
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 code (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 code
    • 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 $p_1$
    • 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 $p_2$
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 $p_1$ (individual learning rate)
    • Low $p_1$ means people are independent thinkers
    • High $p_1$ means people converge quickly on received wisdom (which is likely to be wrong)
  – Org code is updated by the smarter individuals w/ prob $p_2$ (organizational learning rate)
Homogeneous learning rates

- If learning rates ($p_1$) constant across individuals ...
- High $p_1$ 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

![Graph showing the effect of learning rates on equilibrium knowledge.](image)

**Figure 1.** Effect of Learning Rates ($p_1$, $p_2$) on Equilibrium Knowledge.

$M = 30; \ N = 50; \ 80$ iterations.

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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 KN
$M = 30; N = 50; p_2 = 0.5; 80$ Iterations.
Turnover

- Alternate way of maintaining diversity
  - Besides low value of $p_1$
- 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 $p_1$)
  - prevents groupthink

\[ \text{Effect of Turnover ($p_1$) and Socialization Rate ($p_2$) on Period-20 Code Knowledge.} \]
\[ M = 30; N = 50; p_2 = 0.5; 80 \text{ Iterations.} \]

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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
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