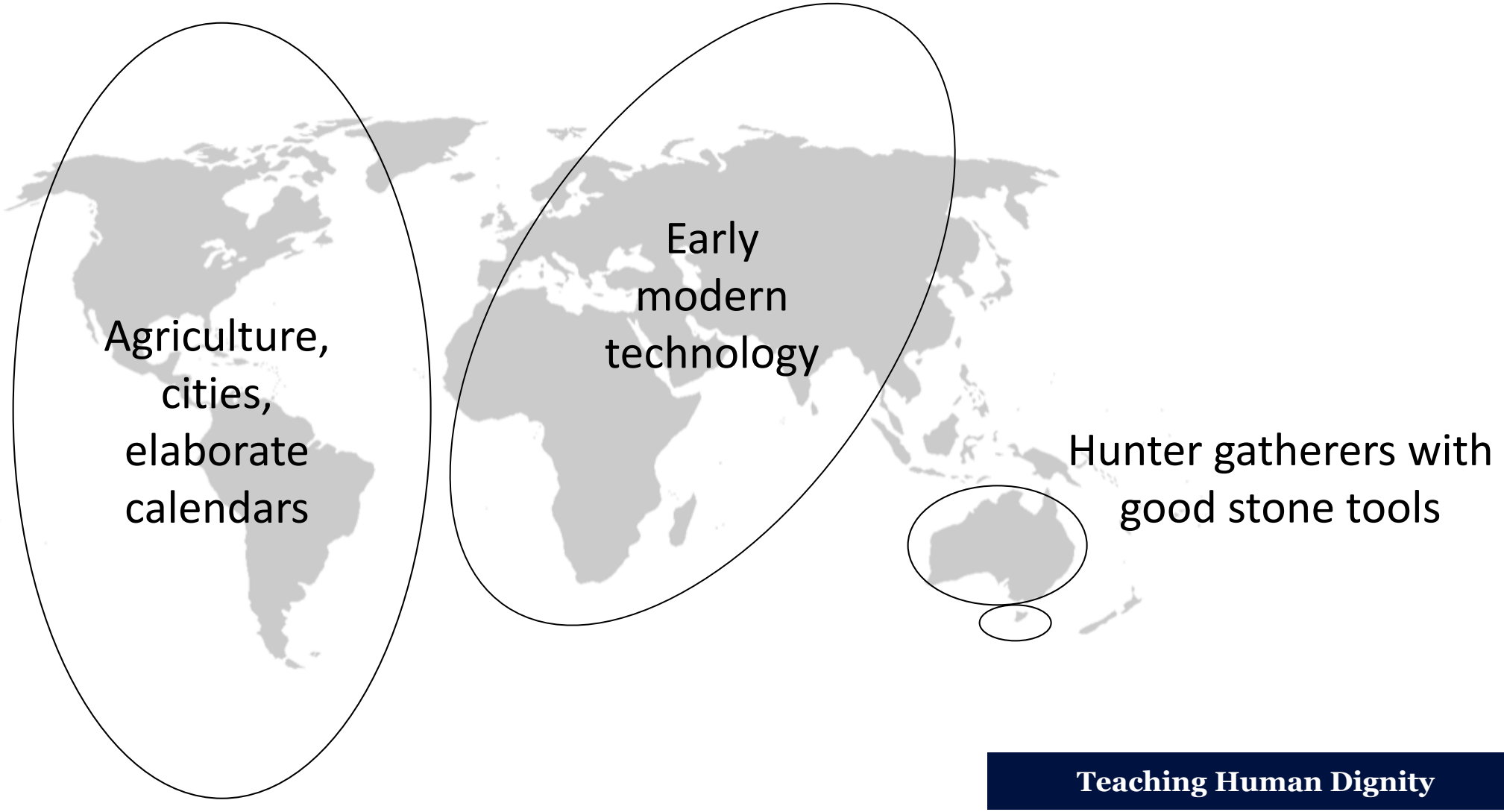

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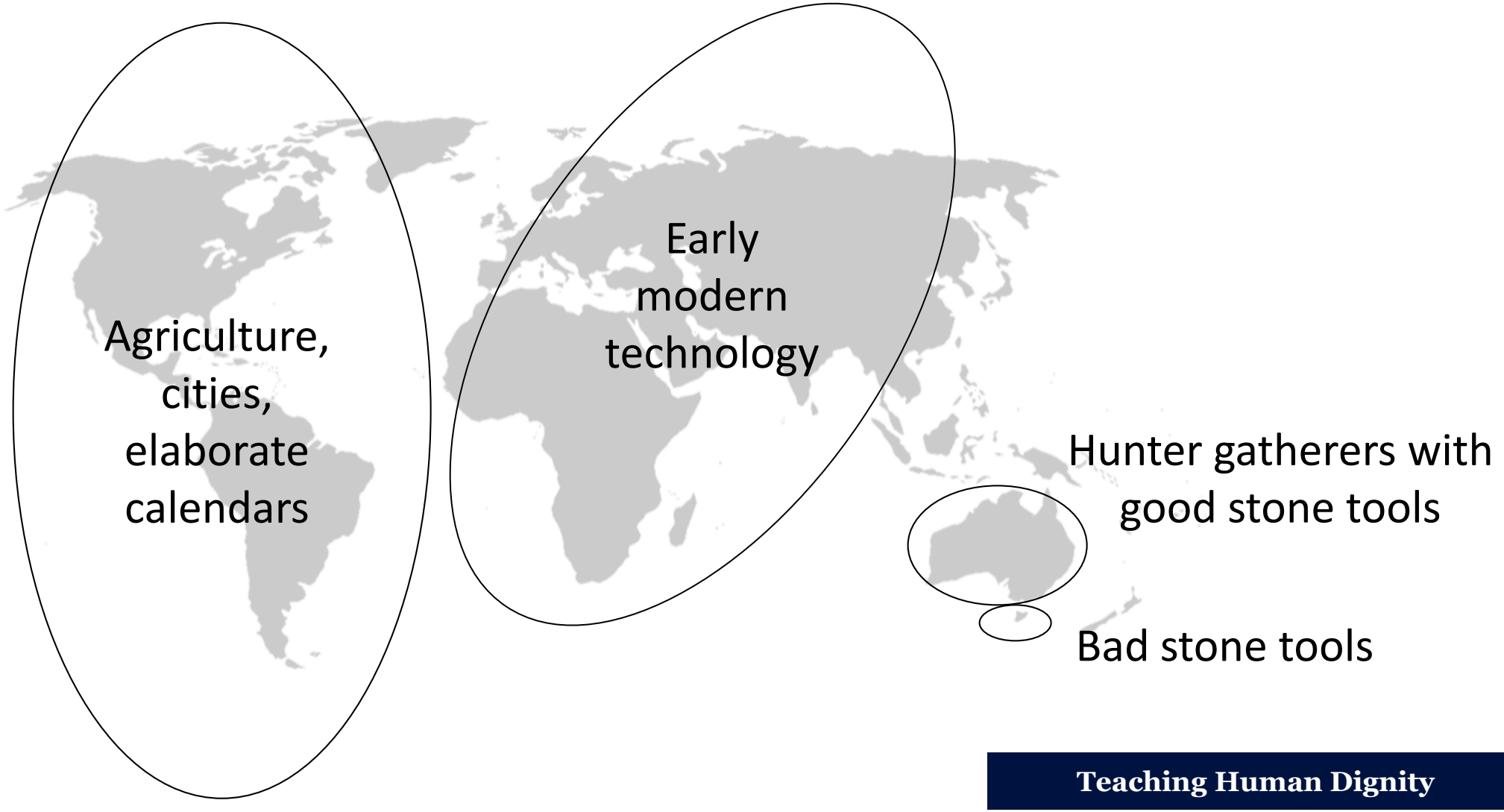

A higher population increases the probability of big discoveries of useful knowledge

Competition and Interaction

- More generally, economics is about two forces:
  - Rivalrous Competition
  - Fruitful Interaction
- We're used to thinking about the competition part: that's what makes us sure that more people means less for each person.

Competition and Interaction

- But more people also means more potential *interactions*
- Interactions can create value:
  - Generate knowledge
  - Exchange goods and services

Competition and Interaction

- And here's the crucial point: as the number of people increases, the number of potential interactions between people increases faster than the number of people
- 2 people: 1 interaction
- 3 people: 3 interactions
- 4 people: 6 interactions
- 5 people: 10 interactions

Competition and Interaction

- Population: n
- Potential interactions: n(n-1)/2
- Increase in potential interactions that we get from population n increasing to population n+1 is larger than the decrease in the share of the pie from population n increasing to n+1

“We should be most concerned about building a healthy society in which people can interact and learn from each other, in which we avoid greed while pursuing sharing. In this society, a new life can be received as a blessing, not a curse.”