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March's Exploration & Exploitation Paper

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Exploration/Exploitation

- Trade-off between investing in exploration of new knowledge, and utilization of current knowledge
- Organizations learn from their members, just as members learn from their organizations
- Reality (the market) determines which beliefs are right (or useful)
- Entities
  - Reality (environment)
  - Organizational <u>code</u> (conventional wisdom; org culture)
  - Individuals
- Individuals learn from the code (socialization)
- Organization learns from individuals whose beliefs match reality

Simulation

- Entities
  - Reality
    - the organization's environment; the market
    - Truth is represented by a string of 1s and -1s
  - Organizational <u>code</u>
    - conventional wisdom; org culture
    - Code represented by string of 1s, 0s (no opinion) and -1s
  - Individuals
    - The organization's members, who vary in knowledge
    - Person's knowledge represented by a string of 1s, 0s, -1s
- Individuals learn from the organizational code
  - i.e., socialization – the group's influence on the individual
  - At each time period, if individual's belief differs from org code, then individual adopts org belief with probability p1
    - If org code is 0, then it has no effect on individuals
- Organization learns from individuals whose beliefs match reality
  - Takes the best ideas and makes them into std practice
  - If total agreement between an individual and reality is higher than org's agreement with reality, then the org learns from the dominant view with probability p2

Simulation Process

- Start
  - Reality is set to random string of 1s and -1s
  - Org code is set to all 0s
  - Individual beliefs set to random strings of 1s, 0s, -1s
- At each point in time ..
  - Individual beliefs are updated by the org code w/ prob $p1$ (individual learning rate)
    - Low $p1$ means people are independent thinkers
    - High $p1$ means people converge quickly on received wisdom (which is likely to be wrong)
  - Org code is updated by the smarter individuals w/ prob $p2$ (organizational learning rate

Homogeneous learning rates

- If learning rates (p1) constant across individuals …
- High p1 is good for individuals but bad for org code
- Max org knowledge at equilibrium occurs when the org code learns fast and people learn slow
  - i.e., people are independent thinkers
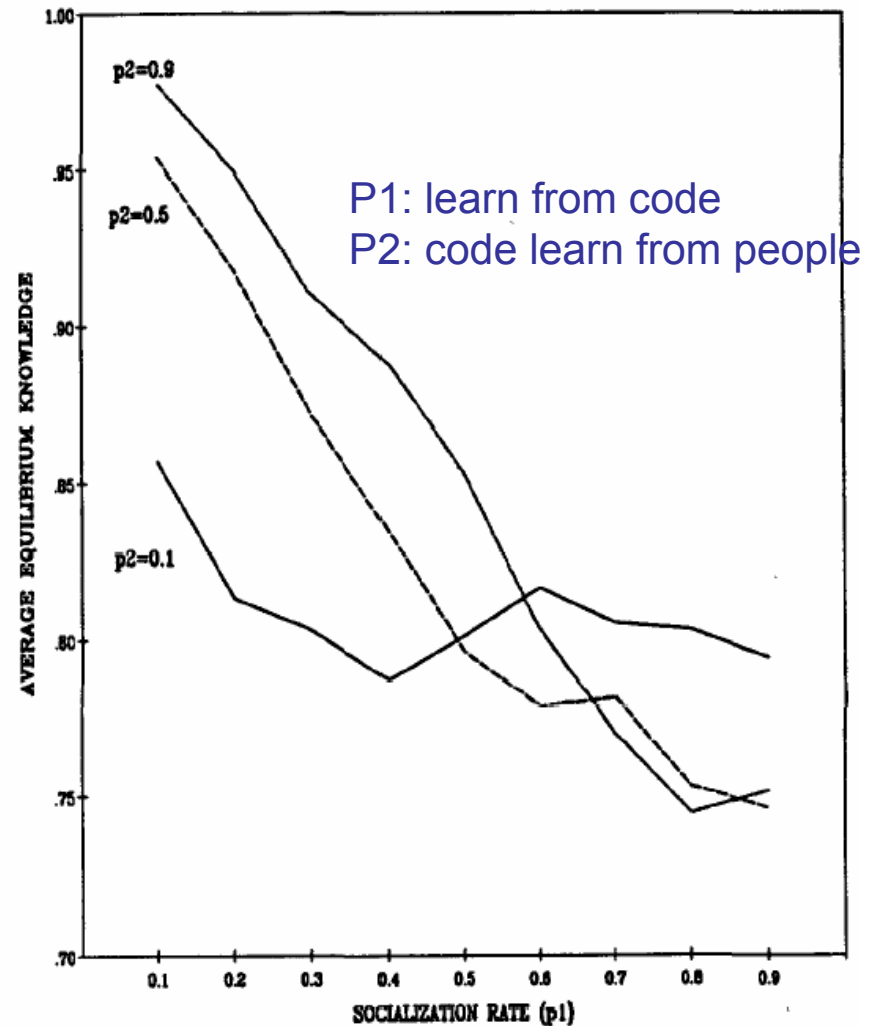 - Slow individual learning permits more exploration time, which increases prob of right answer

P1: learn from code
P2: code learn from people

FIGURE 1. Effect of Learning Rates (p_1, p_2) on Equilibrium Knowledge. $M = 30$; $N = 50$; 80 Iterations.

Heterogeneous Learning Rates

- A mix of slow and fast learning individuals always beats a homogeneous set of medium individuals with same average rate
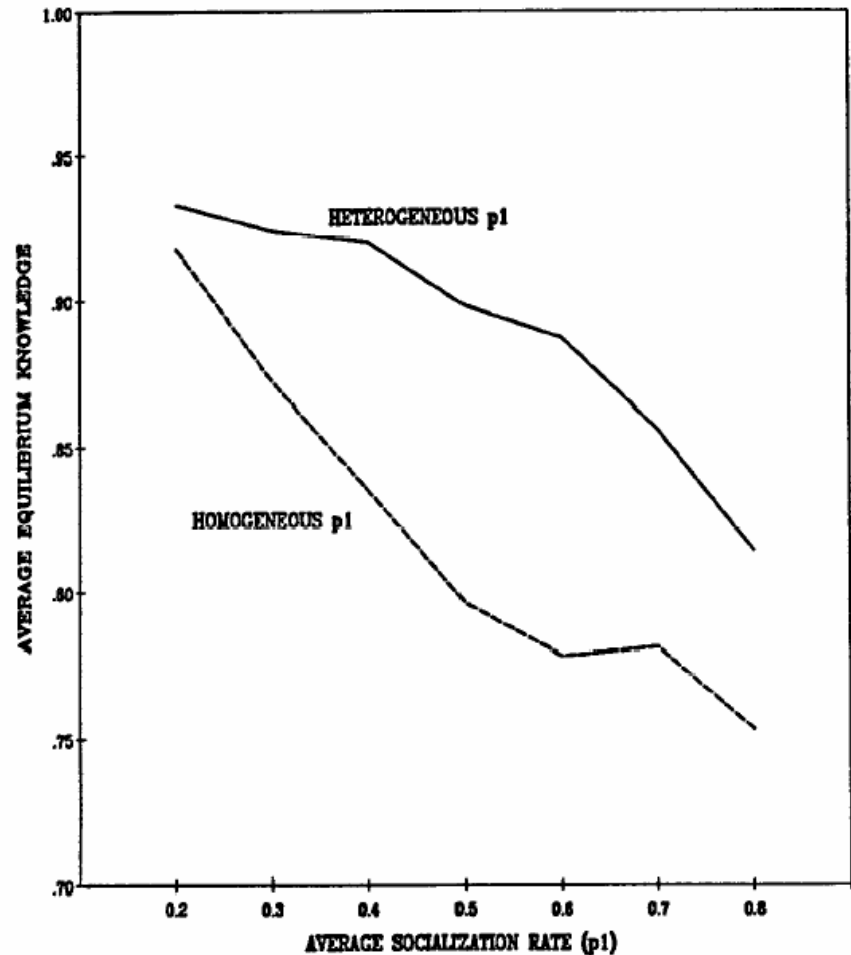

Effect of Heterogeneous Socialization Rates ($p_1 = 0.1, 0.9$) on Equilibrium Knd
$M = 30$; $N = 50$; $p_2 = 0.5$; 80 Iterations.

Turnover

- Alternate way of maintaining diversity
  - Besides low value of p1
- The greater the turnover, the less the avg socialization time, so the less the avg individual knowledge
- But turnover contributes to organizational knowledge if people learn quickly (high p1)
 - prevents groupthink

Org learning maximized by moderate turnover

Fast indiv learning

$p1=0.9$

$p1=0.1$

Slow indiv learning

AVERAGE PERIOD-80 CODE KNOWLEDGE
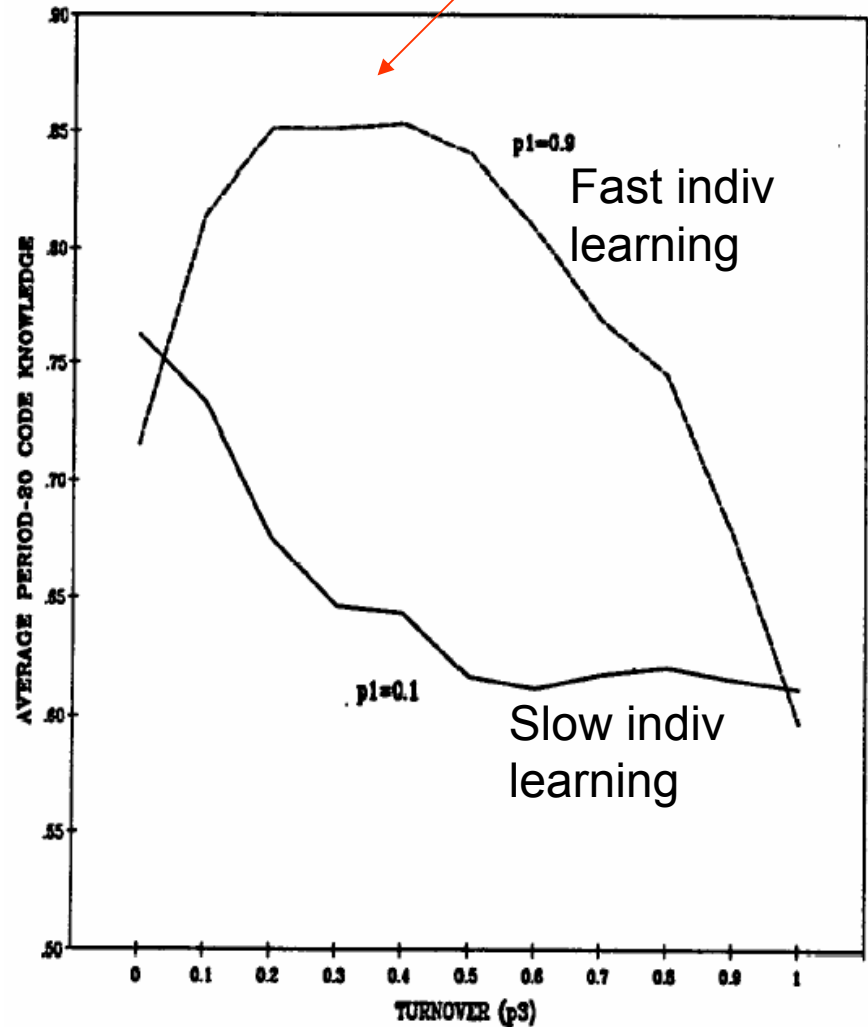
TURNOVER (p3)

. Effect of Turnover (p_3) and Socialization Rate (p_1) on Period-20 Code Knowledge. $M = 30$; $N = 50$; $p_2 = 0.5$; 80 Iterations.

Environmental Turbulence

- Changes in reality
  - With prob p4, a -1 changes to +1 or vice-versa
- When individuals and org converge, there is no more change, regardless of changes in reality, so org knowledge (adaptation) necessarily declines
- This is avoided through turnover
  - Prevents convergence, continues exploration
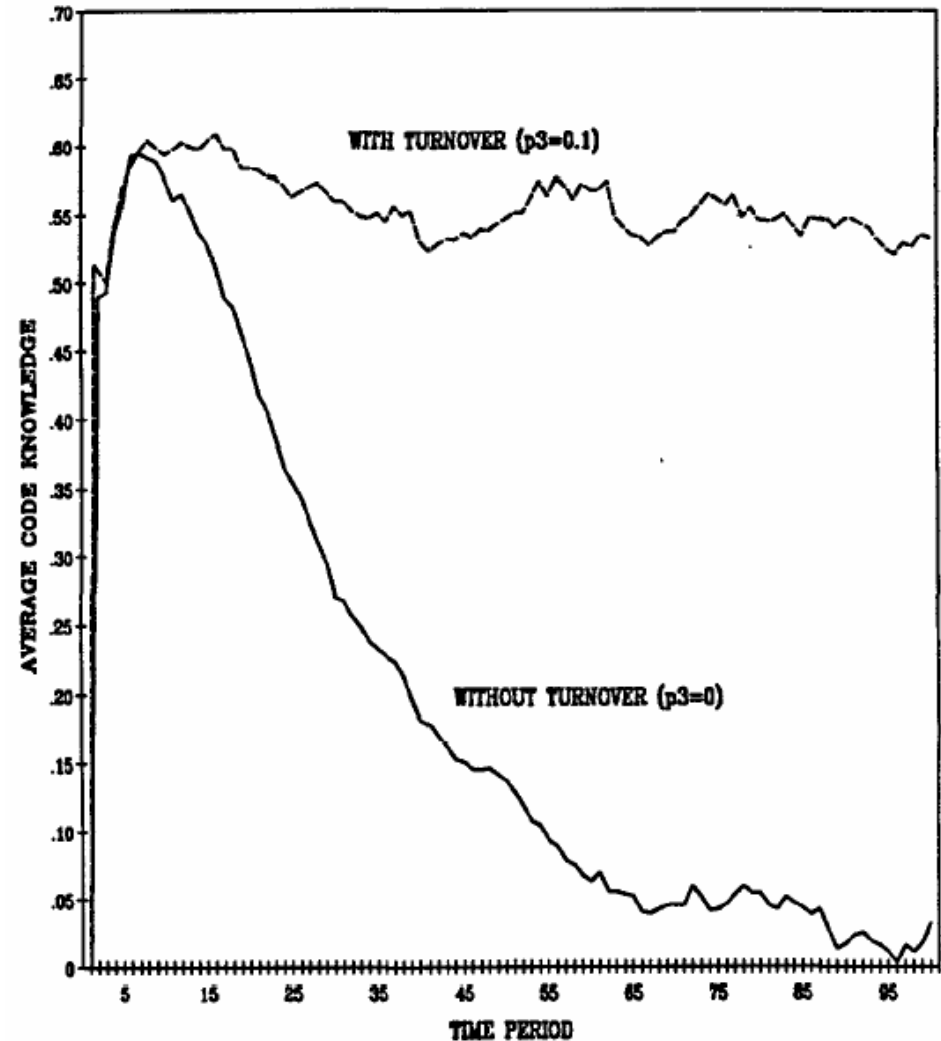
Effect of Turbulence (p_4) on Code Knowledge over Time with and Without Tur
$M = 30$; $N = 50$; $p_1 = 0.5$; $p_2 = 0.5$; $p_4 = 0.02$; 80 Iterations.

Conclusions

- Tension between exploration & exploitation
  - Exploitation
    - Refinement and extension of existing competencies
    - Returns are positive, proximate, predictable
  - Exploration
    - Experimentation with new alternatives; diversity
    - Returns uncertain, distant, and often negative
- Mutual learning has advantages to both individuals and orgs, but contains trap of departing from reality