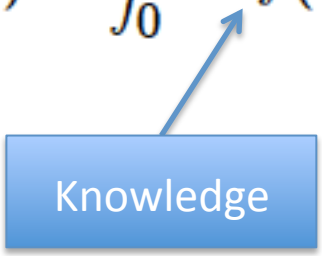
Discussion of Lucas, "Human Capital and Growth"

Sendhil Mullainathan

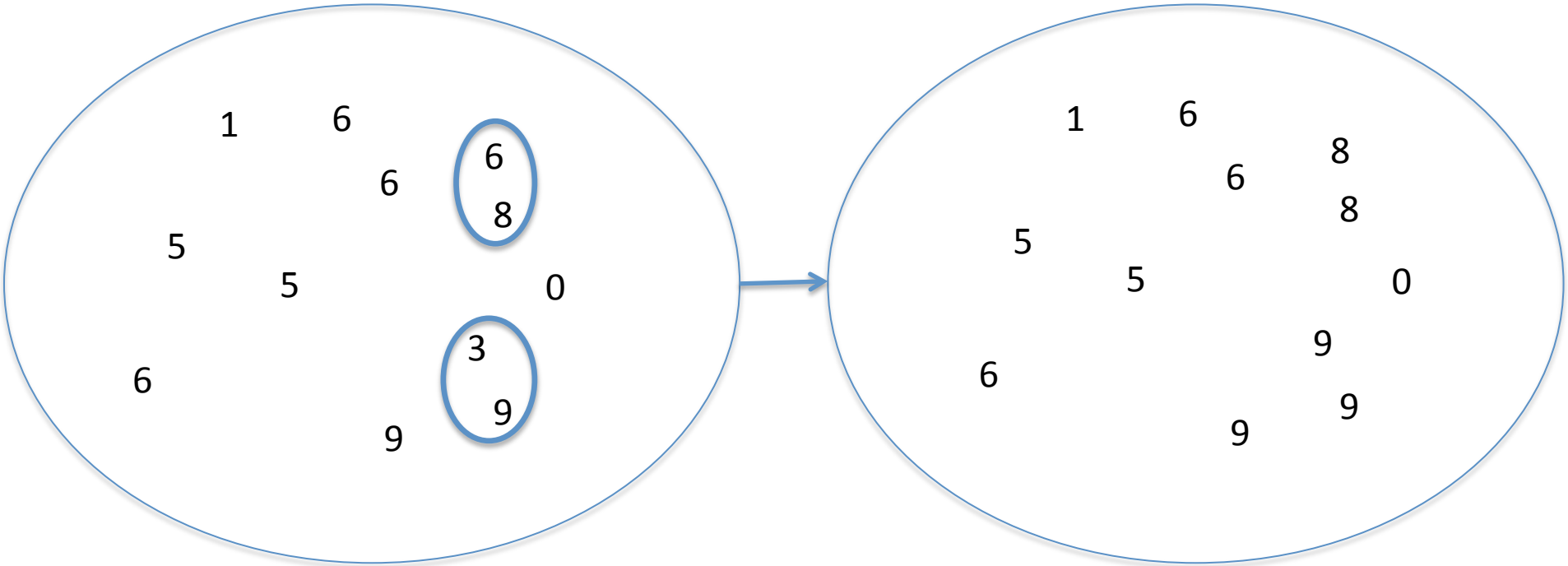
Harvard

$$y(t) = \int_0^\infty x f(x,t) dx$$



Knowledge expands: $\tilde{z} = \max(\tilde{x}, \tilde{y})$

If an x and y meet up both emerge with z



Over time distribution of knowledge shifts

Distribution determines growth path:

How fat is the tail?

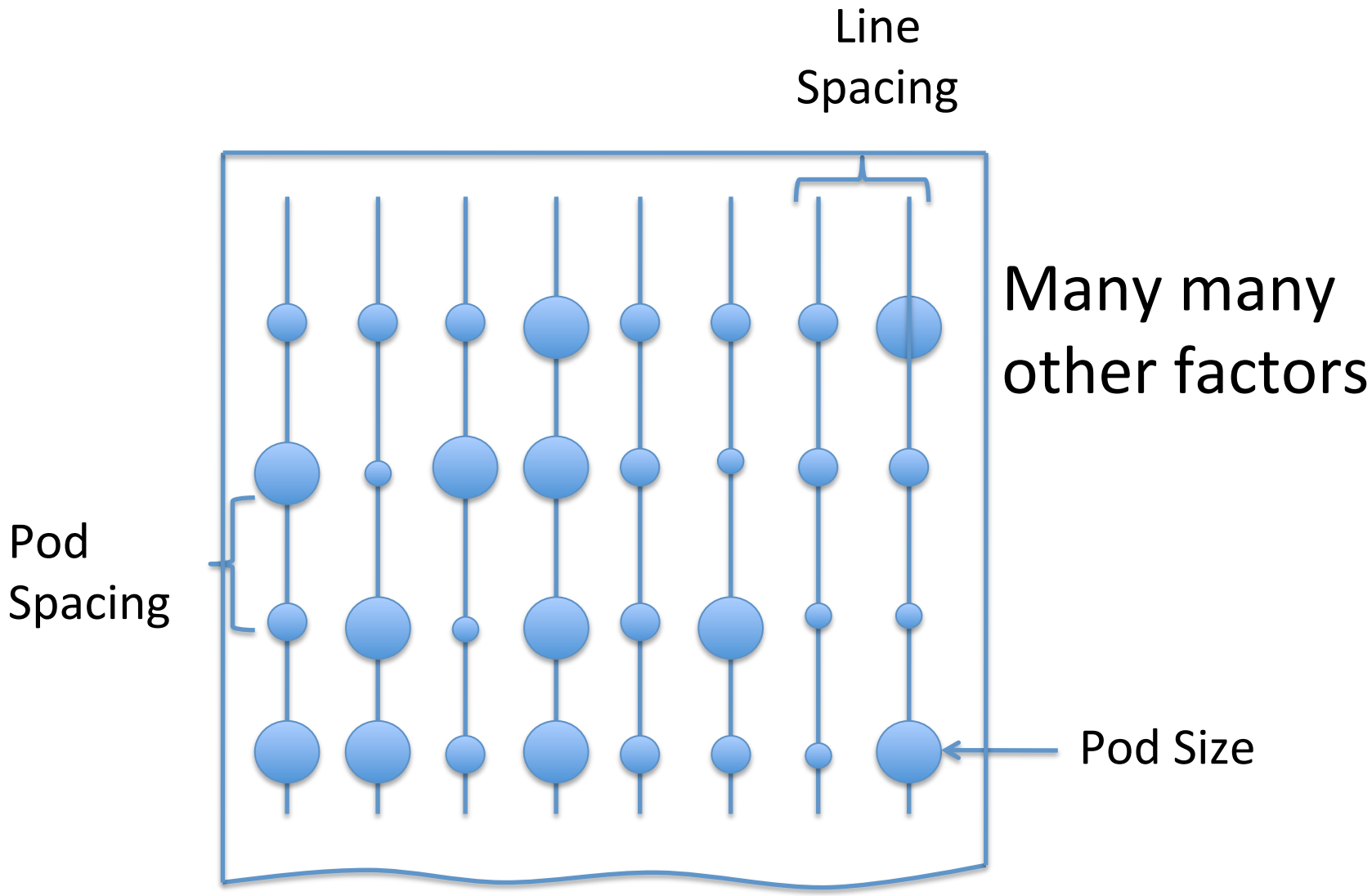
The Biology of Knowledge

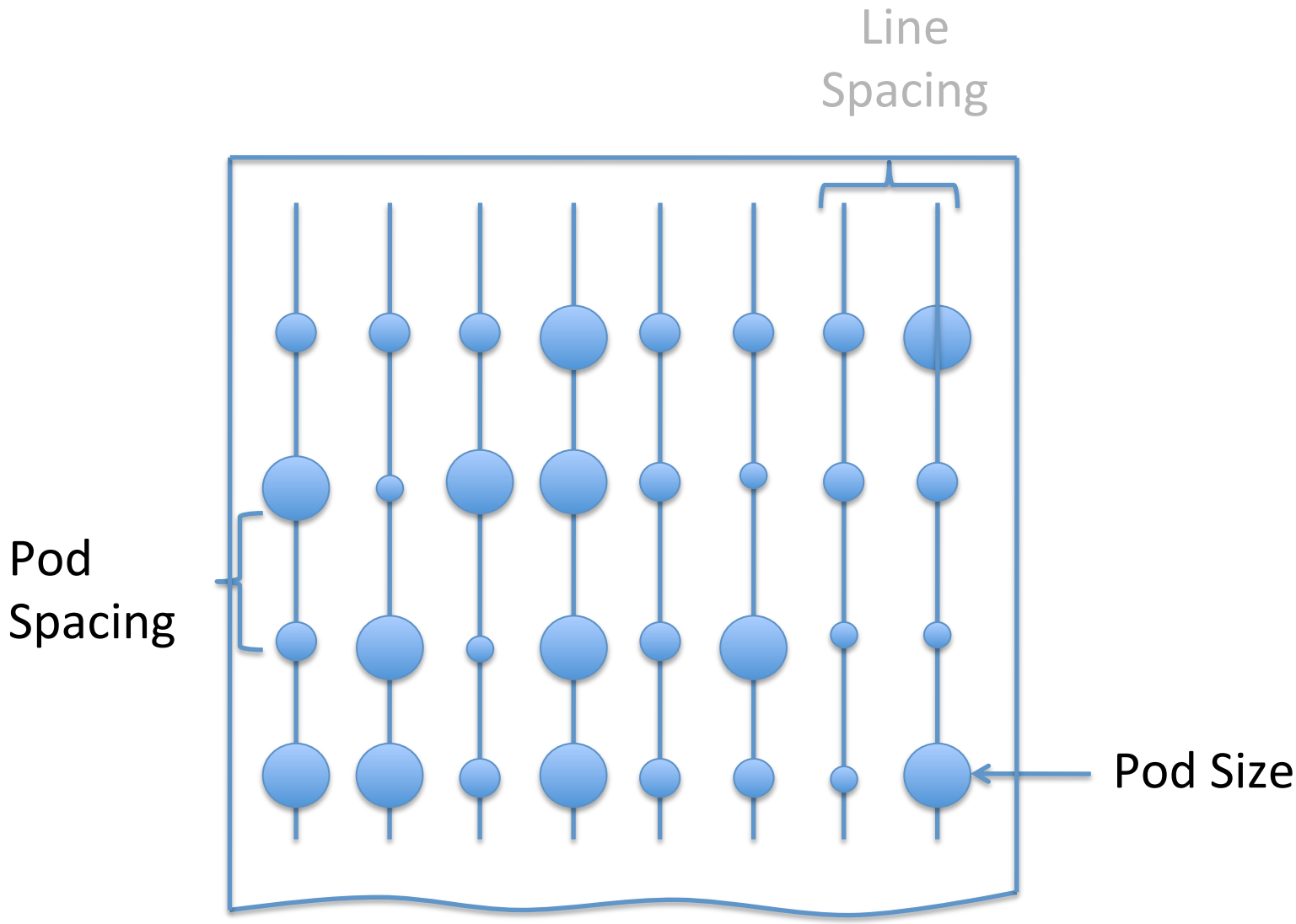
- Infects and spreads like a virus

- idea borders prevent spread of this pathogen
  - Excludability (patents, etc.)
  - Social interaction
  - Trade

My Discussion

- The psychology of knowledge
  - In isolation: what does it mean to know something?
  - How do we learn?


Line
Spacing
Many many
other factors
Pod
Spacing
Pod Size


Line
Spacing
Pod
Spacing
Pod Size

Pod Size Experiment

Table 3: Estimated Percent Income Gain from Switching to Trial Recommendations

	Median Gain (1)	95 Percent Confidence Interval (2)
Panel A: Sort Treatment Group		
Gain from Moving from Average to Recommendation	7.06	[2.92 ,14.19]
Gain from Switching from Worst Bin to Best Bin	23.3	[19.00, 28.18]
Panel B: Weight Treatment Group		
Gain from Moving from Current Pod Size to Best	37.87	[23.60, 58.86]

with Rema Hanna and
Josh Schwartzstein (2012)

A form of knowledge

- Interesting case of on the “job” learning
- How should we think about this knowledge?
- x = |belief in pod size – optimal pod size|
  - Note: Heterogeneity affects “spread” (as Rosenzweig discussed)

	Percent Unable to Provide Answer (1)	Mean (2)
Panel A: Self-Reported Current Production Methods		
Current Pod Size	86%	118.11
Length of Typical Line	2%	5.05
Distance Between Lines	1%	16.49
Panel B: Beliefs on Optimal Production Methods		
Optimal Pod Size	87%	148.26
Optimal Distance Between Knots	2%	15.97
Optimal Distance Between Lines	2%	16.39
Optimal Cycle Length	1%	37.43

What is knowledge?

- Not just

  x = |belief in pod size – optimal pod size|

- Also:
  - Do I even know to think about pod size?

- Farmers in the “trial” experienced the data

How do we learn?

- Farmers in the “trial” experienced the data

Table 4: Effect of Participating in the Trial on Self-Reported Techniques and Measured Pod Size

	Changed Farming Techniques		Pod Size	
	(1)	(2)	(3)	(4)
Trial Participation	-0.084		-2.184	
	(0.051)		(3.610)	
After Trial	-0.146	-0.148	-11.333	-11.661
	(0.048)***	(0.057)**	(3.003)***	(3.578)***
After Summary Data	-0.145	-0.150	-13.587	-13.859
	(0.050)***	(0.061)**	(2.896)***	(3.496)***
Trial Participation * After Trial	0.072	0.079	-2.051	-1.550
	(0.060)	(0.071)	(4.411)	(5.306)
Trial Participation * After Summary Data	0.162	0.171	6.951	7.316
	(0.069)**	(0.084)**	(4.095)*	(4.982)
Hamlet Fixed Effects	X		X	
Farmer Fixed Effects		X		X
Observations	684	684	684	684
Mean of Dependent Variable for the Control Group:				
After Trial	0.10	0.10	97.68	97.68
After Summary Data	0.11	0.11	95.39	95.39

What is knowledge?
How do we learn?

- Farmers in the “trial” experienced the data
  - But they did not notice it

- Different kind of learning:
  - Learning to notice that pod size matters

Another Example

- High maternal mortality in 19th century. Why?
  - Male doctors. Bad smells.
  - Real answer: germs. Doctors didn't wash hands. Took a long time to discover. Why?

Learning by noticing

Schwartzstein (2010)

- Simple theory:
  - Many (many) pieces of data to attend to
  - Selective attention
  - Beliefs drive what is attended to
- Two forms of Learning
  - Learning *within a mental model*
  - Changing the mental model

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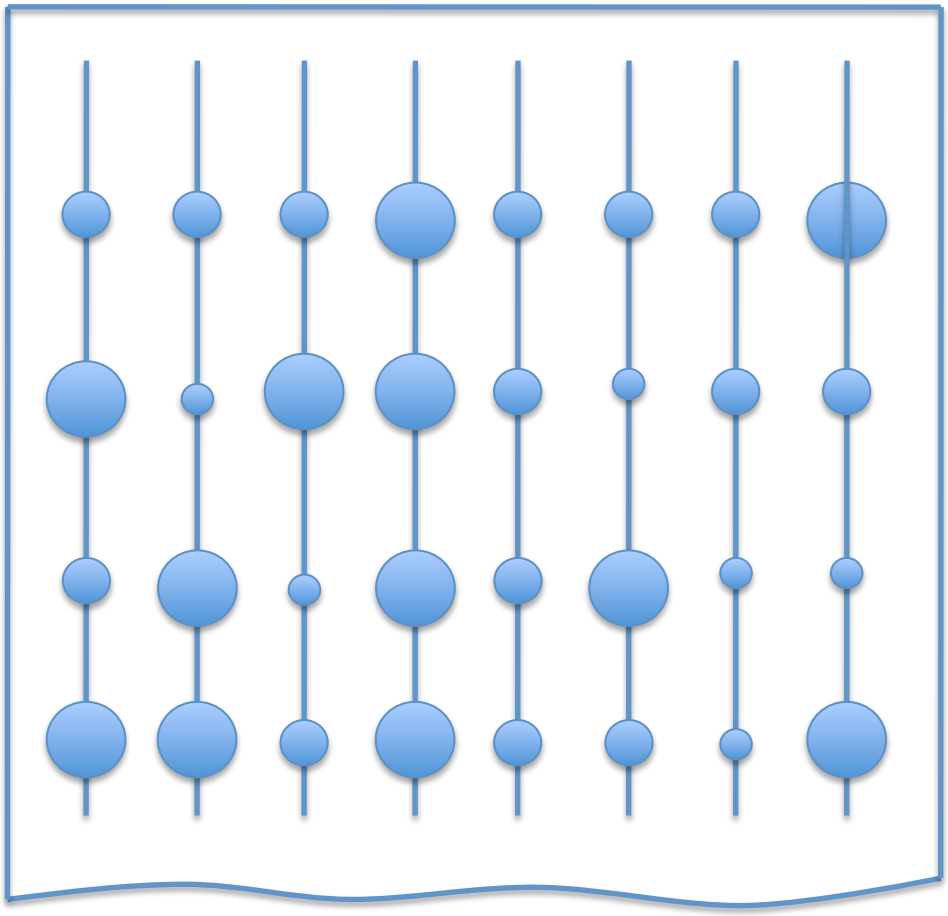
Failure to attend to pod size generated variability even absent trial



Rethinking Knowledge Spread

Knowledge spreads: $\tilde{z} = \max(\tilde{x}, \tilde{y})$
If an x and y meet up both emerge with z

Knowledge fails to spread:
If an x and y meet up they may learn nothing

Models spread
If an x and y meet up they both emerge with a different mental model….and they learn then learn on their own differently

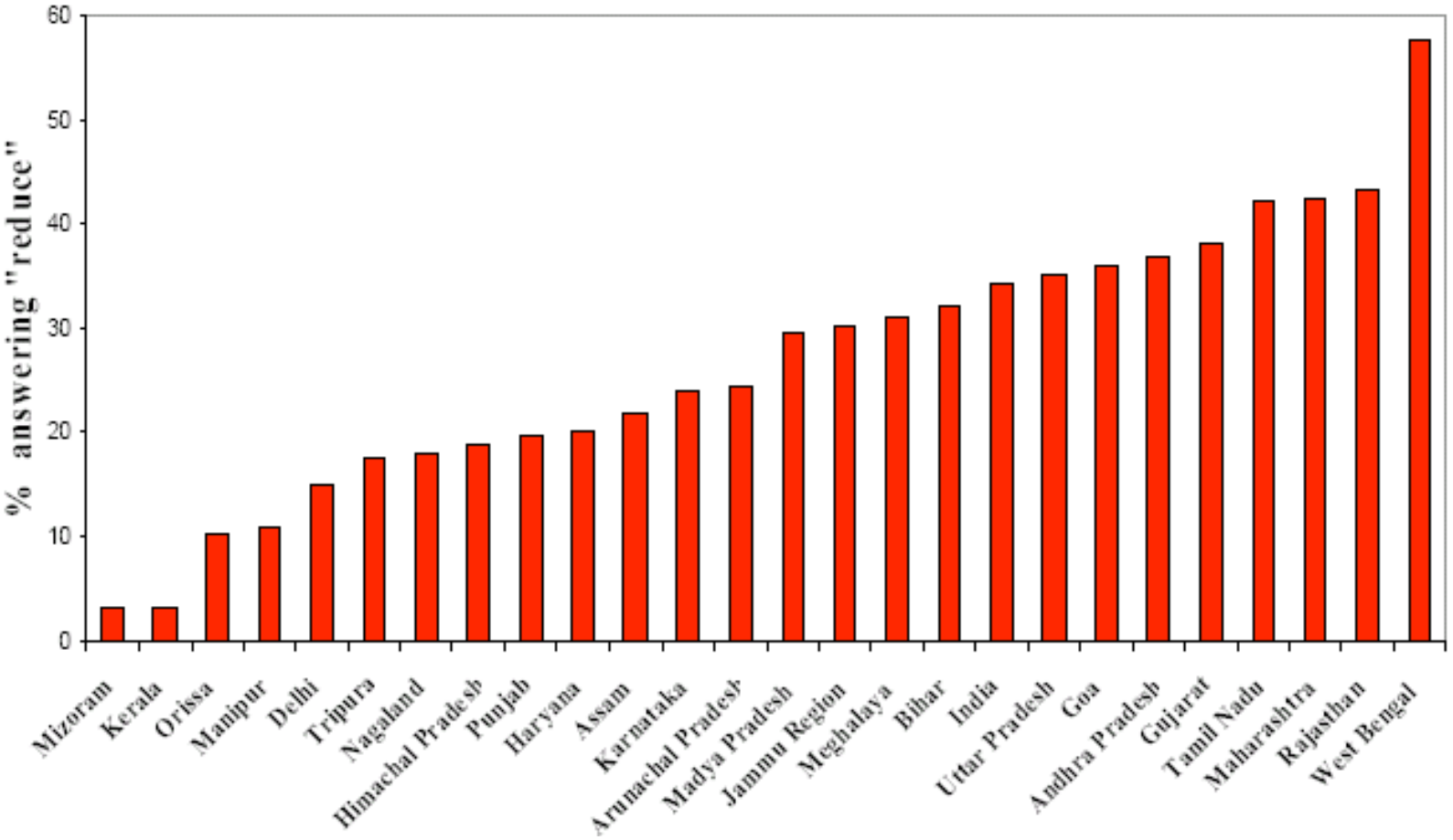
Rethinking Human Capital

- What is human capital?
  - What you know
  - What model you believe in
- Better (not more) human capital speeds up learning even on one's own.
  - It allow for better "conversations" with nature itself
- Human capital, like some physical capital, has lock in effects. Can be a strength and weakness
  - ideas legislate their own borders

Rethinking Growth

- What is a technological advance?
  - Penicillin?
  - Oral rehydration therapy?

Should You Increase, Maintain, or Reduce Fluids, (Or Don't Know) For a Child With Diarrhea



Boone and Johnson 2008

Rethinking Growth

- What is a technological advance?
  - Penicillin?
  - Oral rehydration therapy?
  - Germ theory of disease?

Rethinking Growth

- Mental model changes
  - Example:
    - Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, *what, exactly? If not, what is it about the "nature of India" that makes it so? The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else.*
  - General purpose technologies (Helpman and Trajtenberg 1998)?