Evolution of the intention to vote in random networks

(work in progress, working title)

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Turnout in elections: Who vote? Why do people vote?

Empirically...

- **Individual characteristics:**

- Education & isolation (Matsusaka 1995); income (Lijphart 1997), age (Johnson 2002, Gimpel, Morris & Armstrong 2004).
- Habits (Green & Shachar, 2000, Plutzer, 2002, Gerber, Green & Shachar 2003).

- **External characteristics:**

- Higher turnout under proportional electoral system (Geys 2006).
- Closeness (Geys 2006, Shachar & Nalebuff 1999).

Turnout in elections: Who vote? Why do people vote?

- **Influence of the neighborhood:**
  - Habits of neighbors (Kenny 1992, McClurg 2004).
  - Interpersonal discussion (Huckerfeld & Sprague1995).
  - Moderately informed voters tend to imitate (Johnston 2002).
  - Contagion among spouses (Nickerson 2008), also casual interactions influence (Huckfeldt, Beck, Dalton & Levine 1995).
  - Political disagreement tends to dampen turnout (Mutz 2002, Gimpel, Dyck & Shaw 2004), Nir (2005) distinguishes between isolation and balance of exposure to two conflicting points of views.

Turnout in elections: Who vote? Why do people vote?

Theoretically...

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  - Downs (1957) **rational choice** model: Why do so people vote given that the marginal cost of voting $>$ marginal benefit?
  - Explanations... sense of duty (Riker & Ordeshook 1968), minimizing regret (Ferejohn & Fiona 1974); game models (Palfrey & Rosenthal 1983, 1985, Ledyard 1984); group-based models of mobilization (Uhlaner 1989, Shachar & Nalebuff 1999).
  - More recently: **network theory explains turnout by contagion (or imitation)** (Amaro de Matos & Barros 2004; Fowler 2005, Fowler & Smirnov 2005).
  - In Physics: **Sznajd model** (Sznajd-Weron & Sznajd 2000; Sousa 2004; González, Sousa & Herrmann 2003; Bernardes, Stauffer & Kertész 2001) and **Majority-Vote model** (Pereira & Brady Moreira 2008; Lima, Fulco & Costa Filho 2006).

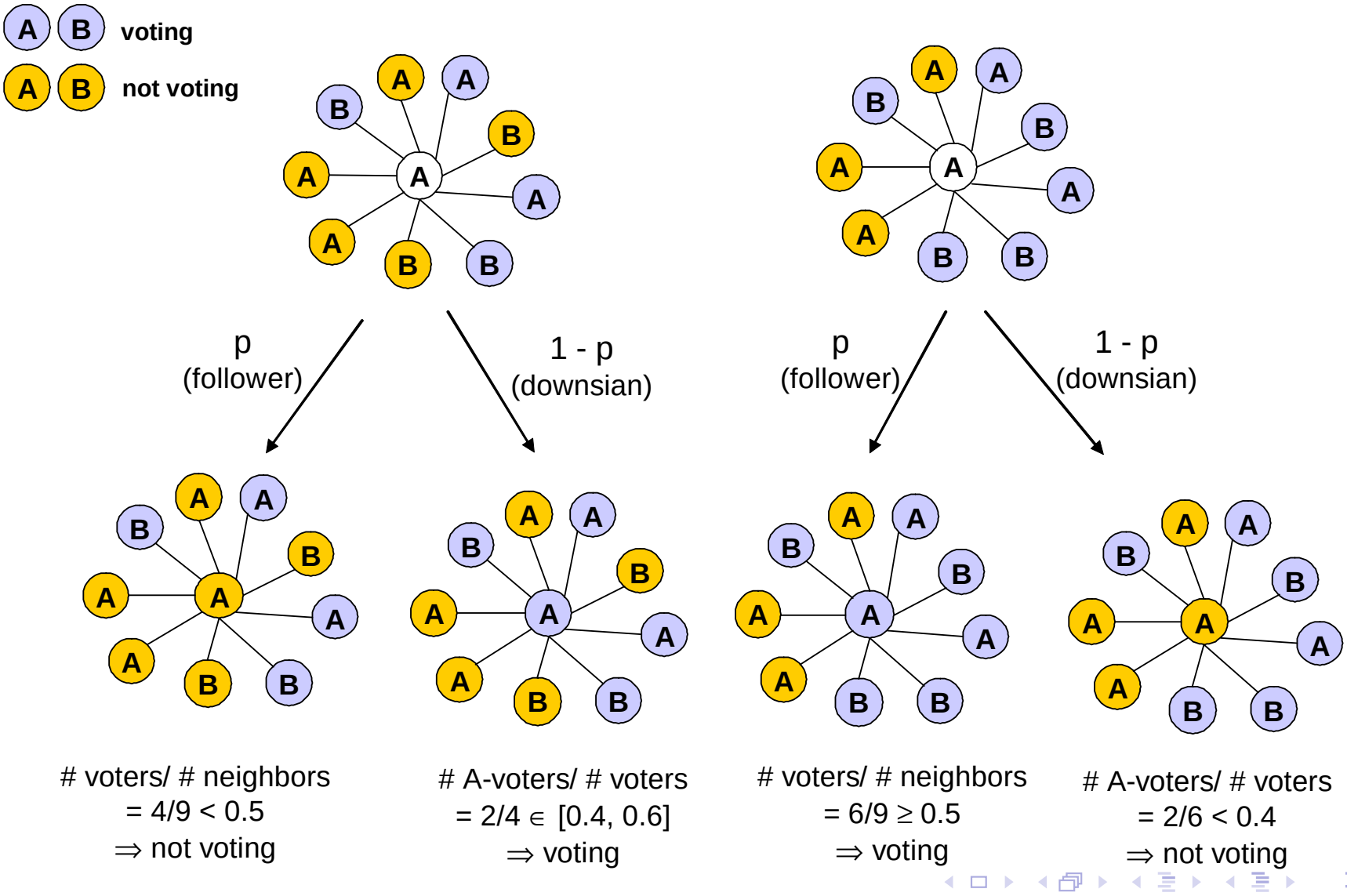
Our model: introducing (local) adaptive calculus of voting into a network majority-vote model...

- N agents, connected by a random social network
- Networks à la Erdös-Renyi –> characterized by $\langle k \rangle = 5, 6, ..., 25$ (*interpretation*)
- Each agent characterized by **fixed** political preference (parties A or B - 50/50)
- During the process of campaigning before any election, agents ("evolutionary") decide whether to vote or not based on "LOCAL" information available
  - **dynamic model of evolution of intention to vote**
  - **adaptive players**
  - **"long run" results $\approx$ turnout**

Our model: how do people form their intention to vote?

- At each t, 1 agent is chosen (rdn-unif.) to "update" her action.
- Agents only know their neighbors' preferences and decision in $t-1$.
- **Mixed behavior** $(1-\varepsilon)$:
  - **p**: **Follower** (Majority-Vote model) - vote if $\frac{\#\text{ neighbors who vote}}{\#\text{ neighbors}} \geq 0.5$
  - **1 − p**: **Downsian** (local adaptive calculus of being decisive) - vote if $\frac{\#\text{ neighbors who vote for } \mathbf{A}}{\#\text{ neighbors who vote}} \in [0.5-\beta, 0.5+\beta]$, $\beta = 0.1$
- (denominator $= 0 \longrightarrow$ inertia)
- ε: small, random choice

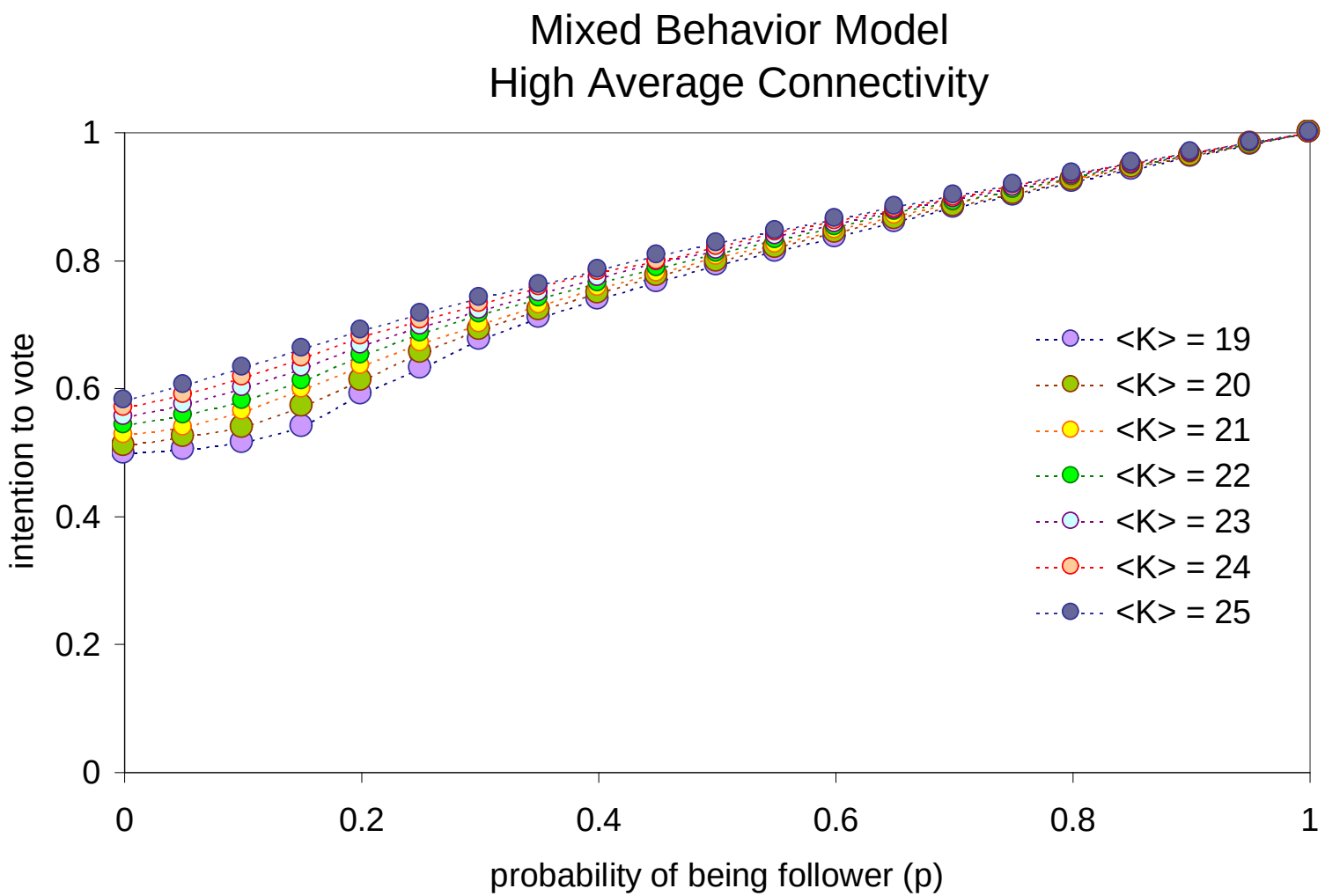
Example


A B voting
A B not voting
p
(follower)
1 - p
(downsian)
p
(follower)
1 - p
(downsian)
voters/ # neighbors
= 4/9 < 0.5
⇒ not voting
A-voters/ # voters
= 2/4 ∈ [0.4, 0.6]
⇒ voting
voters/ # neighbors
= 6/9 ≥ 0.5
⇒ voting
A-voters/ # voters
= 2/6 < 0.4
⇒ not voting

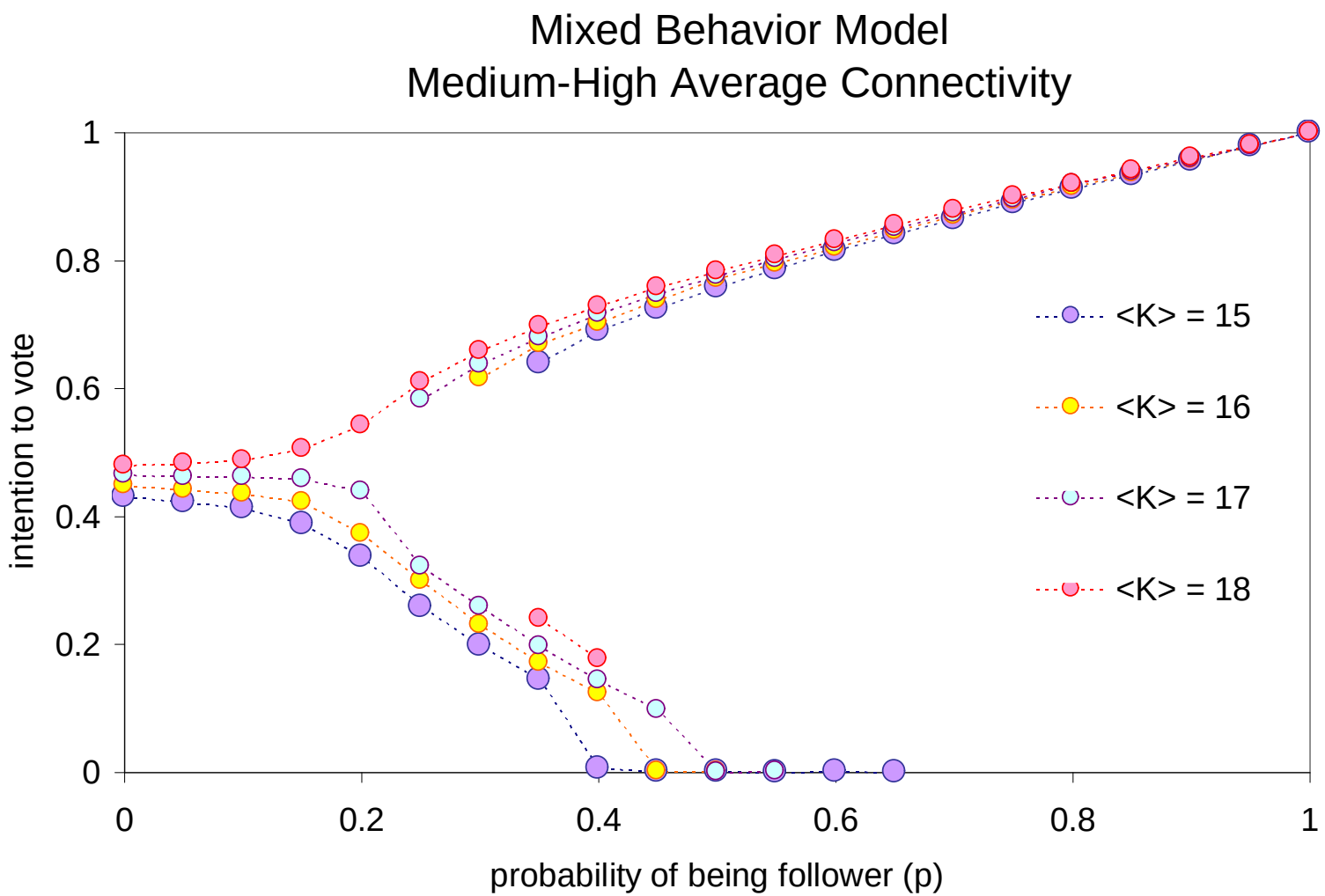
Turnout ("long run" results, simulations)

- Parameters, $p \in [0, 1]$ and $\langle k \rangle \in [5, 25] \cap \mathbb{N}$
- $N = 5 \times 10^3$, T max $= 5 \times 10^5$, ≥ 40 realizations, $\varepsilon = 0.001$
- Initial fraction of "voters" 0.5
- "Long run" results $\approx$ turnout
- According to $\langle k \rangle$, 4 groups: high, medium-high, medium-low, low average connectivity

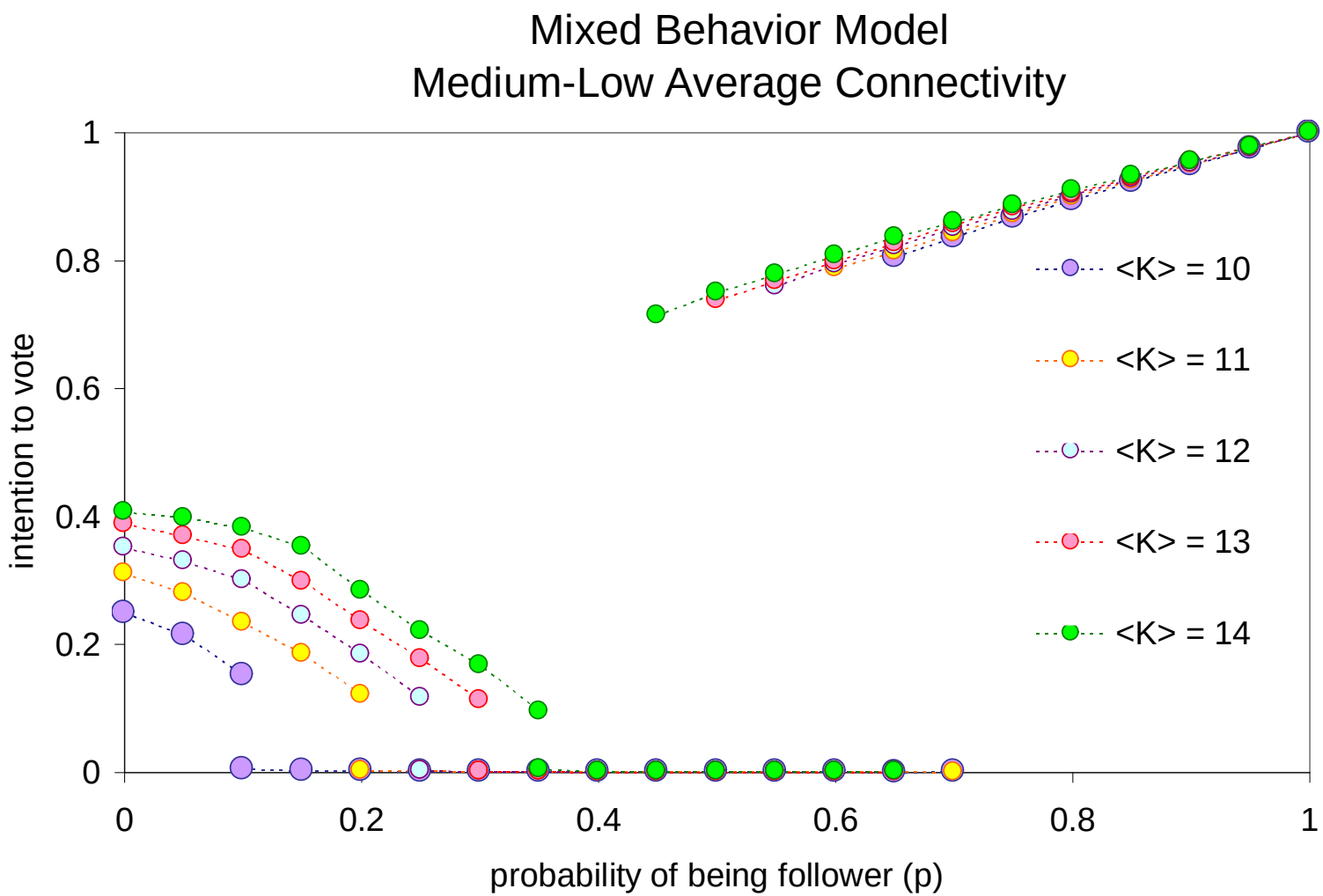
Positive and increasing turnout



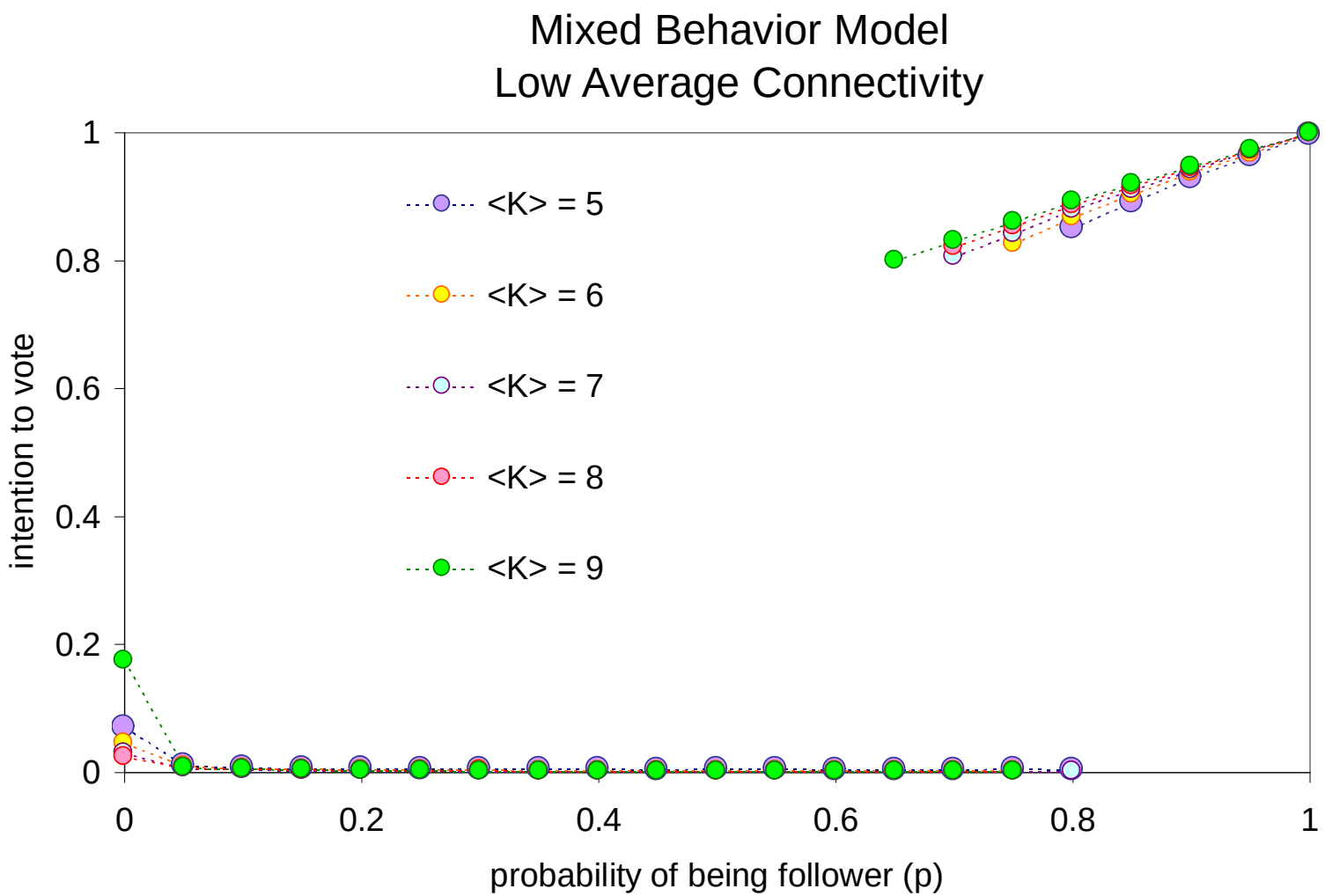
Two equilibria with positive turnout for p ~(0.25,0.35)



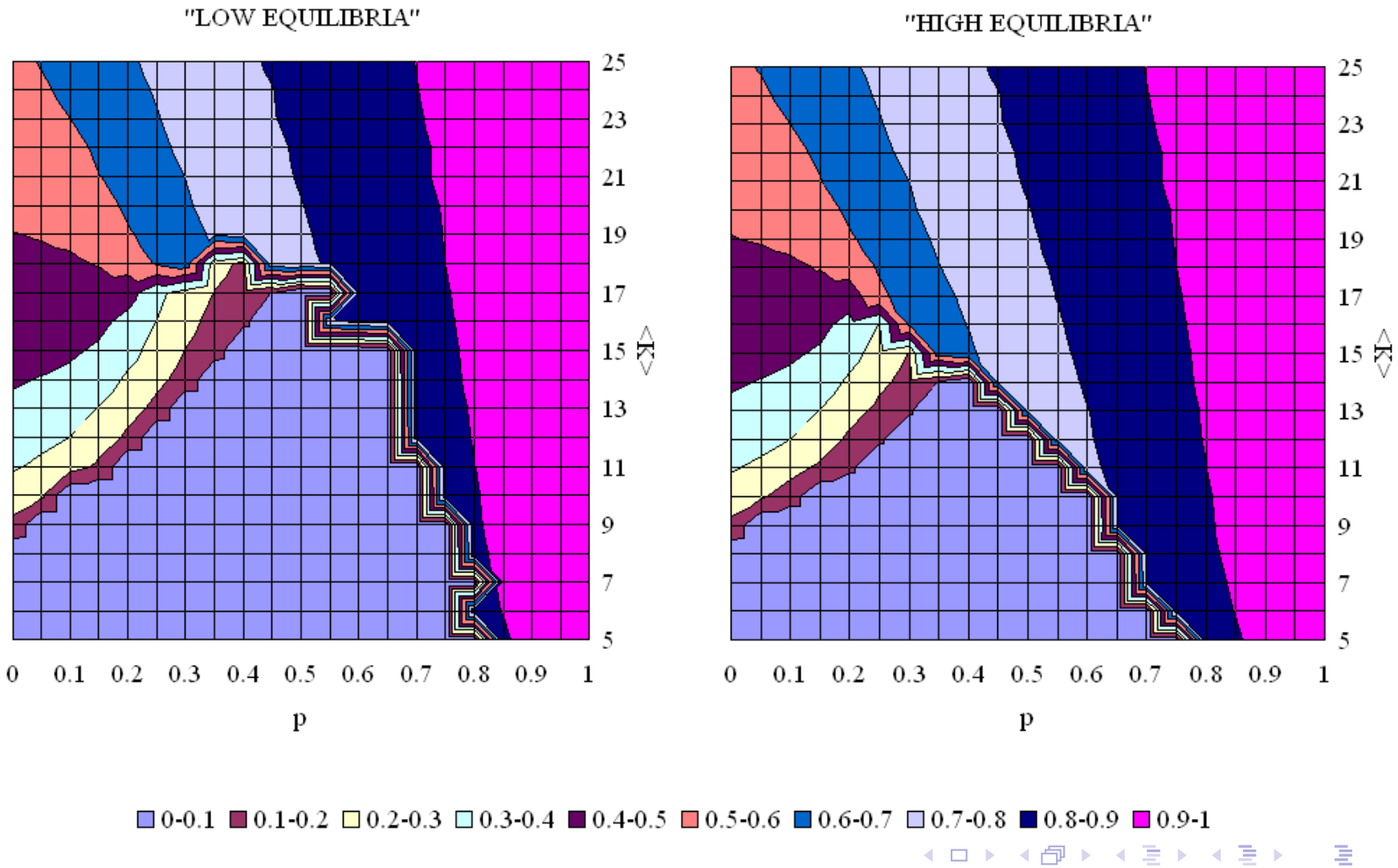
Two equilibria, zero/very high turnout for p ~(0.5,0.7)



Zero turnout until p is very large, then high turnout

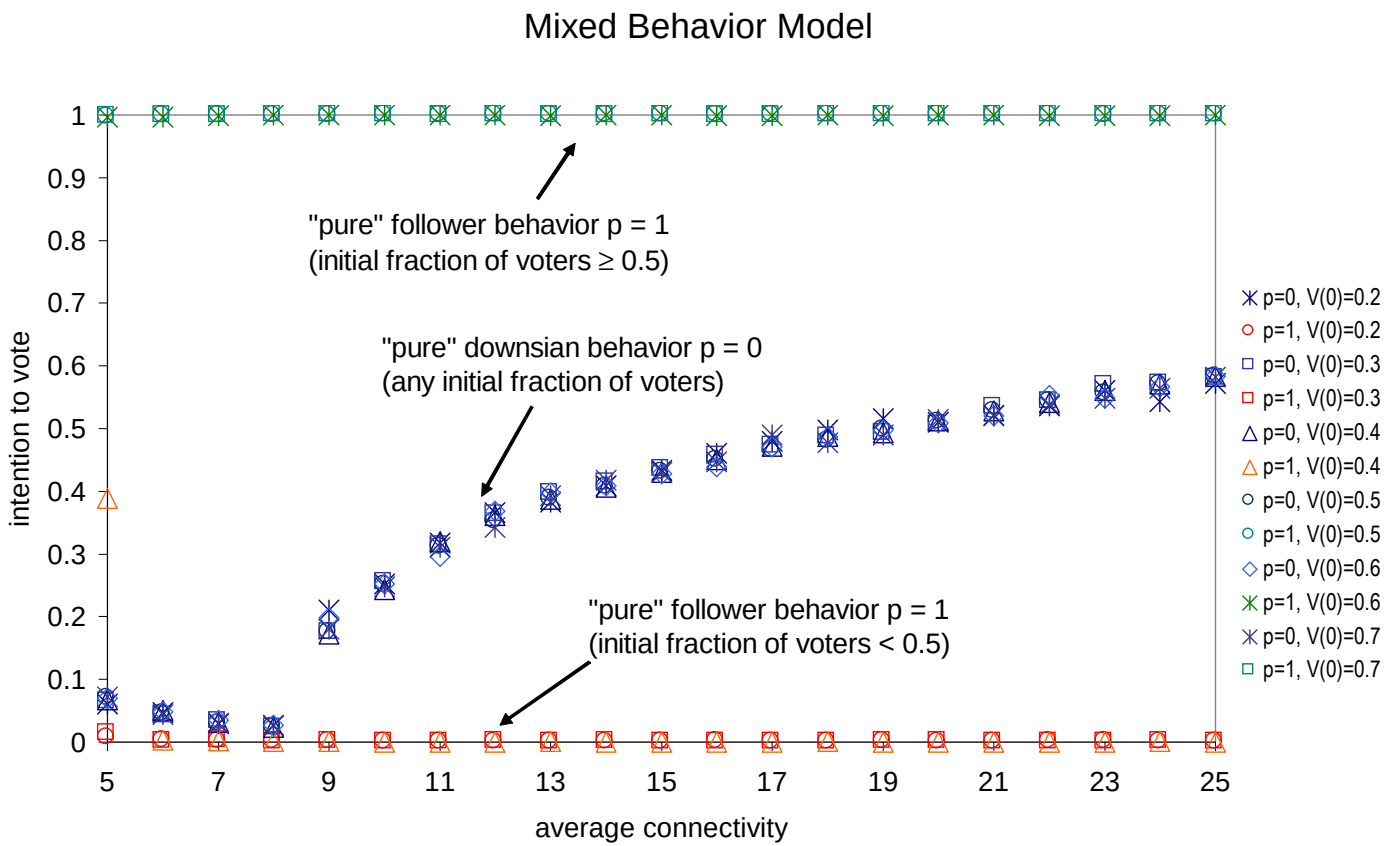


The complete picture: Interplay between p and <K>



Some intuitions

- "Pure" follower's ($p = 1$) "long run" outcome depends on initial conditions, not on $\langle k \rangle$. "Pure" downsian's ($p = 0$) "long run" outcome depends only on $\langle k \rangle$.



Some intuitions

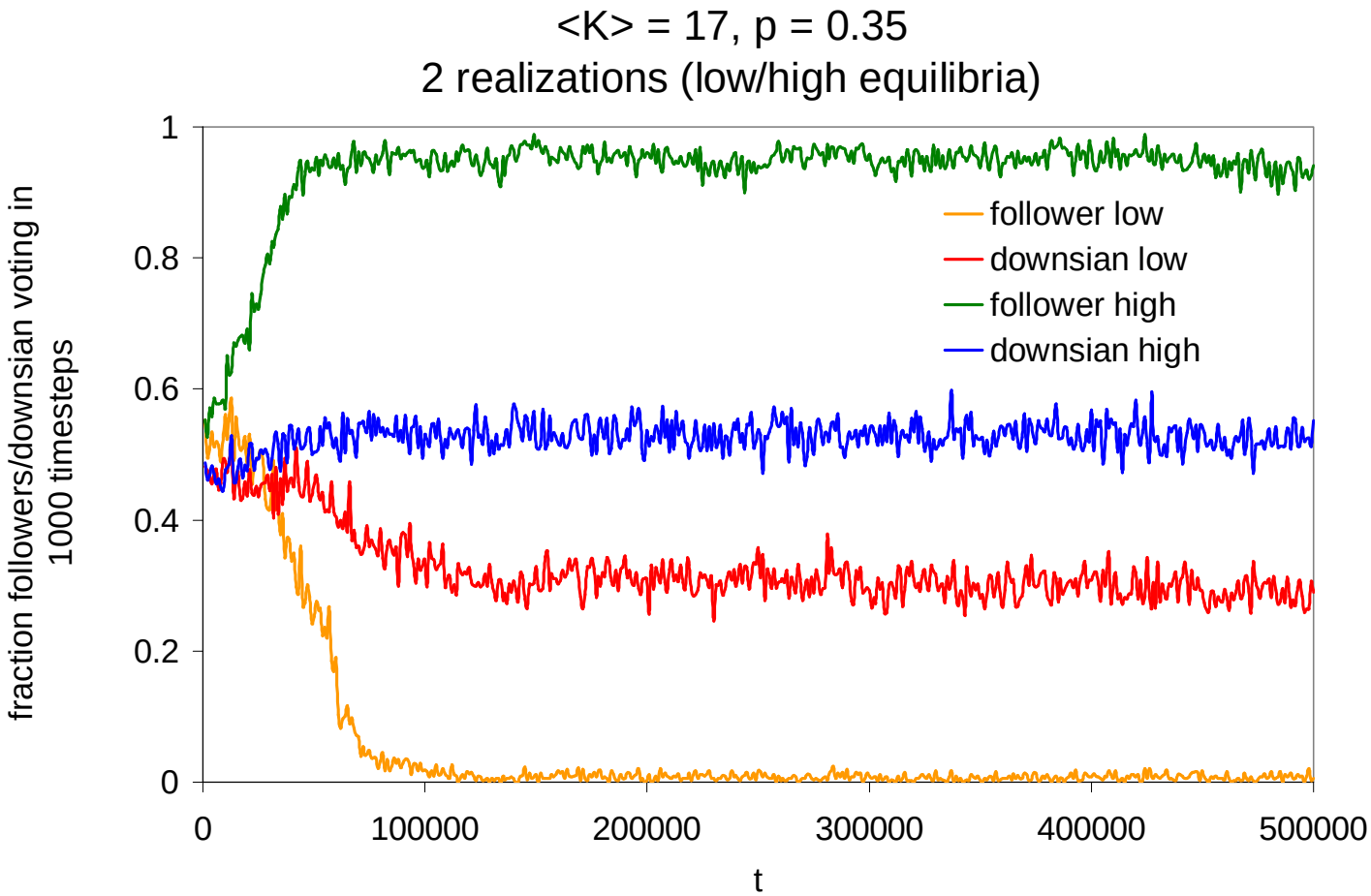
- More generally: followers respond to initial and/or prevailing conditions and reinforce the tendency, while downsians are more likely to vote when $\langle k \rangle$ is large (yet: even-odd effects).
- **Vicious cycle:** downsians reduce overall voting below 50%, followers do not vote, downsians face smaller subsets of voters, thus vote less, followers do not vote, etc.
- **Virtuous cycle:** downsians vote above 50%, followers vote, downsians have many neighbors voting, thus probably find circa 50/50 of preferences and vote, followers vote, etc.

Some intuitions

- Low $\langle k \rangle$:
  - p small: downsians start *vicious* cycle
  - p very large: followers + initial condition dominate, if initial voting ≥ 0.5, high turnout.
- Medium-low $\langle k \rangle$:
  - p small: downsians maintain turnout above 20% but below 50%, thus as long as p increases $\rightarrow$ *vicious* cycle
  - higher p: two equilibria are possible, with initial condition ≥ 0.5, zero or high turnout: this depends on the "conditions" that followers face, they may start either cycle.
  - very high p, followers + initial condition $\geq 0.5 \rightarrow$ high turnout.
- High $\langle k \rangle$:
  - downsians face favorable conditions to vote, this together with initial condition ≥ 0.5, imply that followers simply reinforce voting behavior.

Some intuitions

- Medium-high $\langle k \rangle$: two equilibria with positive turnout



Next steps...

- Global effects (national polls)
- Networks with more structure (clustering?)
- Coevolution **of intention to vote and preferences** (probably incorporating a fraction of undecided people)
- Homophily (no sense in the actual setup...)
- More rational downsian players?
- ...

Thank you!!