Persuasion in Random Networks

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Introduction

- Information constantly shared through social networks
  - Large literature about role of networks on *spread of information* → learning, polarization, ...
  - Sparser literature about the role of networks on *information provision*

→ presence of network changes incentives to provide information for a sender

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How and when to exploit the network rather than public communication?

Is the existence of network detrimental to information?

Sneak Peek

- Classical Bayesian persuasion:

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→ Very limited knowledge sufficient to take advantage of the network

→ Segregation and extreme beliefs make the network more vulnerable

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Is the existence of network detrimental to information?

→ Existence of vulnerable network might be the lesser of two evils

Literature

Bayesian Persuasion

- Seminal works: Kamenica and Gentzkow (2011)
- Heterogenous unconnected receivers: Innocenti (2021)
  → *Introduce*: networks
- Homogenous connected receivers:
  - With voting quota: Kerman and Tenev (2021)
  - For general games: Galperti and Perego (2019)

  → *Introduce*: polarization & random networks

Information design

- link with Bayesian persuasion: Bergemann and Morris (2019)
  → *Introduce*: endogeneity of publicness of signals
- link with network: Egorov and Sonin (2020), Candogan (2019)

Setup

- Classical Bayesian persuasion:
  - A sender wants to induce receivers to take some *favorable* action
  - N receivers want to match a payoff-relevant state
- → Sender commits to signal structure – conditional rate of success (and correlation)

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"Classical" Unique Strategy

- SoW $\omega \in \{0, 1\}$, common prior $\Pr(\omega = 1) = \mu$
- Sender sets:

	$\omega = 0$	$\omega = 1$
s=0	1-p	1-q
s=1	p	q

- Receivers' posterior after $s = 1$: $\beta(1) = \Pr(\omega = 1|s = 1) = \frac{q\mu}{q\mu+(1-\mu)p}$

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- **Key insight:** p, q such that $\beta(1) = t \Rightarrow q^* = 1; p^* = \frac{\mu(1-t)}{t(1-\mu)} =: \alpha$
  - ⇒ Persuasion payoff: $V = \mu + (1-\mu)\alpha$

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  - Two groups (denoted A and B) defined by their priors
  - Persuade one group without dissuading the other

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Heterogenous Agents: "Hard News" Strategy

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- **Key insight:** p, q such that $\beta_B(1) = t \Rightarrow q^* = 1; p^* = \frac{\mu_B(1-t)}{t(1-\mu_B)} =: \alpha_B$
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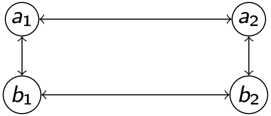
- → Add a communication network
  - Exogenous and random (→ degree distribution)
  - Exogenous communication of signals – *i* observes his and his neighbor's signals.

Exploiting the network

An easy example

Assume:

- $\mu = t = 0.5, \alpha_A = 2, \alpha_B = 1/2$
- $\delta_A(d_i = 1) = 1$ and $\delta_B(d_i = 2) = 1$



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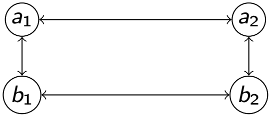

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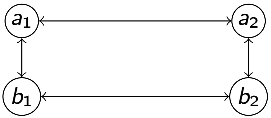

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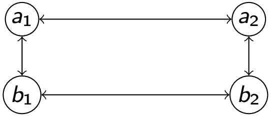

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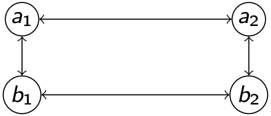

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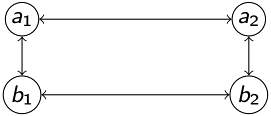

Then:

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$$V_{MM} = \mu + (1-\mu)\left[p^2 + \frac{a}{2}\, 2p(1-p)\right] \approx 13/16$$

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Beyond the example

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- Benefits: exploits connectivity differences between groups (segregation)
- Costs: introduces unnecessary heterogeneity within group
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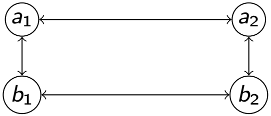

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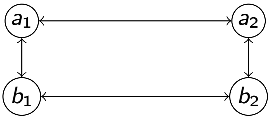

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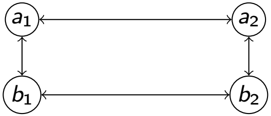

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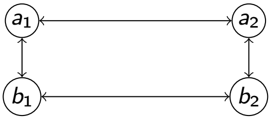

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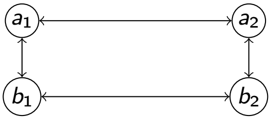

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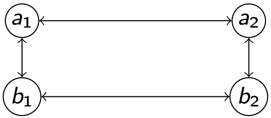

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Beyond the example

If focus on never dissuading A, never optimal to exploit the network

- Soft news ≈ add "confusion" when $\omega = 1$ to retain $A \Rightarrow q_{SN} < 1$
- Intuitively, the "confusion" gets amplified through network

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→ favor both soft news (w/o exploiting the network) and exploiting the network

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- Informative signals only to B $\rightarrow$ optimal with "general" SN strategy and > 2 signals?
  - Move towards optimization over space of posteriors?
  - How to link posteriors space of agents with different degrees?

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Thank you!

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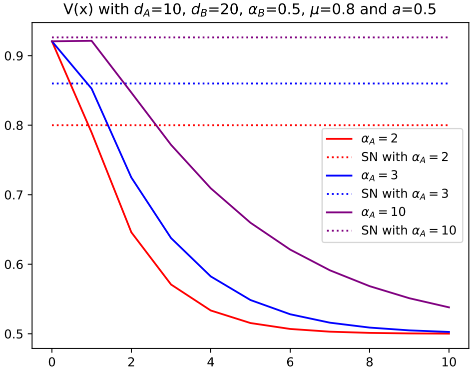
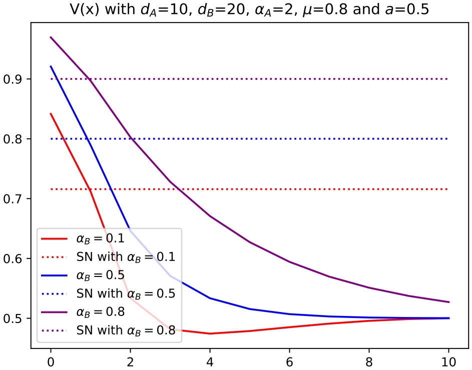
Shape of V(x), numerically





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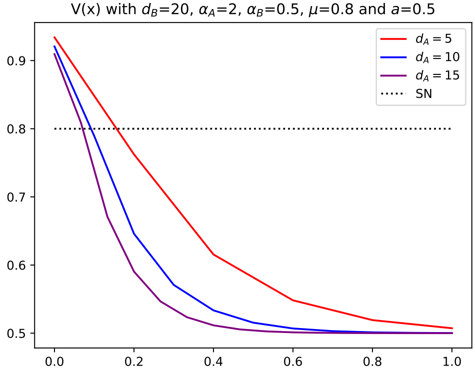
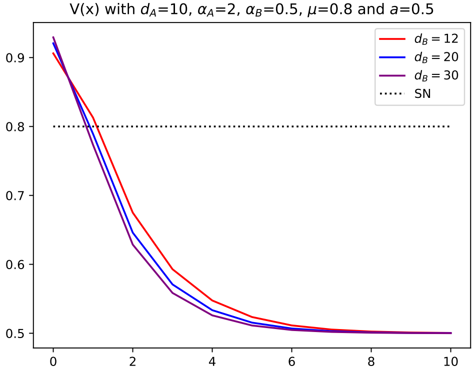
Shape of V(x), numerically





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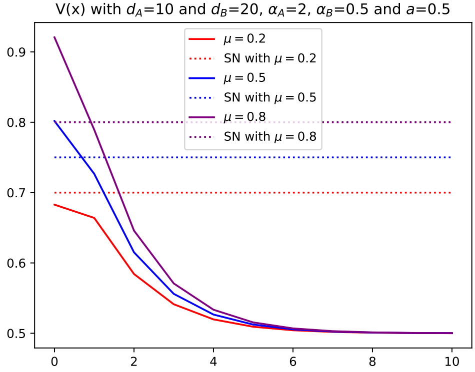
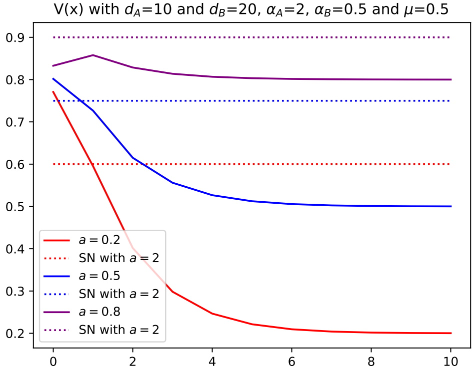
Shape of V(x), numerically





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