Simulations on Correlated Behavior and Social Learning

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Outline

- An example from real world
- Literature
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An example from real world

"Learning about a New Technology: Pineapple in Ghana", by Conlet & Udry (AER,2010)

- A new crop
- New technologies: fertilizers
- Evidence of social learning between nearby farmers
  - time dimension, questionnaires
- Propensity to copy decreases with experience
- No social learning for established crops

Literature

- Sociology
  - Granovetter (1973): *weak* and *strong* ties
- Diffusion and ‘the Wisdom of Crowd’
  - Golub & Jackson (2010)
- Bayesian Learning and Herding
  - Bala & Goyal (1998), Gale & Kariv (2003), Acemoglu et al. (2010)
- Experimentation as a public good
  - Bramoullé & Kranton (2007), Galeotti (2010)

The model - the isolated case

- Safe technology: prob. $k = .5$ of success (payoff 0 or 1)
- Risky technology: prob. $p \simeq U(0,1)$
- The agent can make $n \leq N$ experiments at a cost $c > 0$
- n is decided ex–ante
- Then a technology is chosen (${d = 1}$ is the new one, $d = 0$ is the old one)

$$E(U) \equiv U(n, d; p, k) = k + d(p - k) - cn$$

$$\max_{d \in \{1,0\}} \left\{ \max_{n \in N} E[U(d, n; p, k)] \right\}$$

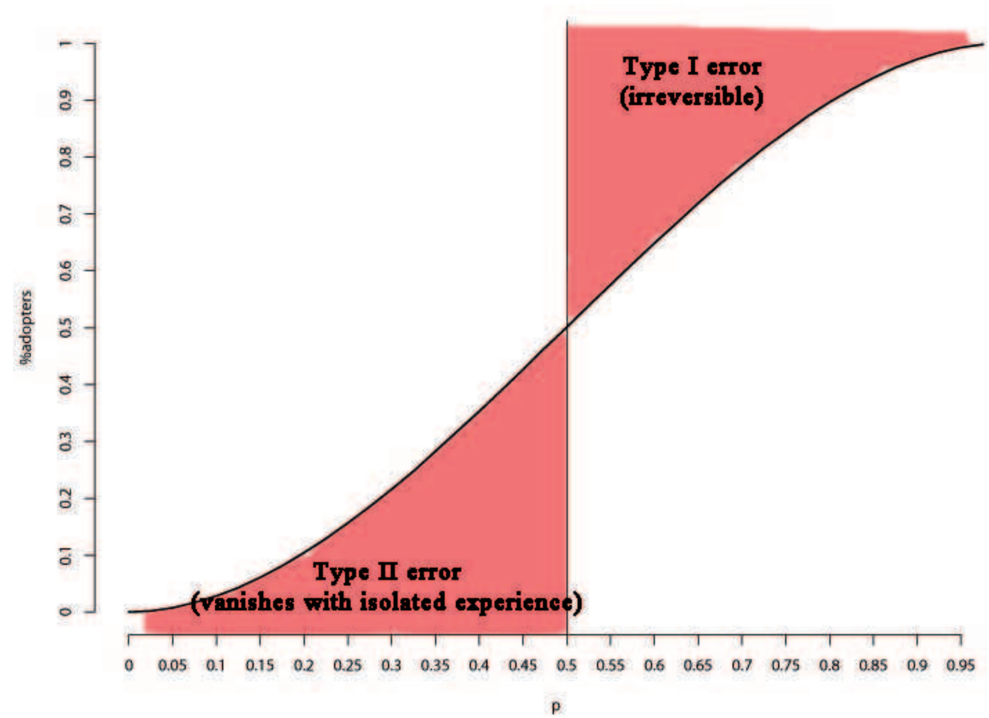
The model - the isolated case

The Bayesian problem can be solved analytically.

Also the iterated case can be solved numerically, up to the point that agents stop experimenting.

Here is plotted the $\%$ of adopters vs. p (for $N = 8$ and $c = .004$):

Errors and long run efficiency.

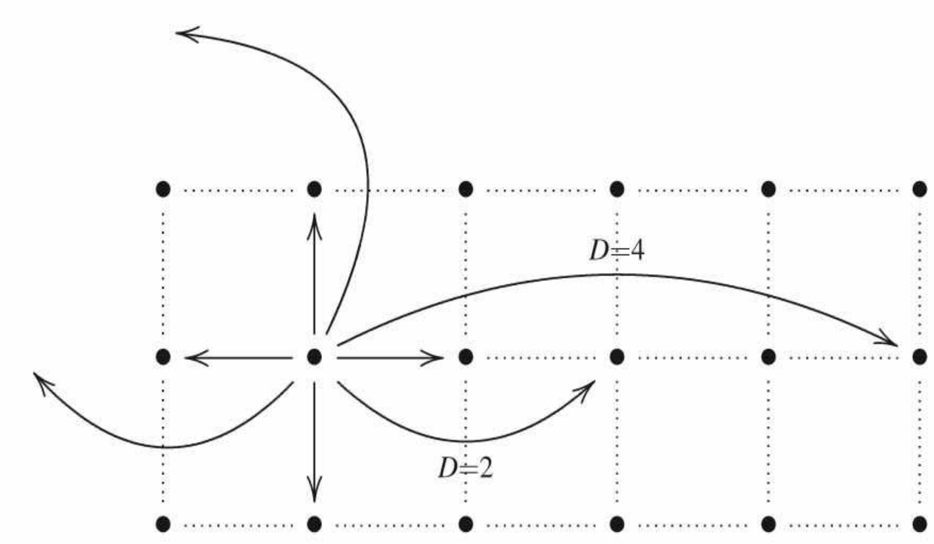


The model - social learning

- Agents are nodes on a (directed) network structure, all have degree N
- The game is iterated and experience accumulated
- Instead of making experiments on their own, agents can observe those neighbors adopting the new technology (at cost c)
- Everything else follow previous model...
- ... but the shape of the network matters
  - the model of Kleinberg (2000), based on Strogatz & Watts (1998)
  - regular random networks (Lamberson, 2010)

Kleinberg's small world

- Start from a torus grid (Von Neumann's 4 neighbors) of 200×200 nodes
- Add other 4 directed links ($N = 8$) with probabilities proportional to $D^{-\delta}$
- where D is the Euclidean distance, and $\delta \in [0, \infty)$ is a parameter

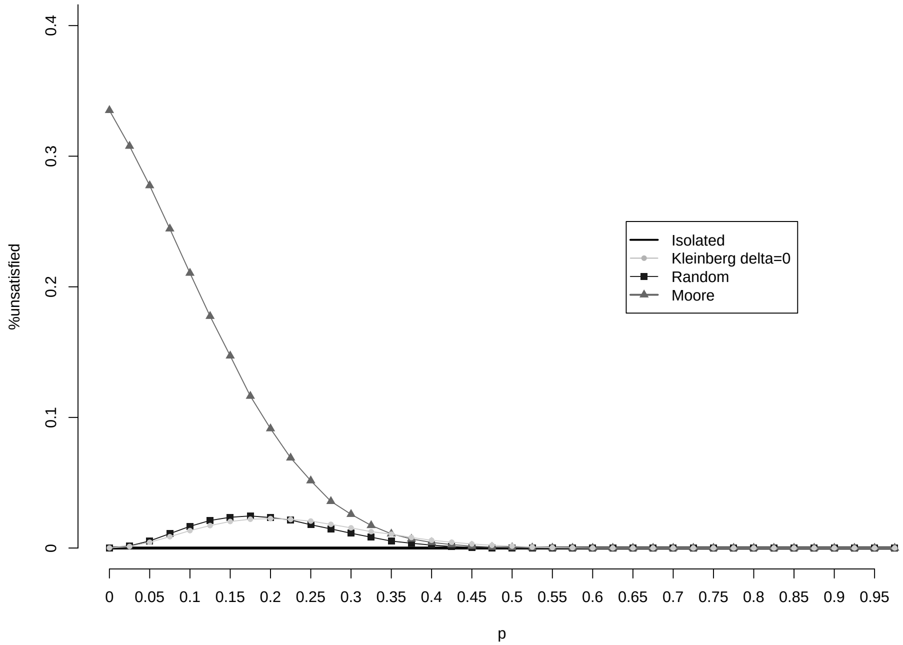


  - $\delta = 0$: uniformly random
  - $\delta \to \infty$: Moore's neighborhood
  - $\delta = 2$ turns out to be a threshold value for information processes

Simulations: is $N = 8$ binding?

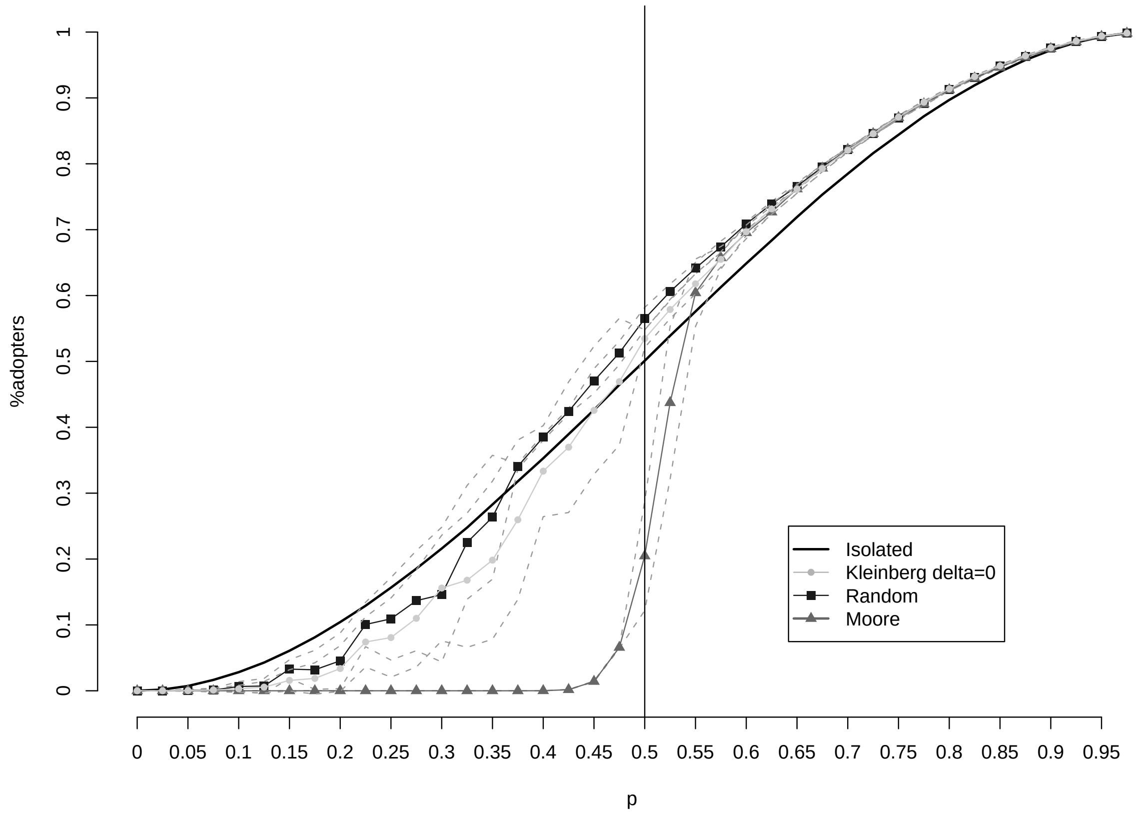
Here is plotted the $\%$ of agents that find $N = 8$ a binding threshold (with $c = .004$):

- agents switching to the old technology provide no information



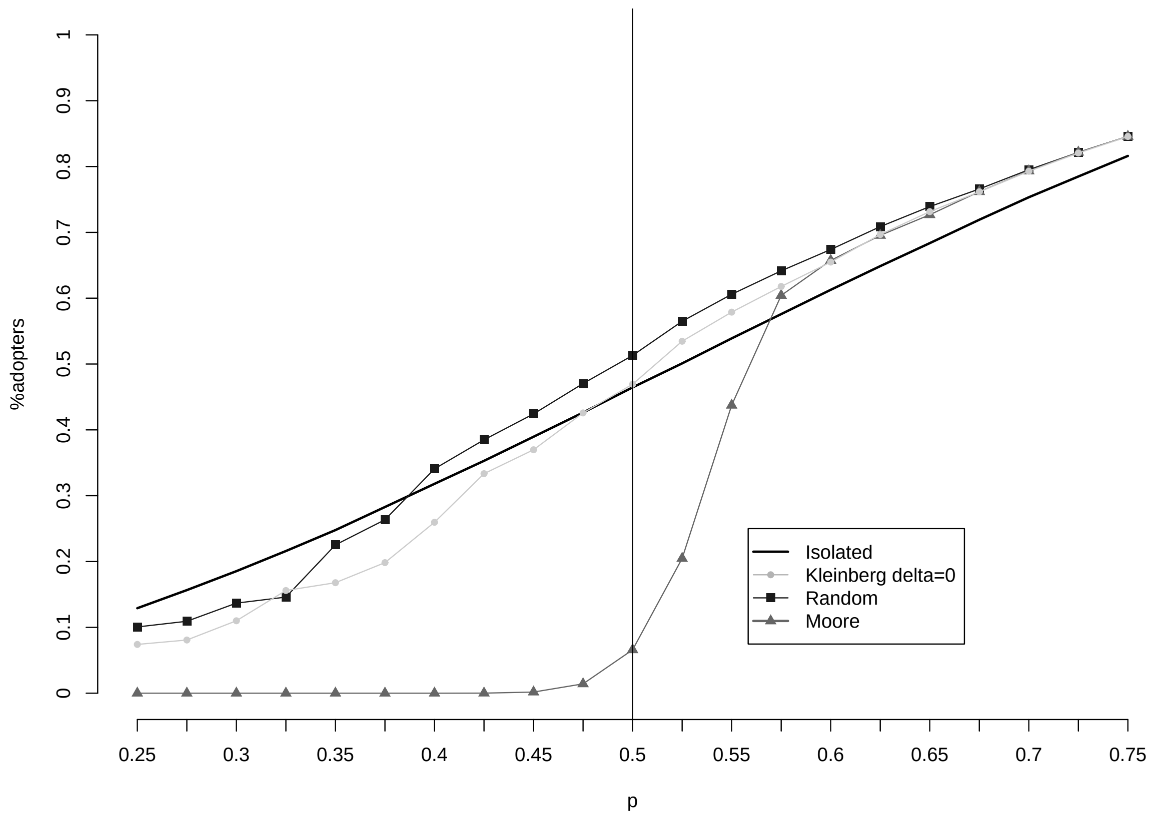
Simulations

Here is plotted the $\%$ of adopters vs. p (20 iterations with $N = 8$ and $c = .004$):



Simulations

Same as above, but x–range is restricted:



Results

- In our model type II errors ($p \leq .5$) are not important, in the long run
- Type I errors are, for long run efficiency
  - for $p \gtrsim .6$ social learning is always more efficient (the wisdom of crowd)
  - for $.5 < p \lesssim .6$ too correlated network structures are bad (herding)
- $\rightarrow$ the importance of weak ties