The Dynamics of Policy Complexity

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Badly-designed systems

- Excessive complexity in organizations and systems
  - Public policy
  - Organizational bureaucracies
  - Software development
- This paper – complexity due to:
  - Frictions in design process
  - Conflict between designers

Kludge

Definition

Kludge: an ad-hoc modification to an existing system that is functional but inefficient.

Obamacare: a kludge

US Affordable Care Act of 2010 ("Obamacare")

- Patches over existing private insurance system
  - Individual mandate, coverage requirements, etc
- Excessive complexity due to 'plugging gaps' design
- Entanglement w/ existing system creates frictions:
  - Once enacted, makes existing system even more entrenched

Kludges

Key elements of kludges:

- interdependencies
- incremental change
- external shocks (Ely 2011, Kolitilin and Li WP), or
- conflict (this paper)

Preview

This paper: policymaking in setting of political conflict

- Focus on long-run outcome w/ myopic players
- Conflict + Interdependence $\Rightarrow$ persistent complexity
- Complexity begets complexity:
  - $*$ simple policies remain simple
  - $*$ complex policies grow more complex

Preview

Comparative statics: persistent complexity iff

- Strong, extremist ideological preferences
- Relatively equal political power
- Severe institutional frictions

Preview

With non-myopic players, additional effects:

- *Intentional Complexity*: " building a moat"
- *Strategic extremism*: "shifting the goalposts"
- Lesson: increasing discount factor exacerbates kludge

Lit review

- Kludges: Ely (2011), Kolotilin and Li (WP)
- Rule Development: Ellison and Holden (2013)
- Policy Politics: Bonatti and Rantakari (2015), Callander and Hummel (2014)

Outline

Model

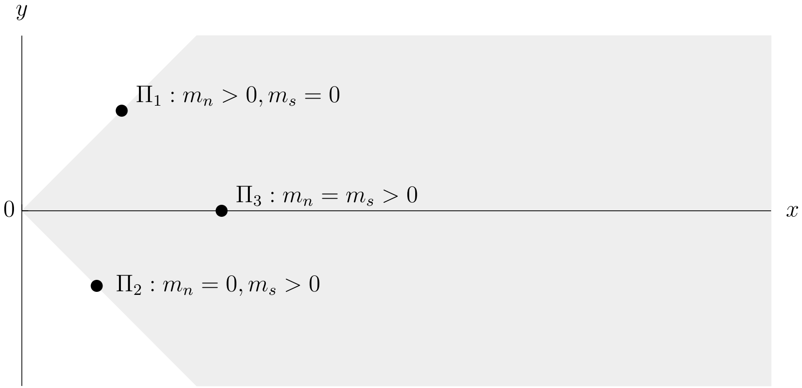
- Continuous time, $t \geq 0$.
- Policy $\Pi(t) =$ continuum of infinitesimal, equal-weighted elements π
- Each element has a direction: either northern (n) or southern (s)
- Policy position is difference between masses of northern vs southern elements:

$$y(t) = m_n(t) - m_s(t)$$

- Policy complexity is total mass of elements:

$$x(t) = m_n(t) + m_s(t)$$

Policy Diagram: Examples



Policy with only one type of element is *simple*
(e.g., Π_1 and Π_2)

Policy Preferences

- 2 players, (N)orth and (S)outh
- Each player I cares about policy complexity (x) and position (y):

$$V_{I,t} = \int_{\tau=t}^{\infty} e^{-\rho_I \tau} u_I(\tau) d\tau,$$
$$u_I(\tau) = -\zeta_I |y_I - y(\tau)| - x(\tau).$$

- y_I is player I's *ideal* position
- ζ_I is player I's ideological *zeal*

$$y_N > 0, y_S < 0,$$
$$\zeta_N, \zeta_S > 1$$

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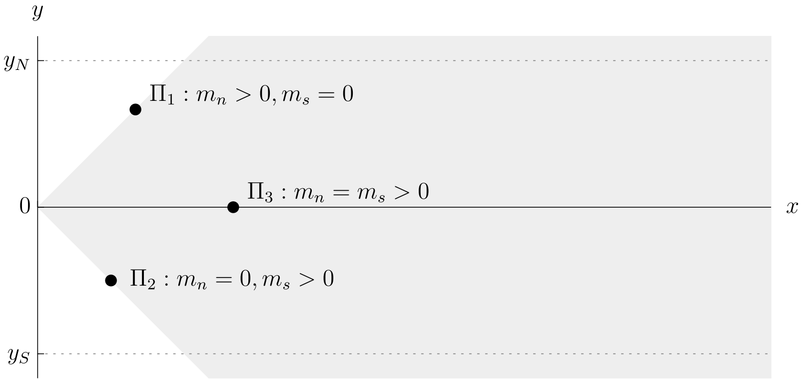
Policy Diagram: Preferences



Interdependencies

- Undirected network over elements in $\Pi(t)$
- New elements uniformly randomly form links with existing elements:
- Each new element forms κ links per unit mass of existing elements

$*$ If element x deleted, then all direct neighbours also removed.

- Players do not observe time-t network structure, but understand network formation process

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Incremental Policymaking

- At any instant t, one player $I(t)$ in control
- Adds new elements $A(t)$ and deletes $D(t) \in \Pi(t)$

$\Rightarrow$ $R(t) = \{D(t) \text{ and neighbours of } D(t)\} \subseteq \Pi(t)$ removed

- Player faces flow constraint on addition and removal *rates*:

$$\frac{d}{dt}|\mathcal{A}(t)| + \frac{d}{dt}|\mathcal{R}(t)| \leq \gamma$$

where $\mathcal{A}(t)$, $\mathcal{R}(t)$ are accumulated sets of additions and removals:

$$\mathcal{A}(t) = \bigcup_{0}^{t} A(\tau),\ \mathcal{R}(t) = \bigcup_{0}^{t} R(\tau)$$

- Constraint represents limited political resources to persuade voters, overcome interest groups, etc

Policymaking Technology

Consider composition of removal set $R(t)$:

- $D(t)$'s neighbours are representative sample of $\Pi(t)$
- i.e., n/s ratio in $R(t)$ is weighted avg. of n/s ratio in $D(t)$ and $\Pi(t)$
- At $\lim \kappa \to \infty$, n/s ratio in $R(t)$ equals $\frac{m_n}{m_s}$

Reduced-Form: Policymaker's Problem

- Player $I(t)$ chooses

$$\text{addition rates } a_n^+(t) \geq 0, a_s^+(t) \geq 0$$
$$\text{removal rates } a_n^-(t) \geq 0, a_s^-(t) \geq 0$$

- so masses of north and south elements, m_n and m_s, evolve as

$$\dot{m}_i(t) = a_i^+(t) - a_i^-(t)$$

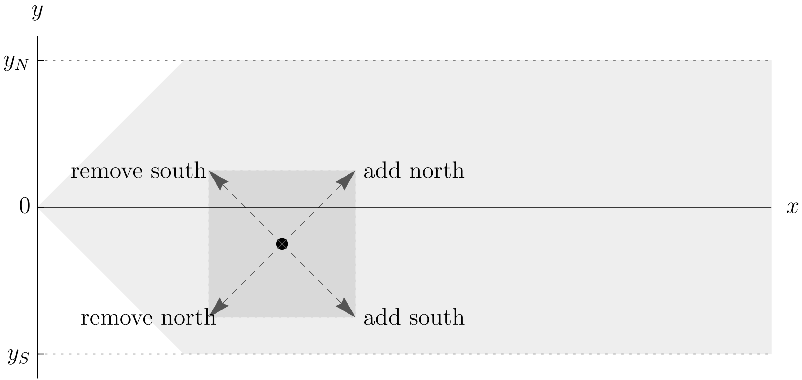
- subject to flow constraints

$$a_\ell^+(t) + a_r^+(t) + a_\ell^-(t) + a_r^-(t) \leq \gamma^{-1},$$
$$a_i^-(t) = 0 \text{ if } m_i(t) = 0$$

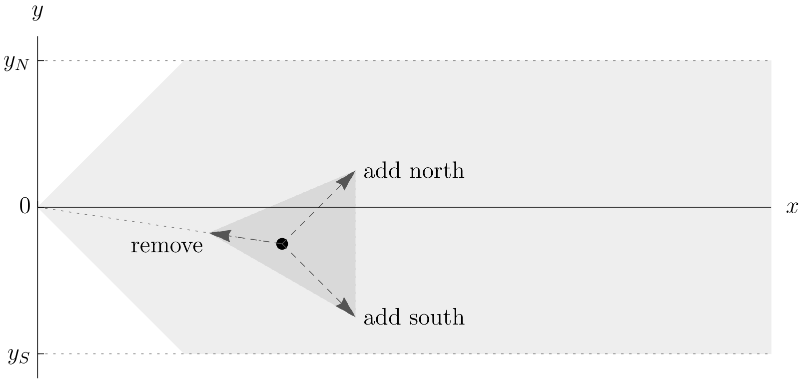
- and *entanglement constraint* (given $\kappa \to \infty$)

$$\frac{a_n^-(t)}{a_s^-(t)} = \frac{m_n}{m_s}$$

Unentangled Policymaking



Entangled Policymaking



Dynamics

- Player N starts with control at $t = 0$ (WLOG)
- Whenever I in control, control switches to $-I$ at random time
- Control switch from I to $-I$ has constant arrival rate λ_I.

  (i.e., power transitions independent of current policy position)

- Focus on myopic setting, $r_I \to \infty$: so
- Policymaker $I(t)$ maximizes $\frac{d}{dt}u_I(t)$.

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Outline

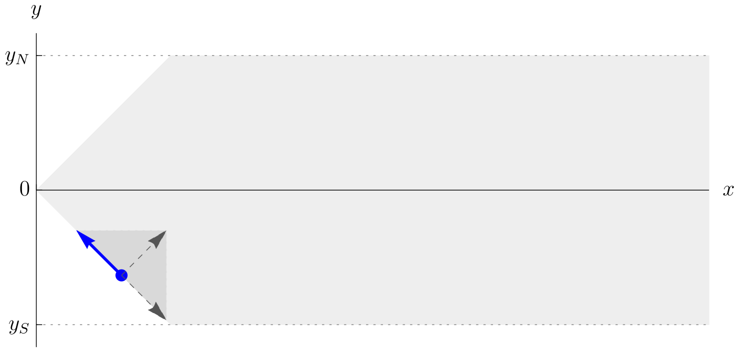
One-Player Game: Dynamics

Myopic player N. Focus on non-extreme policies, $y_S \leq y \leq y_N$

Observation

If (x, y) is S-simple, then N removes elements.

$$(a_n^+, a_s^+, a^-) = (0, 0, \gamma^{-1})$$



One-Player Game: Dynamics

Observation

If (x, y) is **almost** *S-simple, then N removes elements.*

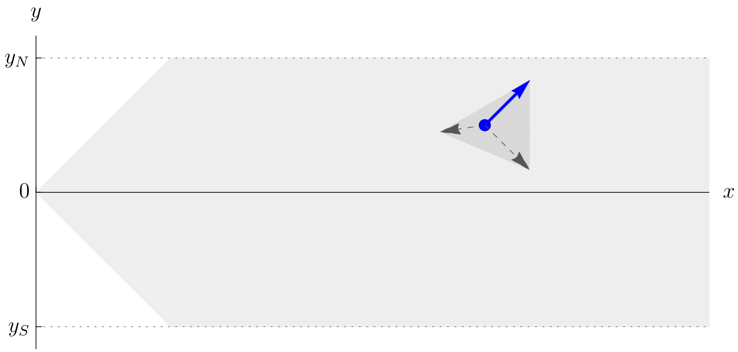
$$(a_n^+, a_s^+, a^-) = (0, 0, \gamma^{-1})$$

One-Player Game: Dynamics

Observation

Otherwise, N adds elements towards his ideal:

$$(a_n^+, a_s^+, a^-) = (\gamma^{-1}, 0, 0)$$

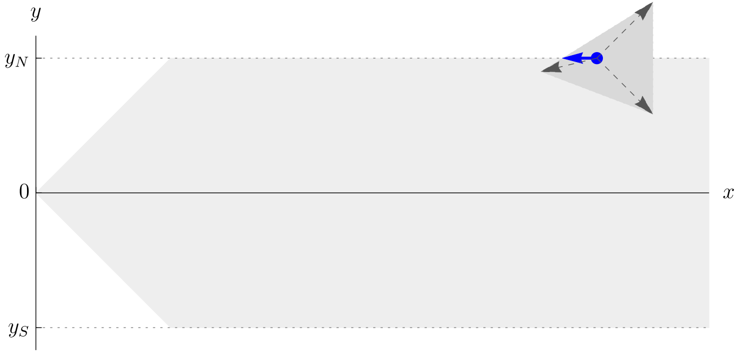


One-Player Game: Dynamics

Observation

N moves along own ideal once he gets there:

$$(a_n^+, a_s^+, a^-) = \left(\gamma^{-1}\frac{y}{x+y}, 0, \gamma^{-1}\frac{x}{x+y}\right).$$



One-Player Game: Dynamics

Observation

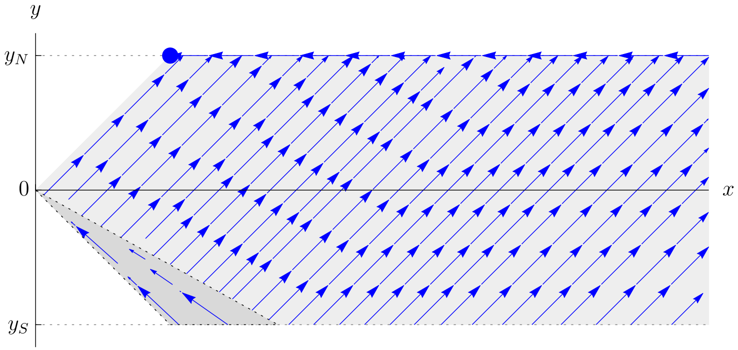
At **simple**, **ideal** *policy, N stagnates:*

$$(a_\ell^+, a_r^+, a^-) = (0, 0, 0).$$

One-Player Game: Dynamics

Observation

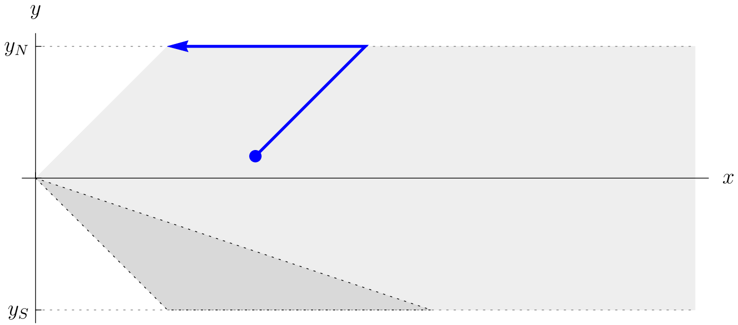
L removes elements in "basin": $\zeta_N < \frac{2x}{x+y}$.
Otherwise, he adds (or moves along ideal).



One-Player Game: Dynamics

Observation

For any starting policy $\Pi(0)$, simple ideal policy eventually attained.
(i.e., no kludge without conflict.)



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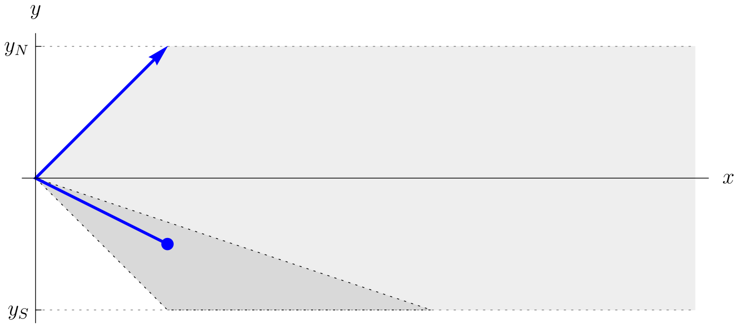
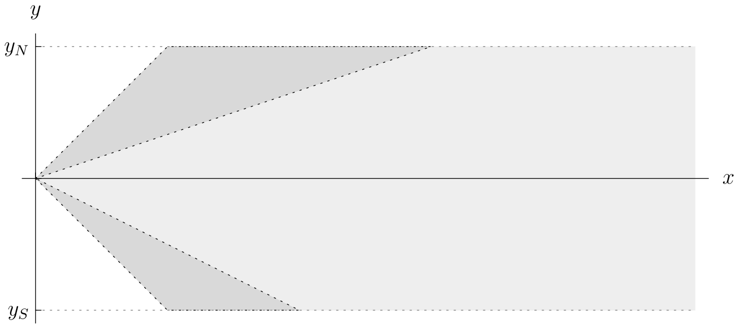


Outline

Two-Player Game: Preliminary Observations

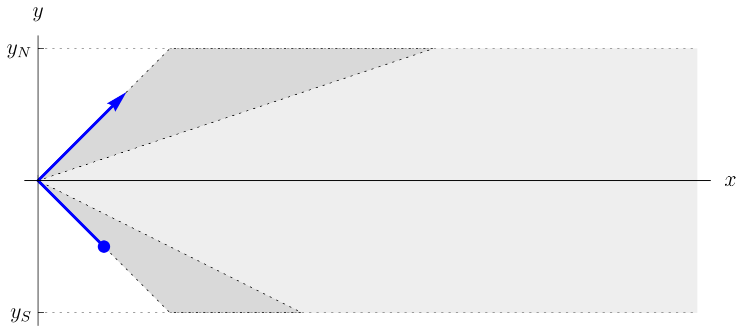
- Myopic players $\rightarrow$ no strategic interactions;
- Players' strategies same as in one-player game
- Can restrict attention to $y \in [y_S, y_N]$;
- Policy never becomes "extreme"



Two-player game: persistent simplicity

Observation

Suppose $\Pi(t)$ *is simple. Then* $\Pi(\tau)$ *will be simple for all* $t > \tau$*.*



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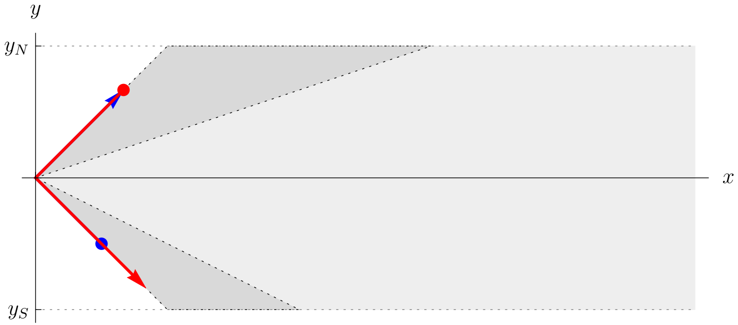
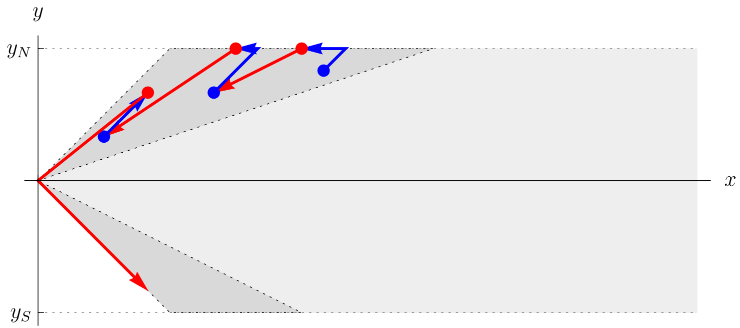


Two-player game: persistent simplicity

Lemma

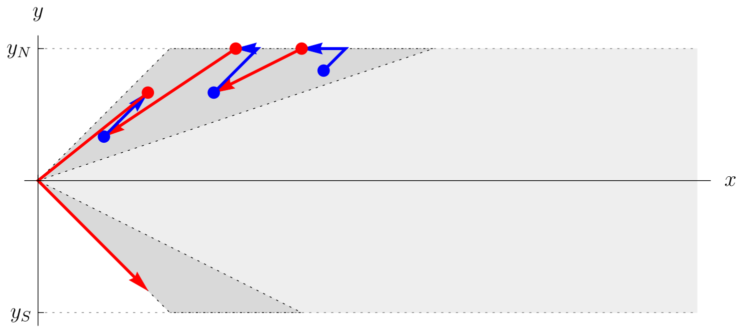
Suppose $\Pi(t)$ is "approx. simple" ($\frac{2x}{x+y} < \zeta_N$, or $\frac{2x}{y-x} < \zeta_S$). Then policy eventually becomes simple.



Two-player game: persistent simplicity

Observation

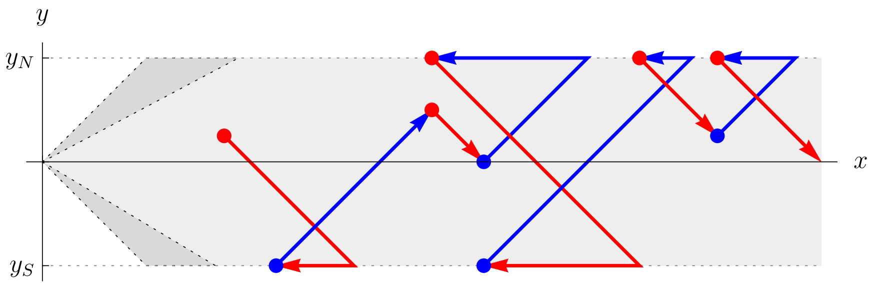
"Approx. simple" policies are attracting basin for set of simple policies.



Long-run outcome: two possibilities

Definition

If $\lim_{t\to\infty} x(t) = \infty$, *then we say policy is kludged*



Long-run outcome: two possibilities

Definition

If $\lim_{t\to\infty} x(t) = \infty$, *then we say policy is kludged*

Lemma

In the long-run ($t \to \infty$), *policy is almost surely either simple or kludged*

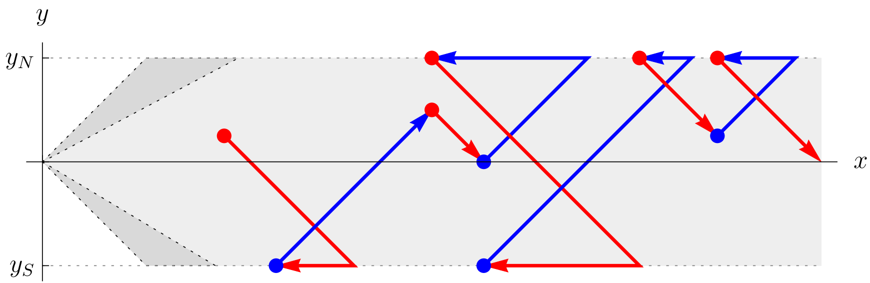
Question

What is $\Pr[\textit{kludge}]$*?*

When does kludge occur?

Outside attracting basin,

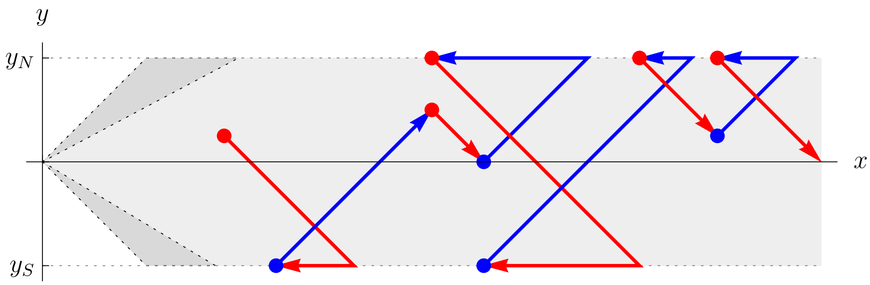
- If $y(t) = y_N$ or y_S, then complexity decreases: $\dot{x}(t) \approx -\gamma$
- If $y_S < y(t) < y_N$, then complexity increases: $\dot{x}(t) = \gamma$



When does kludge occur?

Then (intuitively)

- Kludge only if policy spends more time *between* than *at* ideals
- i.e., kludge only if $\dot{x}(t) > 0$ "on average"



When does kludge occur?

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- Kludge only if policy spends more time *between* than *at* ideals
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Lemma

$\Pr[\mathit{kludge}] > 0$ *iff*

- *initial policy is outside sink, and*
- *"average long-run drift" is asymptotically positive:*

$$\mathbb{E}\left[\underbrace{\lim_{\tau\to\infty}}_{\text{long}-\text{run}} \underbrace{\lim_{x(0)\to\infty}}_{\mathit{asymptotic}} \frac{1}{\tau}\int_0^\tau \dot{x}(t)\,dt\right] > 0$$

Comparative Statics

Definition

$$\phi = \frac{1}{\lambda_N - \lambda_S} \ln \frac{\lambda_S (3\lambda_N - \lambda_S)}{\lambda_N (3\lambda_S - \lambda_N)}$$

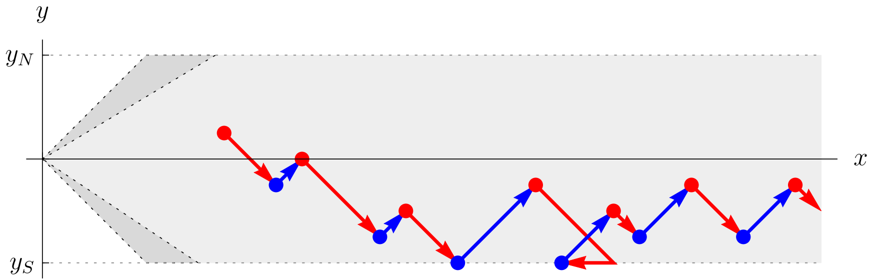
Theorem

$\Pr[\mathit{kludge}] > 0$ *iff the following conditions hold:*

- *Players' ideals are far apart, and frictions are high:* $y_N - y_S > \gamma/\phi$
- *Power is relatively equal:* $\frac{1}{3} < \frac{\lambda_I}{\lambda_{-I}} < 3$
- *Initial policy outside attraction basin*

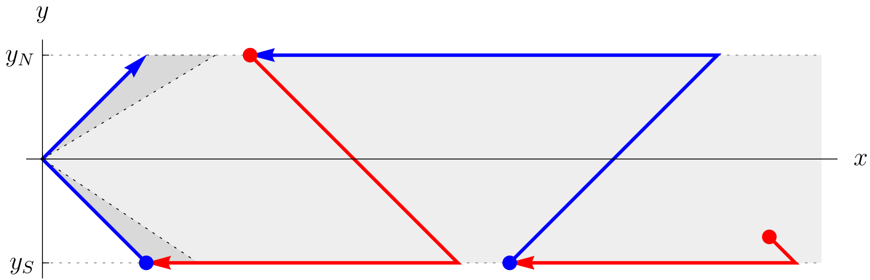
Institutions matter

- **High** institutional frictions (γ) $\Rightarrow$ **more** kludge
- e.g., supermajority elements, multiple veto points



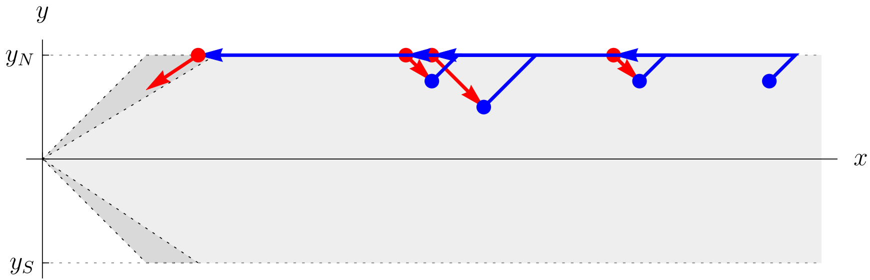
Institutions matter

- **Low** institutional frictions (γ) $\Rightarrow$ **less** kludge



Institutions matter

- Power imbalance (large $|\lambda_I/\lambda_{-I}|$) $\Rightarrow$ kludge $\downarrow$
- $*$ Less kludge with one dominant party or with autocracy;
- $*$ More kludge with democracy

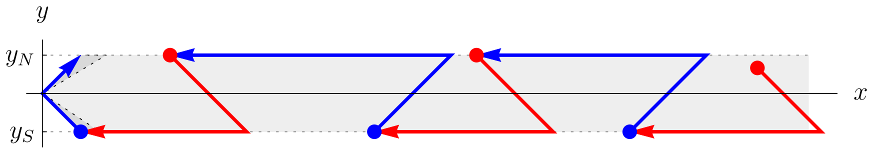


Institutions matter

- Planner who chooses $\gamma, \lambda_N, \lambda_S$ faces tradeoff:
  * Low-friction, autocratic systems produce less kludge (low $y(\tau)$)
  * but also more extreme outcomes (high $|x(\tau)|$)
- Comparison: US versus Singapore?

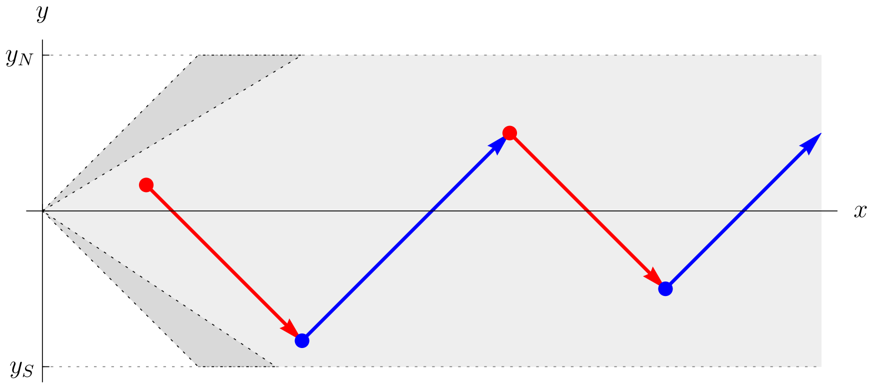
Ideology / preferences matter

- **Less** extreme competing ideologies (**small** $y_N - y_S$) $\Rightarrow$ **less** kludge



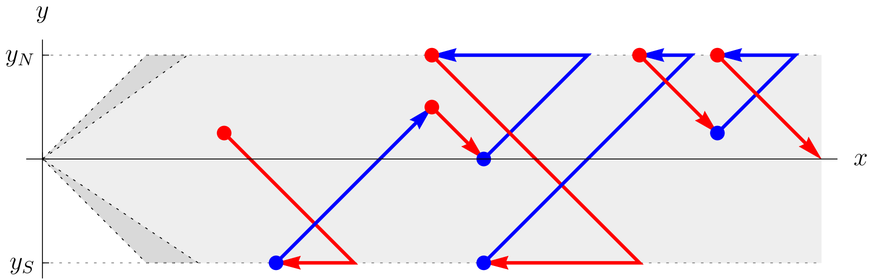
Ideology / preferences matter

- **More** extreme competing ideologies (**large** $y_N - y_S$) $\Rightarrow$ **more** kludge



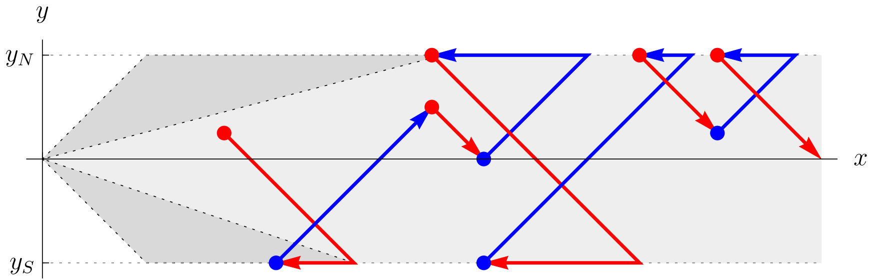
Ideology / preferences matter

- **Stronger** preferences over ideology (**large** ζ_N, ζ_S) $\Rightarrow$ **more** kludge:



Ideology / preferences matter

- **Weaker** preferences over ideology (**small** ζ_N, ζ_S) $\Rightarrow$ **less** kludge:



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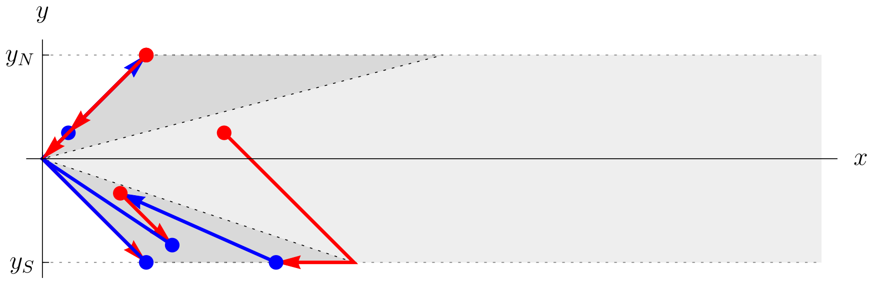
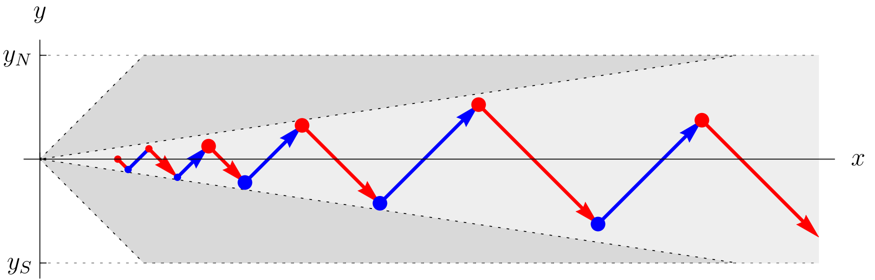


Complexity begets complexity

Proposition

Suppose the conditions from the theorem are satisfied, so $\Pr[kludge] > 0$.

- *As* $x(0) \to \infty$, $\Pr[kludge] \to 1$ *uniformly for all* $y(0)$.
- *As* $x(0) \to 0$, $\Pr[kludge] \to 0$ *uniformly for all* $y(0)$.



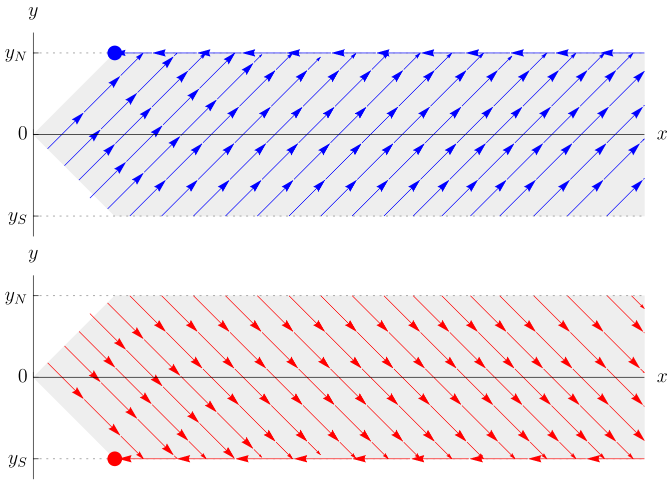
Outline

Modeling Strategic Effects

- Consider nonmyopic players, $\rho < \infty$
- Markov-perfect equilibria (no punishment schemes)
- Player N is zealous: ζ_N large
- N's strategic behavior vs: (i) zealous S, (ii) moderate S

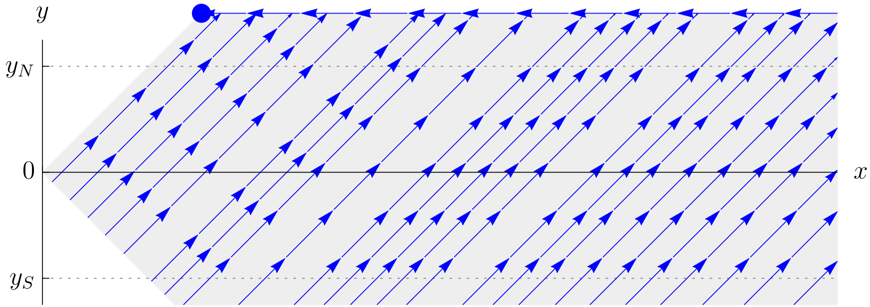
Zealot vs. Zealot

- Simplifying assumption: $\zeta_N, \zeta_S \to \infty$
- Baseline: absent strategic interaction ($\rho = \infty$),

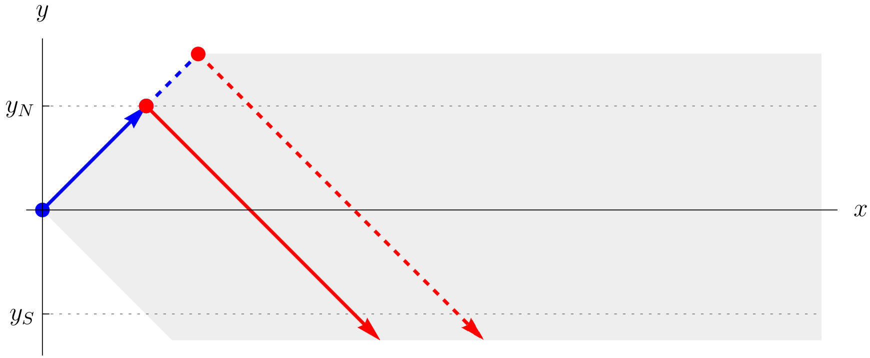


Strategic Extremism

Zealots "overshoot" ideal.



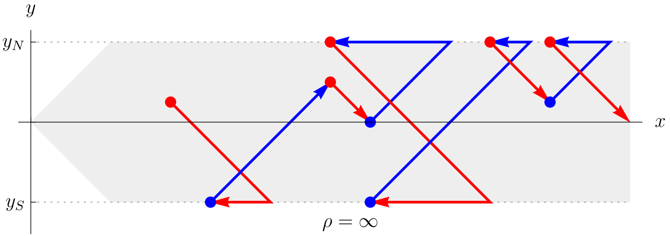
Shifting the Goalposts



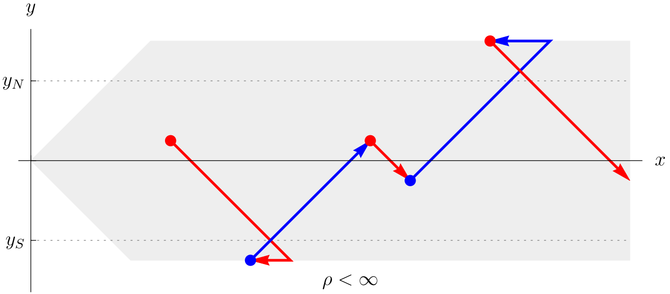
strategy	short run	medium run	longer run
overshoot	away from ideal	**closer to ideal**	higher complexity
stagnate	**at ideal**	further from ideal	**lower complexity**

Strategic extremism → more kludge

With zealous players, 'endogenous extremism'



$\rho = \infty$



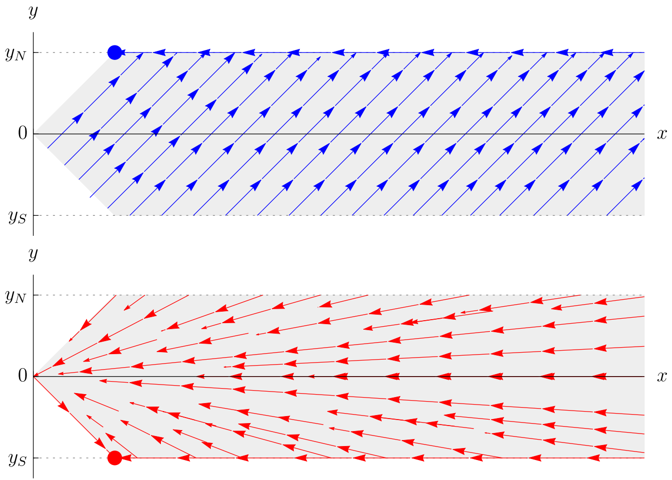
$\rho < \infty$

Zealot vs. Moderate

- Simplifying assumption: $\zeta_N \to \infty$ and $\zeta_S \to 1$

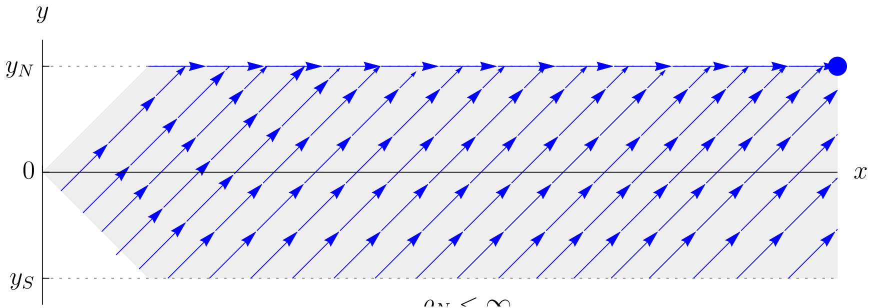
$*$ Also, $1/\lambda_N \gg 0$

- Baseline: absent strategic interaction ($\rho = \infty$),

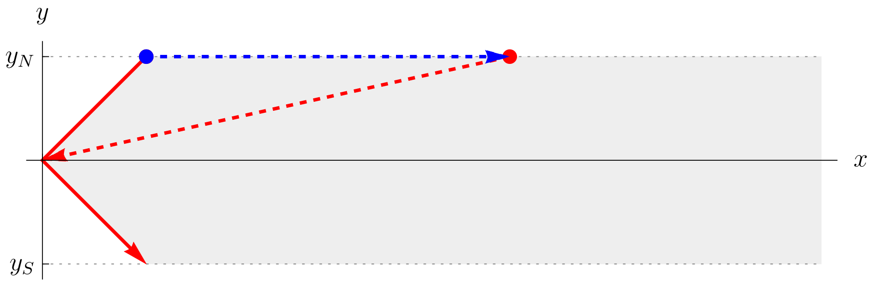


Intentional Complexity

Zealots add "useless" complexity vs. moderates



Building a Moat



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stagnate	**lower complexity**	further from ideal	-

Obstructionism

How to protect policy? Depends on opponent:

- *Strategic extremism* vs. zealots
- *Intentional complexity* vs. moderates
- Intentional complexity is transient, strategic extremism is persistent

Long-run effects differ:

- Strategic extremism is *persistent*
- Intentional complexity is *transient*

Conclusion

- Model of policymaking w/ two key features: complexity and interdependence.
- Highlights role of political conflict in persistent policy inefficiencies
- Implications for optimal institutional design
- OE applications: bureaucracies, routines