Sequential Decision-Making & Information Aggregation in Small Networks

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"Networks matter" to both individual decision-making and macro political outcomes

- Many networks emphasize role of communication
  - Chains of command, committee structures, social media, etc.

- In general, communication is a sequential process

- It is also a potentially strategic process—people observe some prior decisions of others, and know that others can observe *their* decisions

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Two well-known challenges with network analysis

1. The effect of network structure on strategic behavior

2. The fact that there is a wide variety of network structures

In this paper we deal with (1) to examine the effect of (fixed) network structures on individual behavior and on policy outcomes

We focus exclusively on small networks both because we can, and because they exhibit particularly extreme variation in their structures

The Question:

Given decentralized decision-making & strategic agents, what kinds of networks support truthful information sharing?

Decentralized Decision-making:

1. Multiple agents with private information

2. Sequential decisions & information revelation

3. Policy decisions jointly affect all agents

(Incentive compatible networks are more informative, more valuable to the agents involved and potentially more likely to be sustained in the real world)

Primitives

- 3 players: $N = \{1, 2, 3\}$

- State of nature, $\theta \in [0, 1]$

- Player $i \in N$'s private information (signal): $s_i \in \{0, 1\}$

- Player $i \in N$'s policy decision: $y_i \in \mathbf{R}$

- Player $i \in N$'s policy preference (bias): $\beta_i \in \mathbf{R}$

- Player $i \in N$'s discretionary authority, $\alpha_i \geq 0$

Agent i's payoff:

$$u_i(y, \theta; \beta) = -\sum_{j=1}^{n} \alpha_j (y_j - \theta - \beta_i)^2$$

Sequence of Play

1. State of nature, θ, drawn from Uniform$[0, 1]$ distribution

2. Each player i privately observes an independent signal, s_i

3. Player i chooses policy y_i after every player j preceding i has chosen y_j

   - Depending on the network structure, i may also observe & *learn* from one or more decisions y_j prior to choosing y_i

4. θ revealed, players receive their payoffs

Related Models

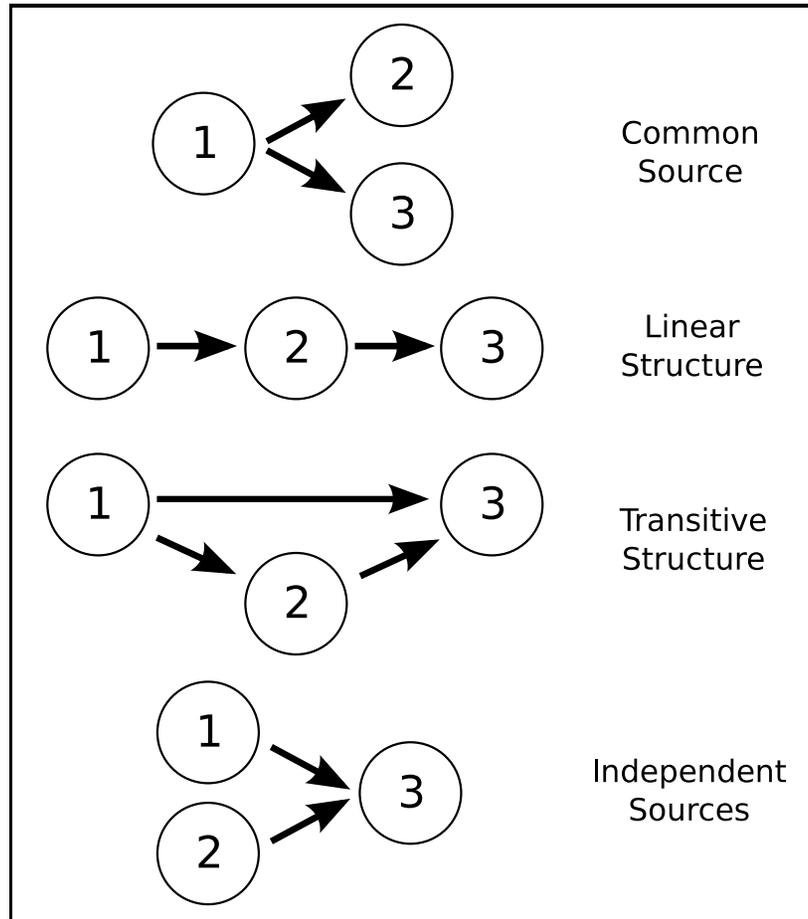Galeotti, Ghiglino, & Squintani (2011), Dewan & Squintani (2012)

Figure 1: The Four Interesting 3-Player Network Structures

What The Paper Does

- For each of the four possible network structures we characterize every possible distribution of preferences and discretionary authority that supports a truthful equilibrium

What We Find

- Order matters above & beyond preferences

- Middle-movers face a lower cost of lying

- Extremists are more tempted to lie by early positions in the
  network than are moderates

- Less powerful individuals more tempted to lie by early positions in
  the network

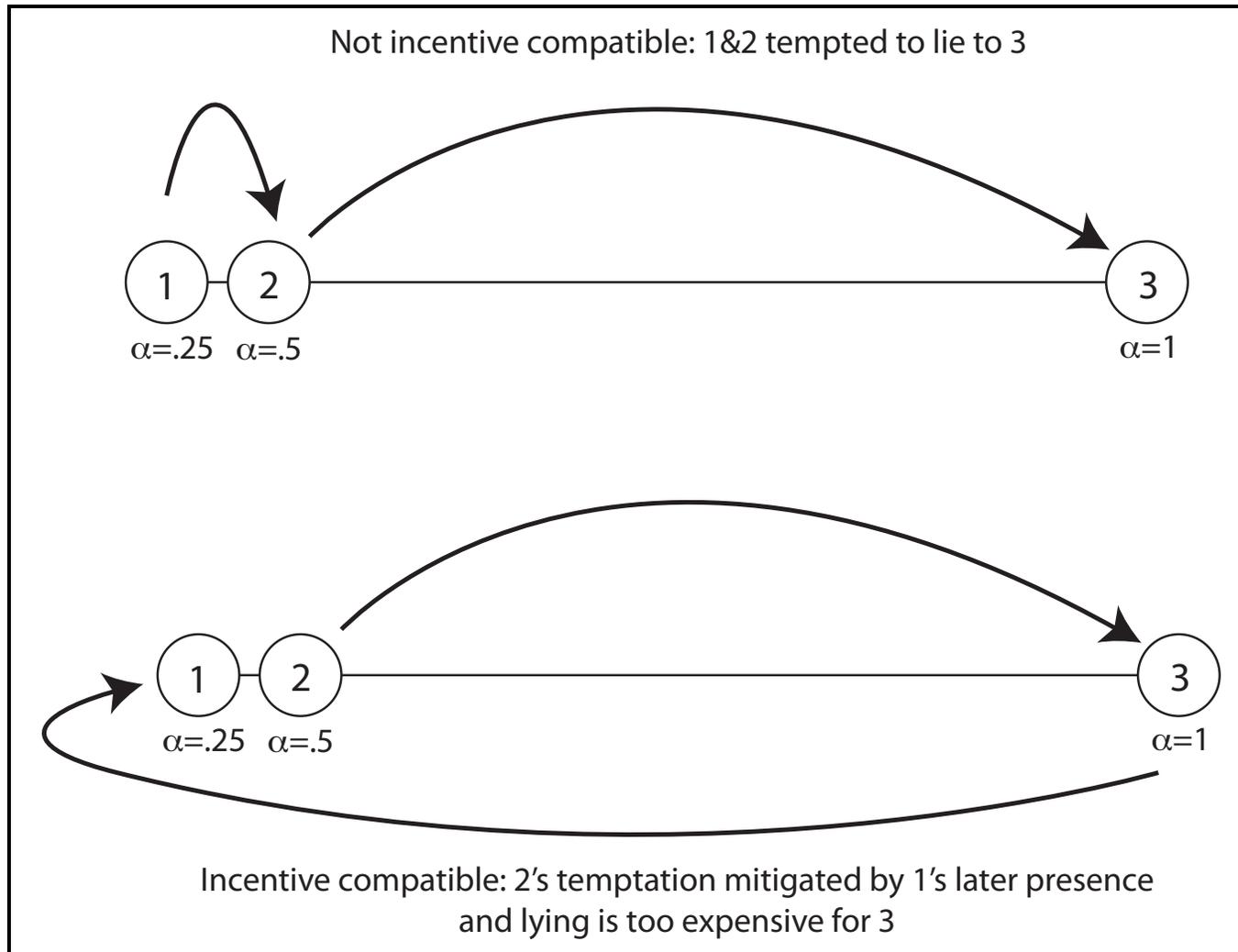- Details of structure, preferences & power matter . . . a lot

Figure 2: Networks matter (beyond preferences & power)

Conclusions

- IC networks are more valuable than ones providing incentives to lie

- Empirical implications highly conditional on specifics

- Incentives depend on network position, *not* just network structure
  - One linear configuration might be IC, while another is not

- Power incentivizes truthfulness
  - Divergent Predictions: Information Revelation vs. Ally Principle