Overconfidence & Diversification

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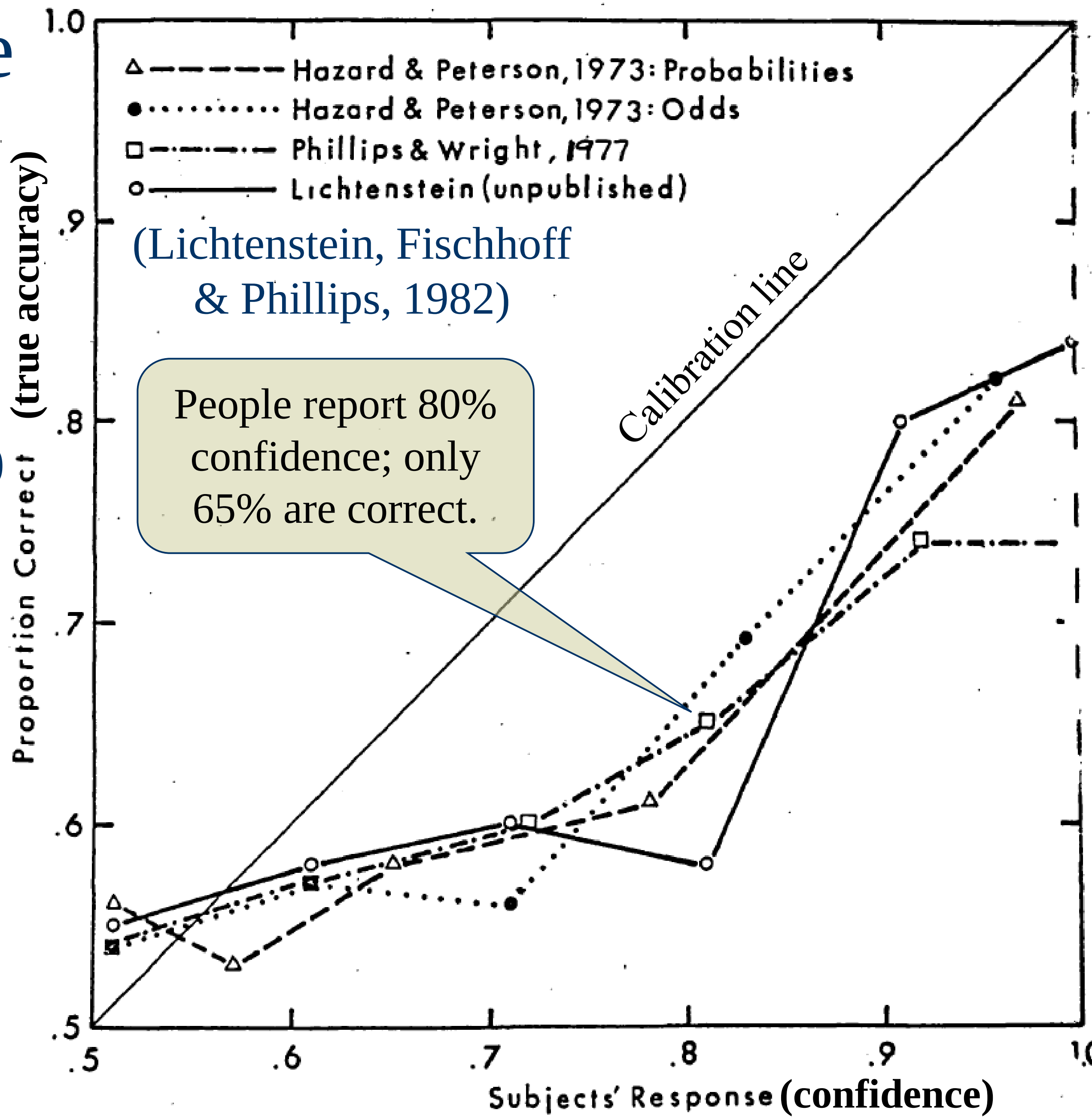
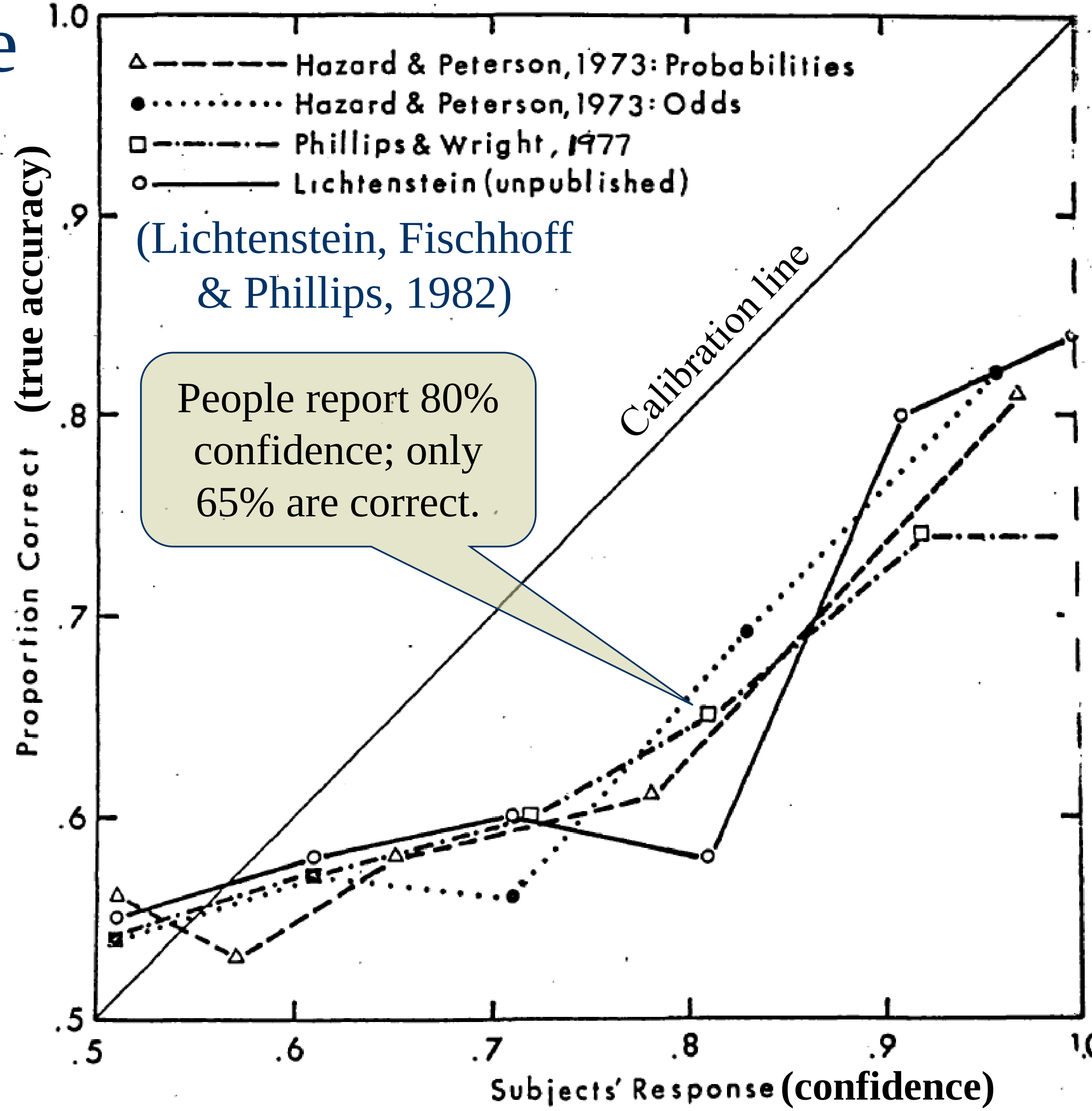
Overconfidence

- Participants answer "trivia" questions
- Report confidence (subjective probability) of being correct
- Instructed to be *calibrated* (sometimes with incentives)



Overconfidence

- Interpretation: overestimating accuracy of private information
- Oskamp, 1965; …
- Recent surveys: Griffin & Brenner (2004), Skala (2008)



Main Motivation

- Existing Evolutionary foundations for overconfidence:
  - Group selection (Bernardo & Welch, 01): improve aggregation of information → a few overconfident agents survive
  - Second-best outcome; compensates another bias (e.g., excess risk aversion): Wang (91), Blume & Easly (92), Waldman (94)

- Gene's interest in diversification → overconfidence
  - First-best outcome, individual selection, everyone is overconfident

Secondary Motivation

- Existing economic models assume overconfidence
  - Directly (Odean, 98, Gervais & Odean, 01, Sandroni & Squintani, 07)
  - "Indirectly" - Positive utility from good self esteem (Compte & Postlewaite, 04; Köszegi, 06; Weinberg, 09)

- Strategic interaction → overconfidence
  - Risk-averse principals prefer overconfident agents

Two Motivations - One Model

- Two different motivations and interpretations:

	Evolutionary	Strategic
Length	Repeated dynamics	Single-stage interaction
Risk-aversion	Endogenous	Exogenous
Explains why	On average people are overconfident	Overconfident agents are more preferred

- Single unifying model (reduced form)

Contents

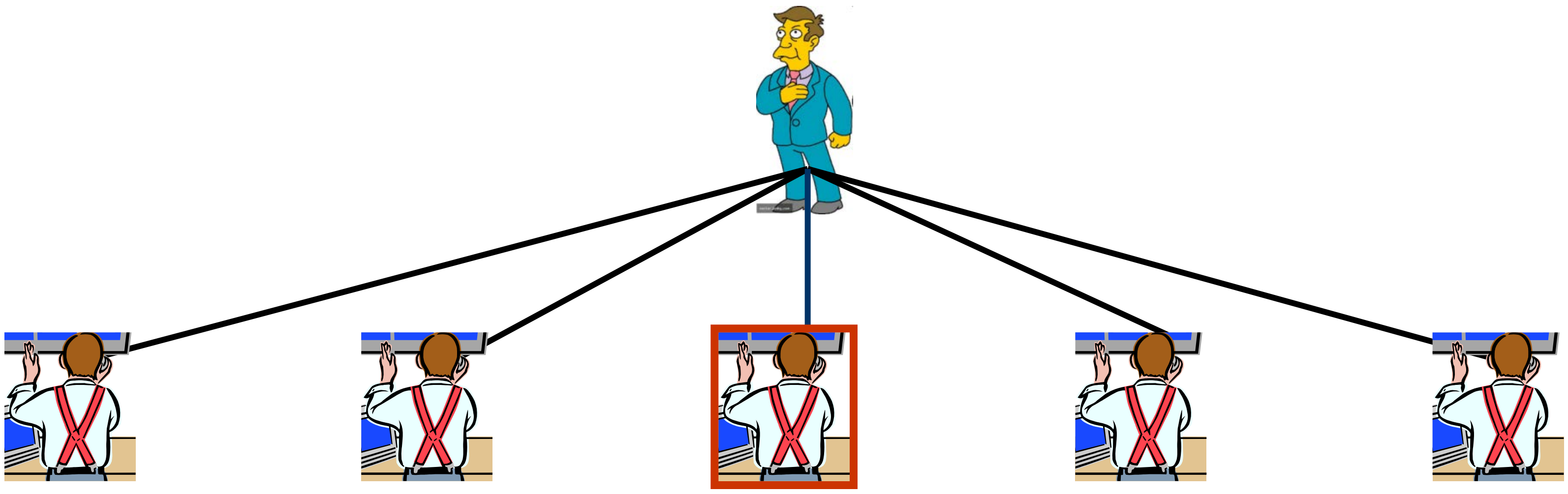
- Introduction
- Illustrating Example
- Model
- Results
- Evolutionary application
- Variants and Extensions

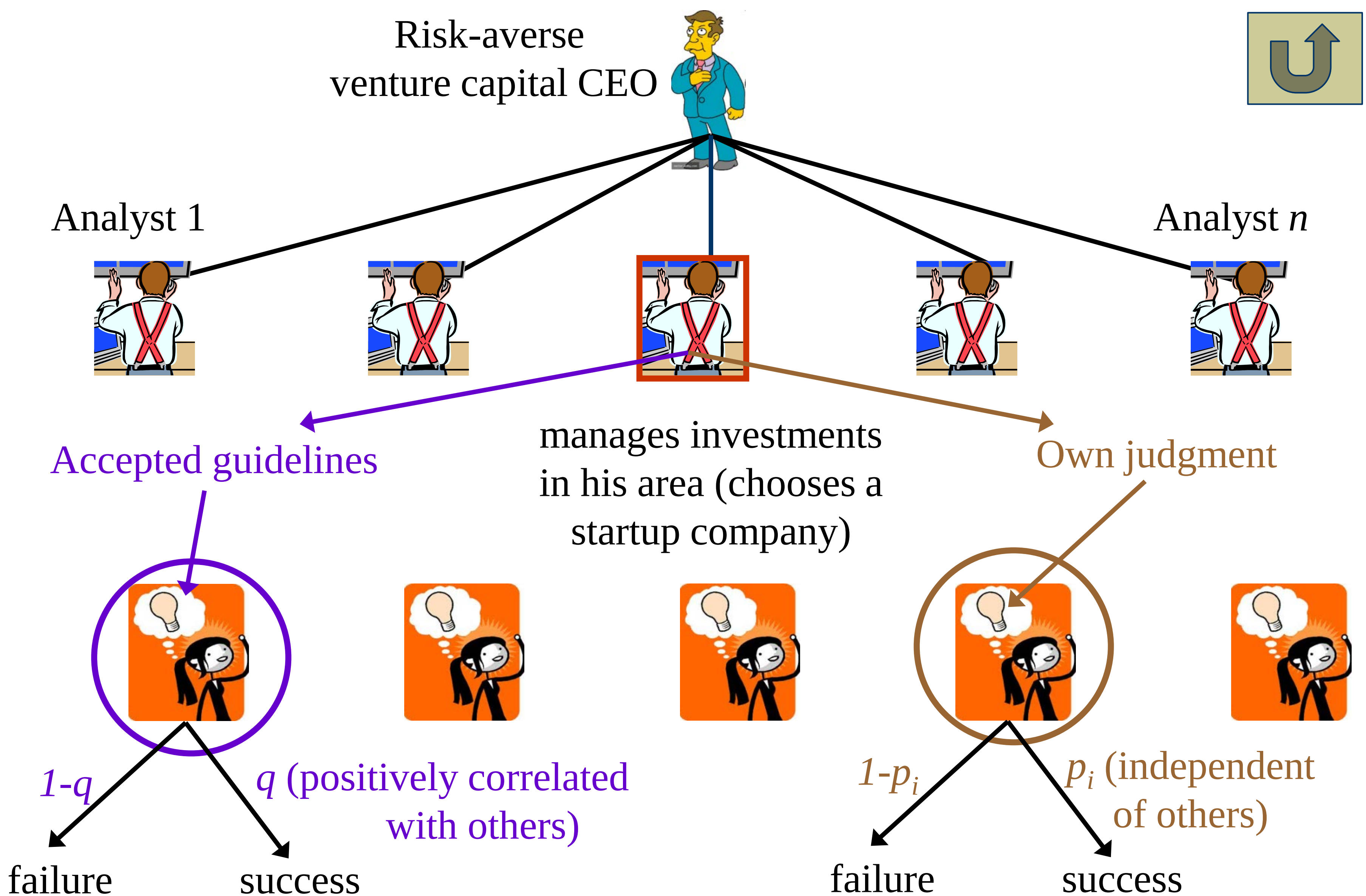
Related Phenomena

- Better than average
- Over-optimism about the future
- Underestimating variance / confidence intervals
- Literature: Lichtenstein et al. (1982), Soll & Klayman (2004), Teigen & Jorgensen (2005), Svenson (1981), Alicke & Govorun (2005), Taylor & Brown (1988)

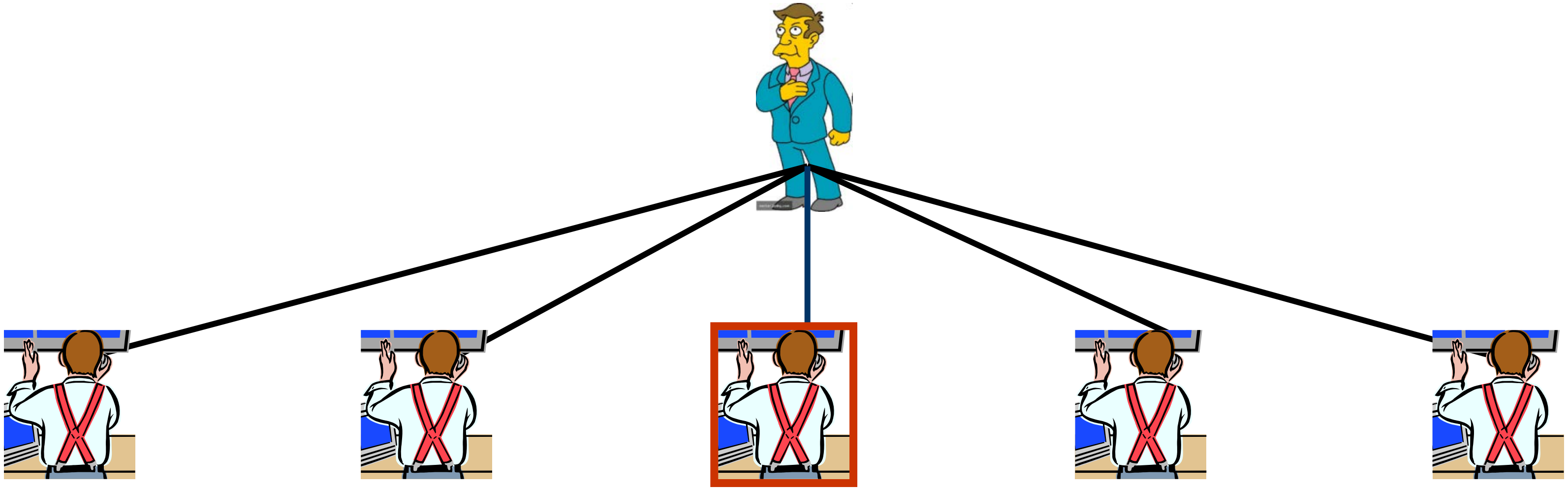
Experts

Illustrating Example




Risk-averse
venture capital CEO
Analyst 1
Analyst n
Accepted guidelines
manages investments
in his area (chooses a
startup company)
Own judgment
$1\text{-}q$
q (positively correlated
with others)
failure
success
$1\text{-}p_i$
p_i (independent
of others)
failure
success

Model



Payoffs:
Agent: 1 (success) / 0 (failure)

Principal: h(#successful agents)
$(h'>0,\ h''<0)$

Risk-averse Principal

2nd example

Stage 1: principal chooses bias profile

g_1 … $g_i:[0,1]\rightarrow[0,1]$ … g_n





Stage 2: agents receive signals

Private: $0<p_i<1\sim f(p)$ (evaluated as $g_i(p_i)$)

Public: $0<q<1\sim f(q)$ (evaluated correctly)

Stage 3: agents choose actions

Accepted guidelines (a_q)
- $1-q$: failure
- q (positively correlated with others): success

Own judgment (a_p)
- $1-p_i$: failure
- p_i (independent of others): success

Basic Intuition

- Agent – only cares if he succeeds:
  - Dominating strategy: Choose a_p iff $g_i(p_i)>q$
  - Bias profile uniquely determines actions
- Risk-averse principal – cares for total number of successes:
  - Tradeoff: higher expectation ←→ lower variance
  - Agents with $q\text{-}\delta<p_i$ should choose a_p
  - Chooses overconfident agents: $g(p)=p+\delta>$p

Comments

- Focus: monetary incentives are costly / infeasible
  - Evolutionary framework (described later)
  - Restriction to informal mechanisms (risk-neutral stock owners)
  - Complicated contracts are costly
- ρ - correlation between agents that choose a_q

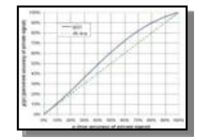
Correlation

  - Benchmark: $\rho = 1$ (all follow a_q: succeed or fail together)
- Technical assumption: decreasing absolute risk aversion
- Agents' preference for risk is irrelevant

$$r_A(x) = -\frac{h''(x)}{h'(x)}$$

Results

Main Result



- Unique optimal bias profile exists:
  - Homogenous profile: $\forall i \;\; g_i = g$
  - Represents overconfidence $(g(p) > p, \;\; \forall 0 < p < 1)$
  - Induces the first-best payoff
  - Strictly better than any other profile
  - Depends only on h, ρ & f_p (not f_q)
- Asymptotic result (sufficiently many agents)

Existence

Uniqueness

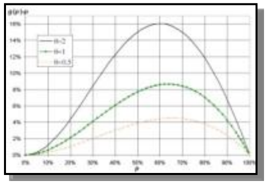
Intuition

Definitions

Contrary

Comparative Statics (1)

- principal I is more risk-averse than principal II ($h_I = \Psi \circ h_{II}$, $\Psi' > 0$, $\Psi'' < 0$) → chooses more overconfident agents: $\forall p$, $g_I(p) > g_{II}(p)$



- Intuition:
  - More risk-aversion →
  - Principal cares more for variance (less for expectation) →
  - More agents should follow a_p (their judgment) →
  - Agents should be more overconfident

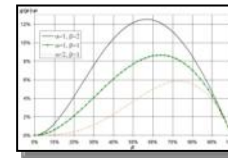
Comparative Statics (2)

- If ρ (correlation) becomes larger → the principal hires more overconfident agents

Correlation

- Intuition:
  - Higher correlation →
  - More aggregate risk from a_q →
  - More agents should follow a_p →
  - More overconfidence

Comparative Statics (3)



- Harder tasks (accurate signals are less likely) induce more overconfidence
  - *Hard-easy effect* (Lichtenstein, et al., 1982; Moore & Healy, 2008)
- Intuition:
  - Principal wants agents with the most accurate private signals to choose a_p
  - In an harder environment, each p_i is more likely to be among the most accurate

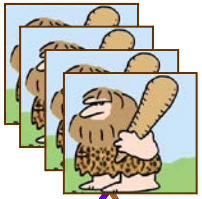
Overconfidence & Evolutionary Stability

Evolutionary Model (Only Agents)

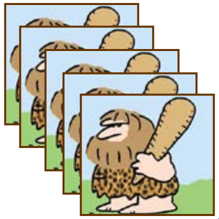
Each type induces a (possibly random) bias function

g_1

g_i:[0,1]→[0,1]



g_n



Agents receive signals

Private: $0<p_i<1 \sim f(p_i)$ (evaluated as $g_i(p_i)$)

Public: $0<q<1 \sim f(p)$ (evaluated correctly)

Each agent makes an important decision

Conformity (a_q)

- $1-q$: failure
- q: success (positively correlated with others)

Own judgment (a_p)

- $1-p_i$: failure
- p_i: success (independent of others)

Payoff (fitness):
Agent: H (success) / L (failure)

Which type will survive in the long run?

Intuition

- #offspring : product of the average fitness in each generation
- The type that maximizes the geometric mean of the average fitness prevails the population (large population, long run)
- Evolutionary dynamics behaves as it was a risk-averse principal with logarithmic utility:
  - *h*(#successful agents)=log (average fitness)
- See:

Lewontin & Cohen (1969), Mcnamara (1995), Robson (1996)

Results (1)

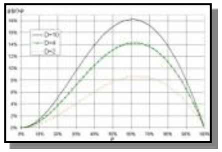
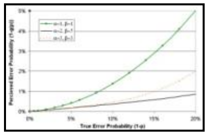
- In the long run all agents are overconfident
- Overconfidence level depends only on:

  $D=(H-L)/L$, ρ & f_p

$$g^*(p)=\frac{Bp}{1-p+Bp}, \text{ where } B=\left(1+\frac{D\cdot F_p(p)}{1+D\cdot\int_p^1 x\cdot f_p(x)\,dx}\right)^{\rho}$$

- Explains findings such as Yates et al. (2002):
  - Both Westerns and Asians present overconfidence
  - Level of overconfidence substantially differs

Results (2)

- Larger D (more important decisions) induces more overconfidence (Sieber, 1974)
  
  - Intuition: larger D → more aggregate risk in a_q → more overconfidence
- When people are certain in their private information ($1-g(p)\sim 0$), they are often wrong ($1-p >> 1-g(p)$)   [for large D-s]
  - *False certainty effect* (Fischhoff et al., 1977)
- Results hold for any CRRA utility
  

Variants & Extensions

- Social welfare
- Agents as experts
- Costly private signals
- Choosing the number of agents — Example
- Bias w.r.t. the public signal
- Underestimating variance

Summary

- Explaining overconfidence as the result of diversification
- Novel evolutionary foundation of overconfidence and its observed properties (1st best, no other bias, no group selection)
- Demonstrate why principals may prefer overconfident agents in some strategic interactions

Future Research

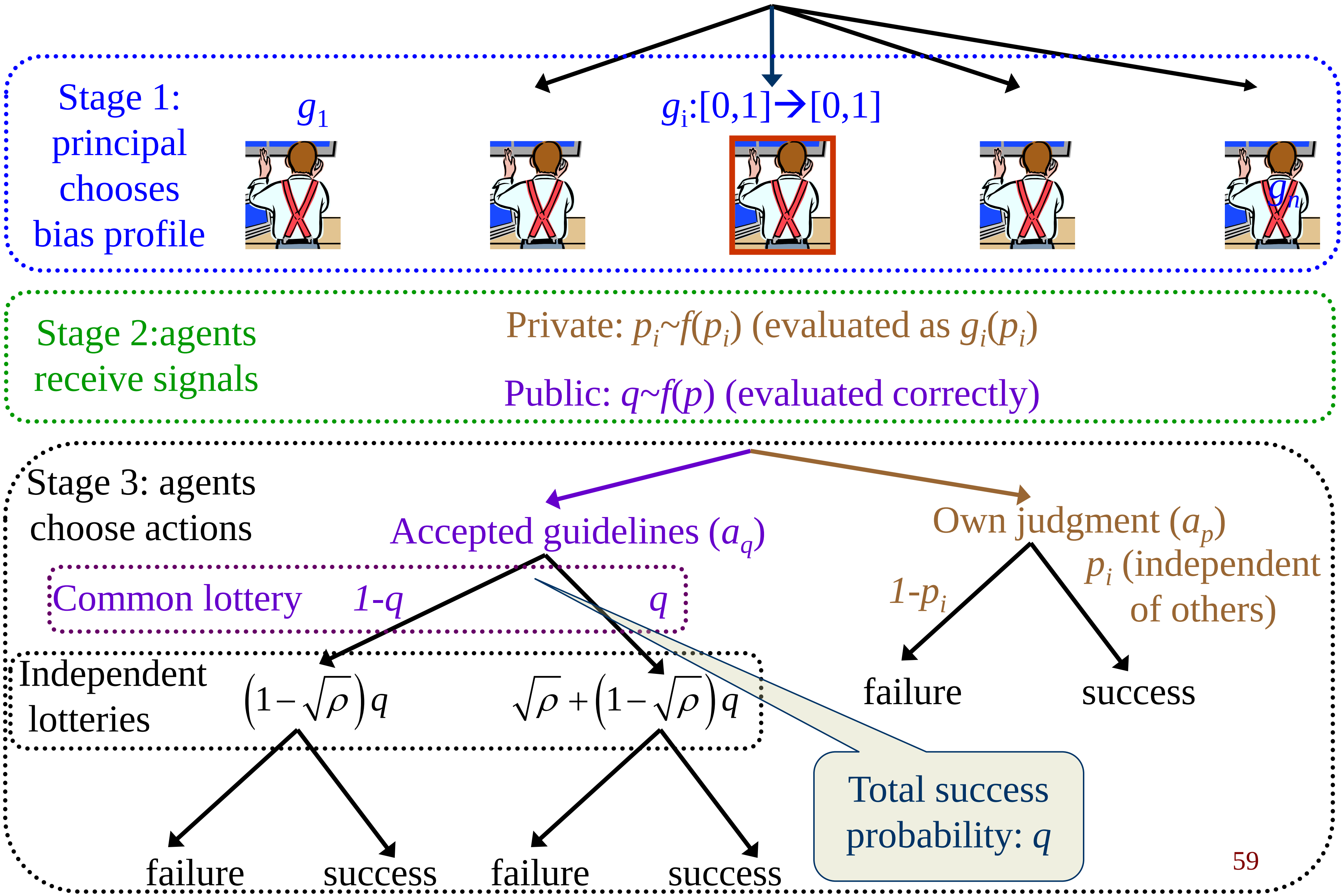
2nd example

Future Research

- Comparing costs: bias profile / monetary incentives / biased preferences
  - General (non-binary) payoff structure
- Applying the model to voting / career-motivated experts
  - Requires relaxing a few technical assumptions: Non-risk-averse principal, asymmetric agents, few agents, general signaling system

Related Literature
(Models of Overconfidence)

- Conflict with future selves (Bénabou & Tirole ,QJE 2002)
- Positive emotions improve performance / utility:
  - Compte & Postlewaite (AER 2004), Köszegi (2006), Weinberg (2009)
- Taking credit for lucky successes (Gervais & Odean, 2001)
- Apparent overconfidence due to unbiased random errors
  - Van Den Steen (AER 2004), Moore (2007), Benoit & Dubra (2008)
- Influence of overconfident agents
  - Odean (JoF 1998), Sandroni & Squintani (AER 2007)
- Evolutionary foundations: Bernardo & Welch (2001), Blume & Easly (1992), Wang (1991), Waldman (AER 1994)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Public: $q \sim f(p)$ (evaluated correctly)
Stage 3: agents choose actions
Accepted guidelines (a_q)
Own judgment (a_p)
Common lottery
1-q
q
$1-p_i$
p_i (independent of others)
Independent lotteries
$\left(1-\sqrt{\rho}\right)q$
$\sqrt{\rho}+\left(1-\sqrt{\rho}\right)q$
failure
success
failure
success
failure
success
Total success probability: q