

Cooperation and Conflict in Wikipedia

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Introduction

- In this talk: model of opinion formation and participation structure in open authoring systems (e.g. wikis, opensource projects)
- The method is agent-based simulations
- The model is not 100% stable, new ideas thrown in, old features dropped

Outline of the talk

- Motivation of this research
- Modeling open authoring environments
- Studying the model with agent-based simulations
- Discussion and future directions

Motivation

- **Opinion dynamics**
 - Negotiation
 - Fact Finding
 - Prediction
- **Open authoring process is a mix of some or all of the three**
- **In online communities, contribution is usually on a voluntary basis**

Research questions

- Is there any interplay between opinion formation and the level of participation of users in the authoring process?
- Is it possible to model the users' level of participation by taking into account simple motivational factors?
- Interactions between users are indirect (mediated by objects being authored). How does this influence the collective dynamics?

Model ingredients

- A group of N agents working on P artifacts
- The state space is a continuous opinion space, e.g. $S = [0,1]$ in the simulations

$x_i(t)$ i -th agent, $y_j(t)$ j -th artifact

- Agents modify “features” of the artifact
- Some artifacts are more controversial than others

- Each artifact has its own intrinsic degree of controversiality/tolerance ε_j
- Hence a bounded confidence rule (à la Deffuant) models the act of editing

if $\|x_i(t) - y_j(t)\|_2 \leq \varepsilon_j$

$$x_i(t) \leftarrow x_i(t) + \mu(y_j(t) - x_i(t))$$

$$y_j(t) \leftarrow y_j(t) + \mu(x_i(t) - y_j(t))$$

if $\exists t^* = \max\{t' < t : \|x_i(t) - y_j(t')\|_2 \leq \varepsilon_j\}$

$$y_j(t) \leftarrow y_j(t^*)$$

else:

$$y_j(t) \leftarrow x_i(t)$$

- **Activity selection model**

$$\Pr\{\text{user } i \text{ edits artifact } j\} = p_i(t), \quad i = 1, \dots, P$$

$$\Pr\{\text{user } i \text{ does nothing}\} = p_0(t)$$

- **Introduces memory of past actions of agents**
- **Probability $p_j(t)$ to select artif. j is proportional to the number of successes**

gratification rule:

“success” if: $\|x_i(t) - y_j(t)\| \leq \varepsilon_j$

“failure” otherwise

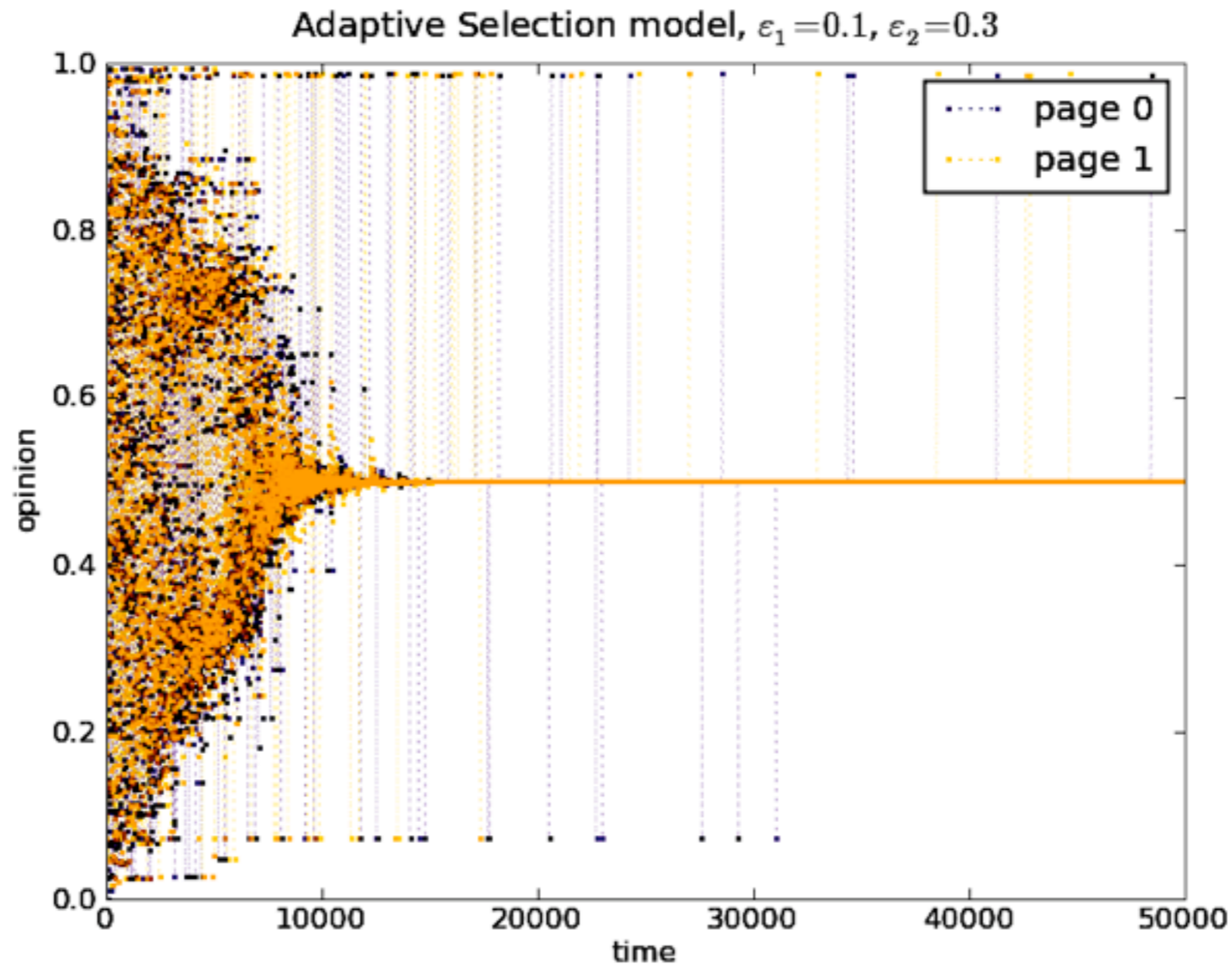
Features

- Indirect interactions between agents
- Artifacts act as centers of attraction for agents by means of repeated averaging
- But to foster local consensus of agents into clusters, the artifact must stay within the bound of confidence of the cluster
- Hence clusters compete for artifacts

Simulations with adaptive selection

- Agents interact and update their memory of actions
- Initial conditions
 - opinion profile uniformly distributed in $[0,1]$
 - all artifacts equally probable of being selected, probability of no action is 0
- Limit selection distribution depends on the opinion dynamics:
 - consensus, polarization, fragmentation and slow convergence

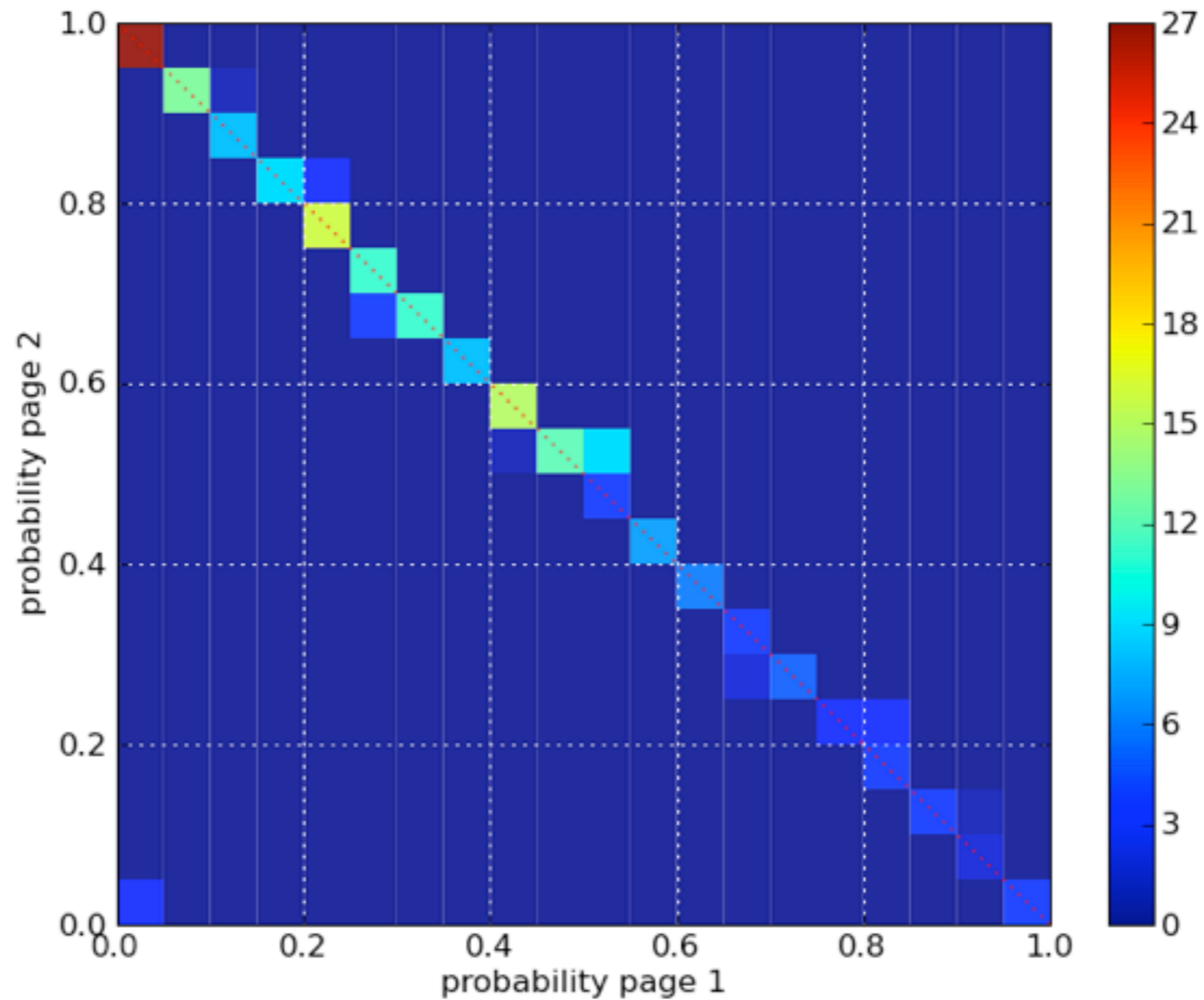
Global consensus



$N = 200$ agents, $\varepsilon_{1,2} = 0.1, 0.3$

$T = 5 * 10^4$, memory = 50 edits

Global consensus



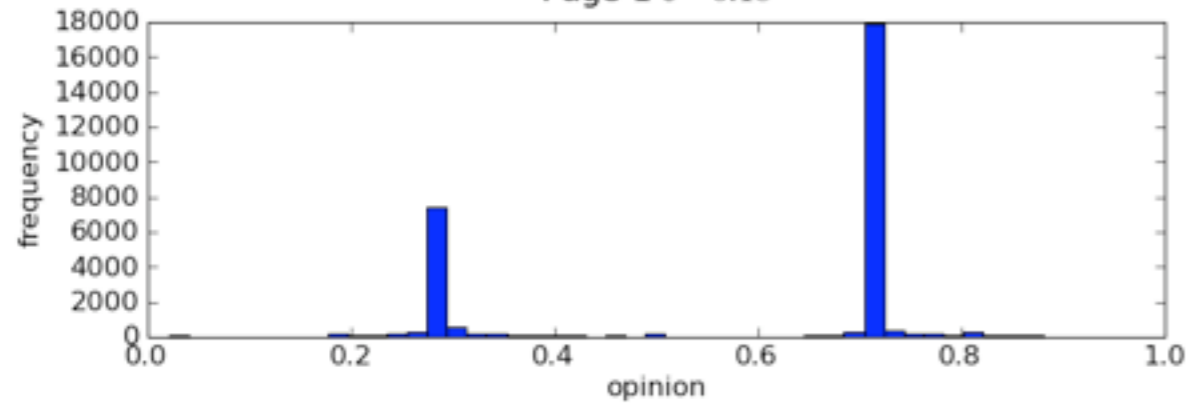
$N = 200$ agents, $\varepsilon_{1,2} = 0.1, 0.3$

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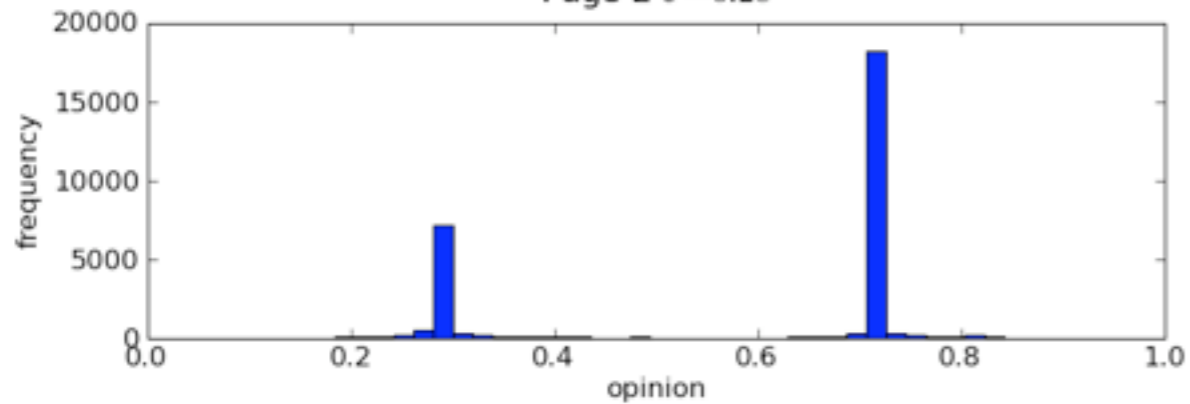
Polarization

artif. histogram

Page 1 $\epsilon = 0.18$



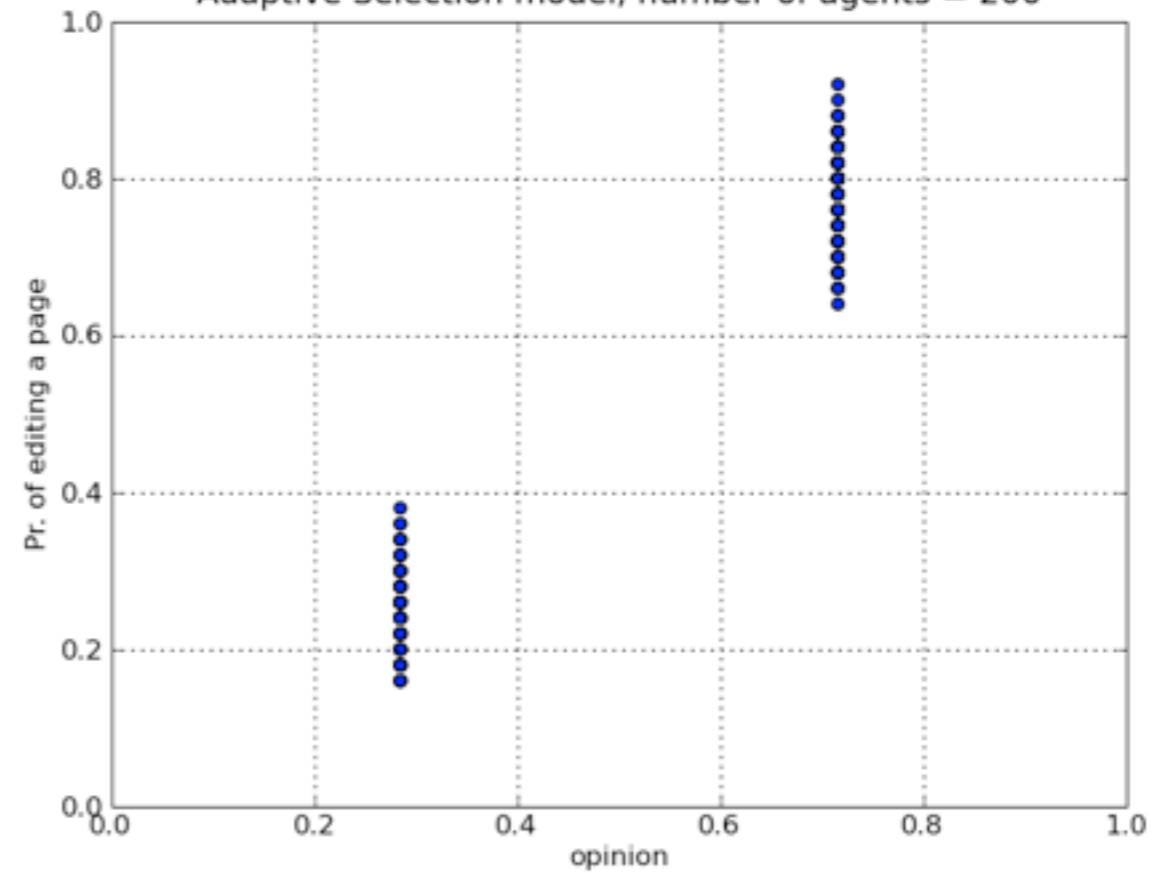
Page 2 $\epsilon = 0.28$



Artifact state

opinion vs probability of edit scatter

Adaptive Selection model, number of agents = 200

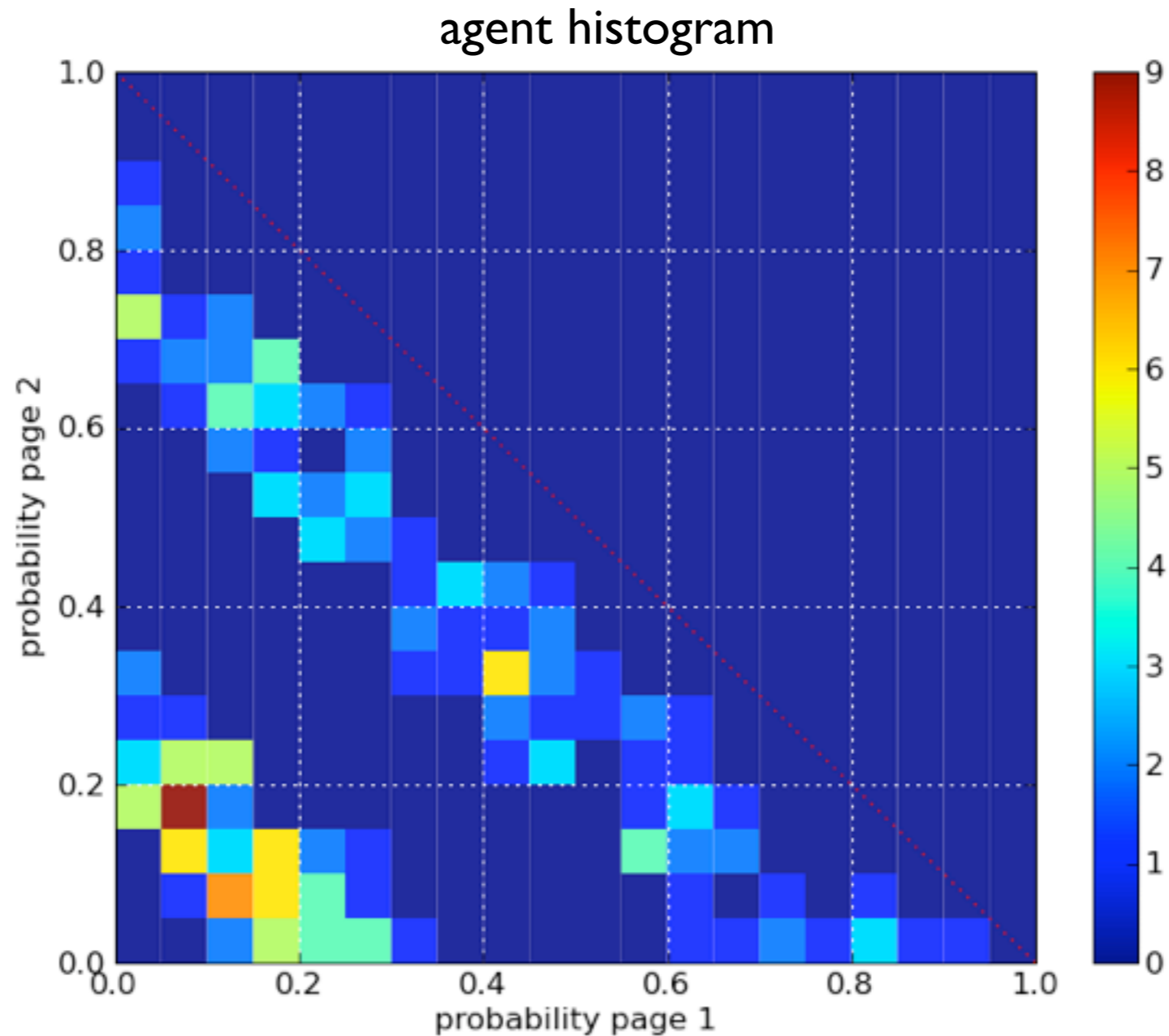


Agent state

$N = 200$ agents, $\epsilon_{1,2} = 0.18, 0.28$

$T = 5 * 10^4$, memory = 50 edits

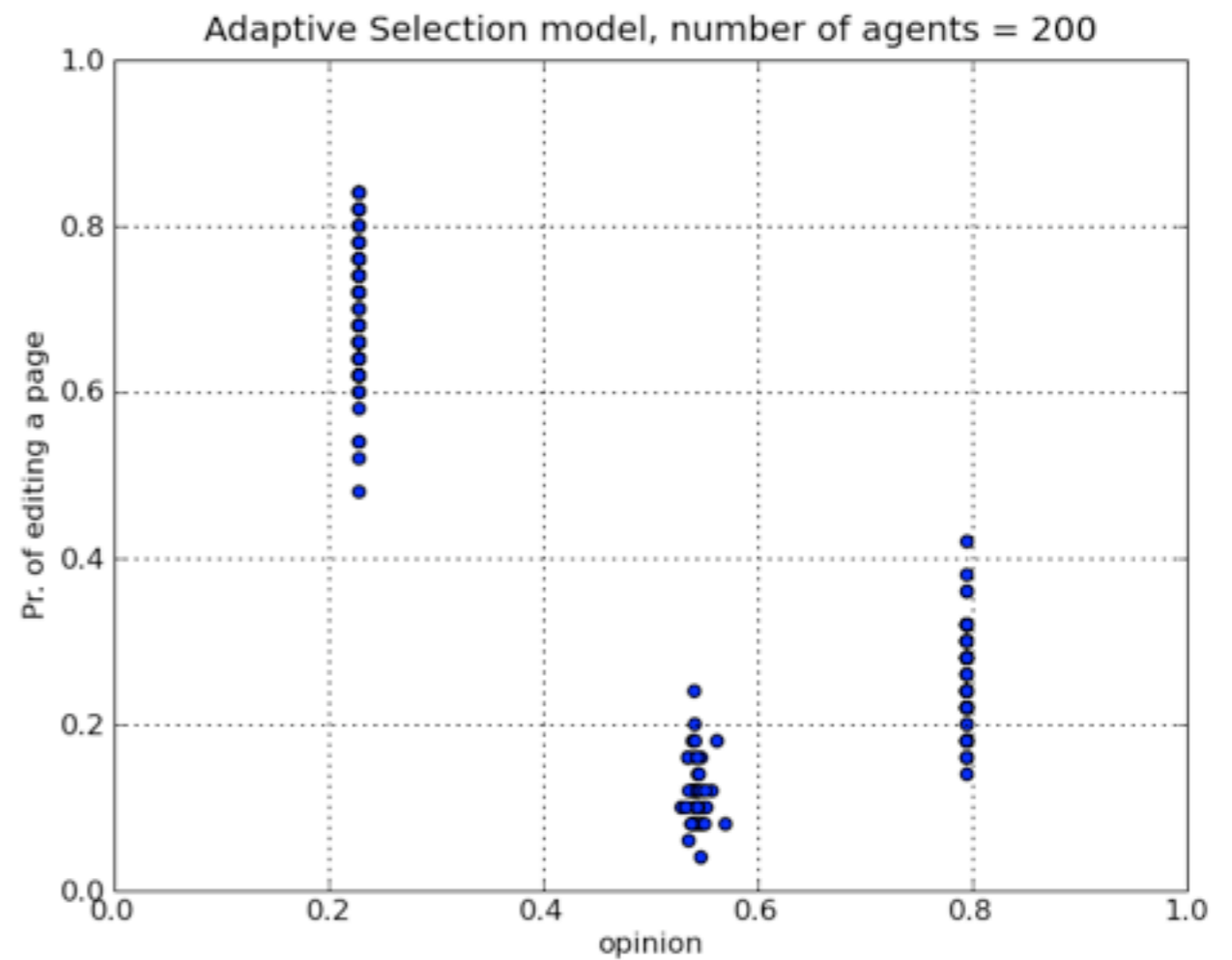
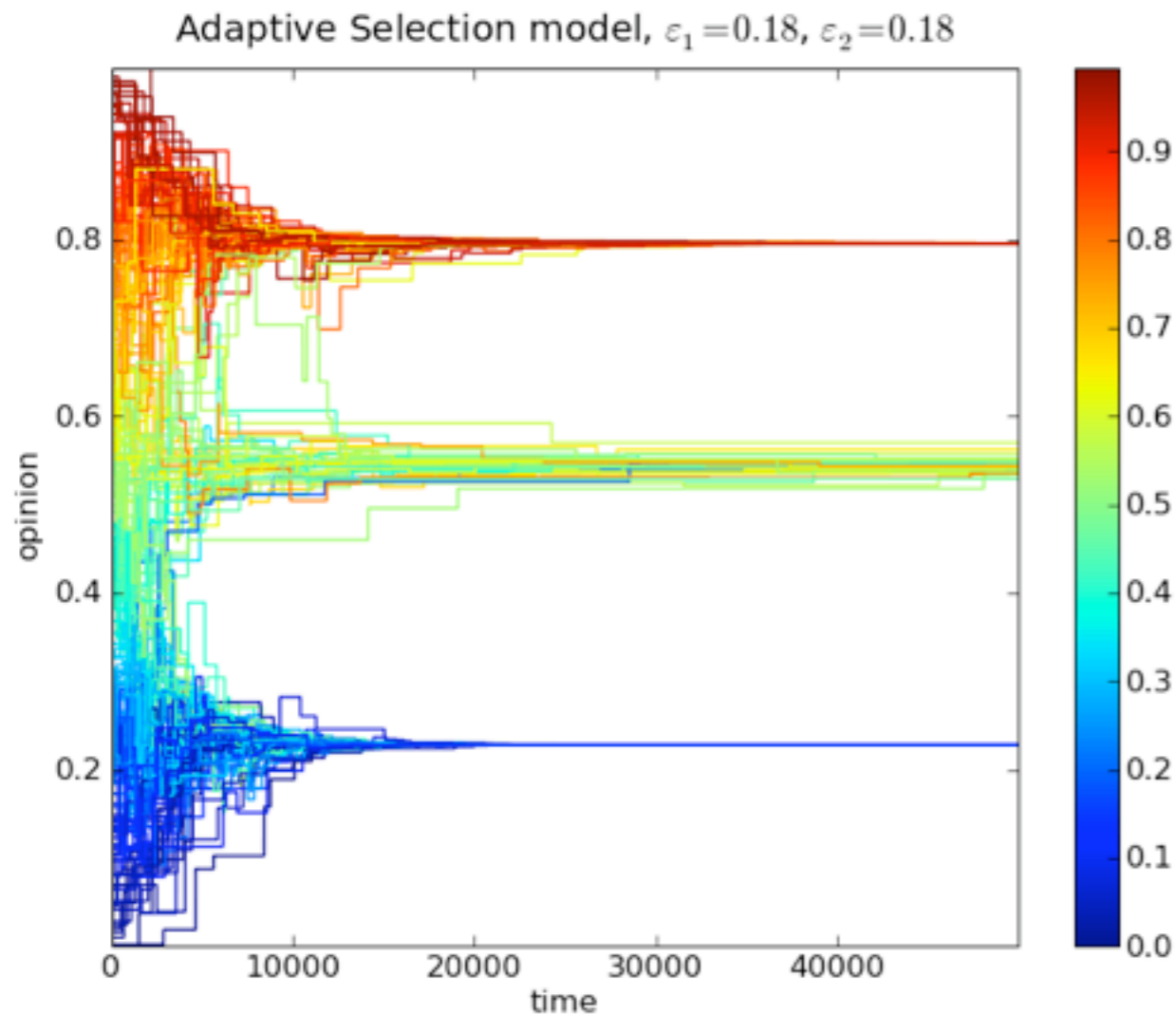
Polarization



$N = 200$ agents, $\varepsilon_{1,2} = 0.18, 0.28$

$T = 5 * 10^4$, memory = 50 edits

Fragmentation and slow convergence



$N = 200$ agents, $\varepsilon_{1,2} = 0.18$
 $T = 5 * 10^4$, memory = 50 edits

Summary of qualitative effects

- **Expulsion of outliers / small clusters
(Consensus, Polarization, Fragmentation)**
- **Heterogeneous levels of activity between
clusters (Polarization, Fragmentation)**
- **Slow convergence within clusters
(Polarization, Fragmentation)**

Extensions of the model

- The state of an artifact is not determined only from the most recent interaction
 - A memory of past states
- Small edits affects less a large document compared to a small one (increasing inertia)
- Consider effects due to social selection between agents

Discussion

- Simple extensions of bounded confidence models yield interesting phenomena on collective behavior
- Idealized model of gratification may explain different levels of participation to a community
 - assumption is an open authoring policy
 - but psychological studies of uses and gratifications in media audience are fairly more detailed!

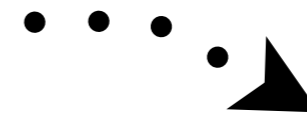
Challenges



the weight of an Ox

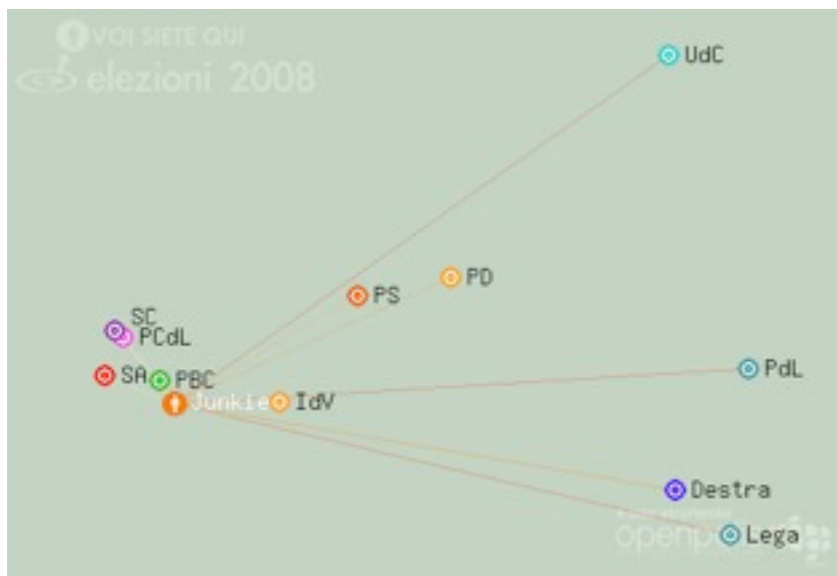


continuous
opinion



Impartiality between POVs

wording issues



your position in the political spectrum

