SEMANTIC SHIFT IN SOCIAL NETWORKS

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*the meaning of a word does not hold for a word **simpliciter**, but for a word **in a particular community***

(Clark, 1996)

Question: How do the socio-structural characteristics of communities affect how much lexical semantic change they expeience?

DATA

- 45 randomly selected communities from Reddit

- For each community: comments from 2015 and 2017 (avg. 158k per community)

- Two larger "generic" Reddit corpora from the same time periods (54M comments each)

- Normalized, Lemmatized, lower-cased, and tokenized

MEASURING CHANGE

red dots are words with high rectified semantic change (0.995 confidence interval)

To model semantic change, we use a **diachronic skip-gram model** (Kim et al., 2014; Del Tredici, et al., 2019).

We trained a base model from the generic 2015 corpus and then, for each community, sequentially fine-tuned it with first the 2015 and then the 2017 community-specific corpus.

Then, we measure the **naive cosine change** for each word in the vocabulary by taking the angular distance between the vectors from the 2015 and 2017 community-specific models.
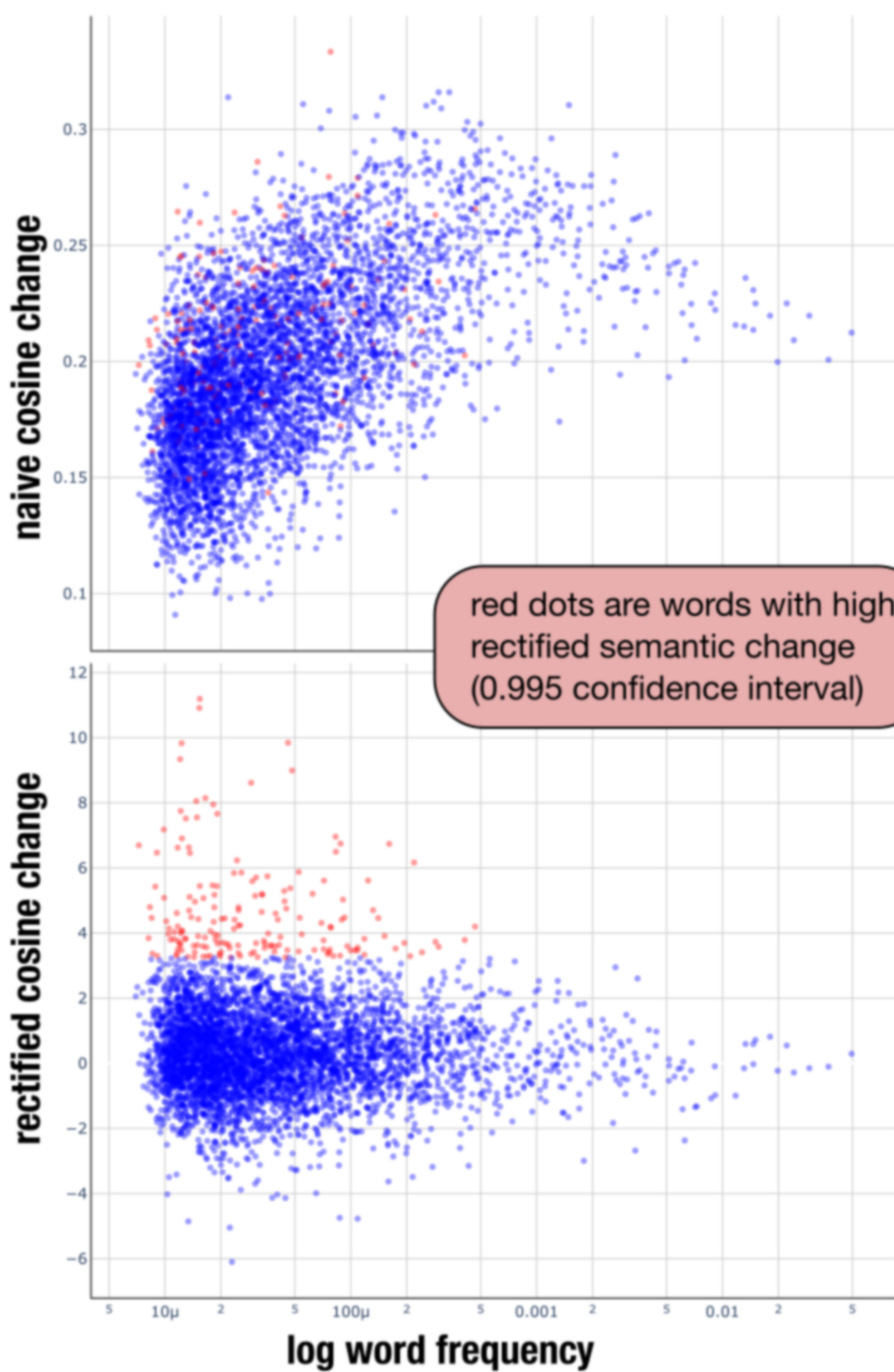
For a word w in community c:

$$\Delta_c^{\cos}(w) = \frac{\cos^{-1}(\cos \text{sim}(\vec{w}_{c,2015}, \vec{w}_{c,2017}))}{\pi}$$

where

$$\cos \text{sim}(v_1, v_2) = \frac{v_1 \cdot v_2}{\|v_1\|\|v_2\|}$$

Problem: Navie cosine change is biased towards words that appear in more variable context distributions, regardless of how much the context changes across time (Dubossarsky & Weinshall, 2017).

$$\Delta_c^*(w) = \frac{\Delta_c^{\cos}(w) - \bar{x}_{c,w}}{s_{c,w}\sqrt{1 + 1/n}}$$

**Solution:** We train multiple skip-gram models on *pseudo-diachronic* corpora. **Rectified cosine change** is the number of standard deviations naive cosine change is from the mean of the "cosine change" for the word in the pseudo-diachronic models.

COMMUNITY FEATURES

- Mean posts by active users
- Size (number of active users, 2015)
- Stability (active users Jaccard index)
- Clustering coefficient

Clustering coefficient measures the cohesiveness of the community's social network.

Network nodes are individual users and the edges between users are defined by how many interactions the users have with each other in the comments.
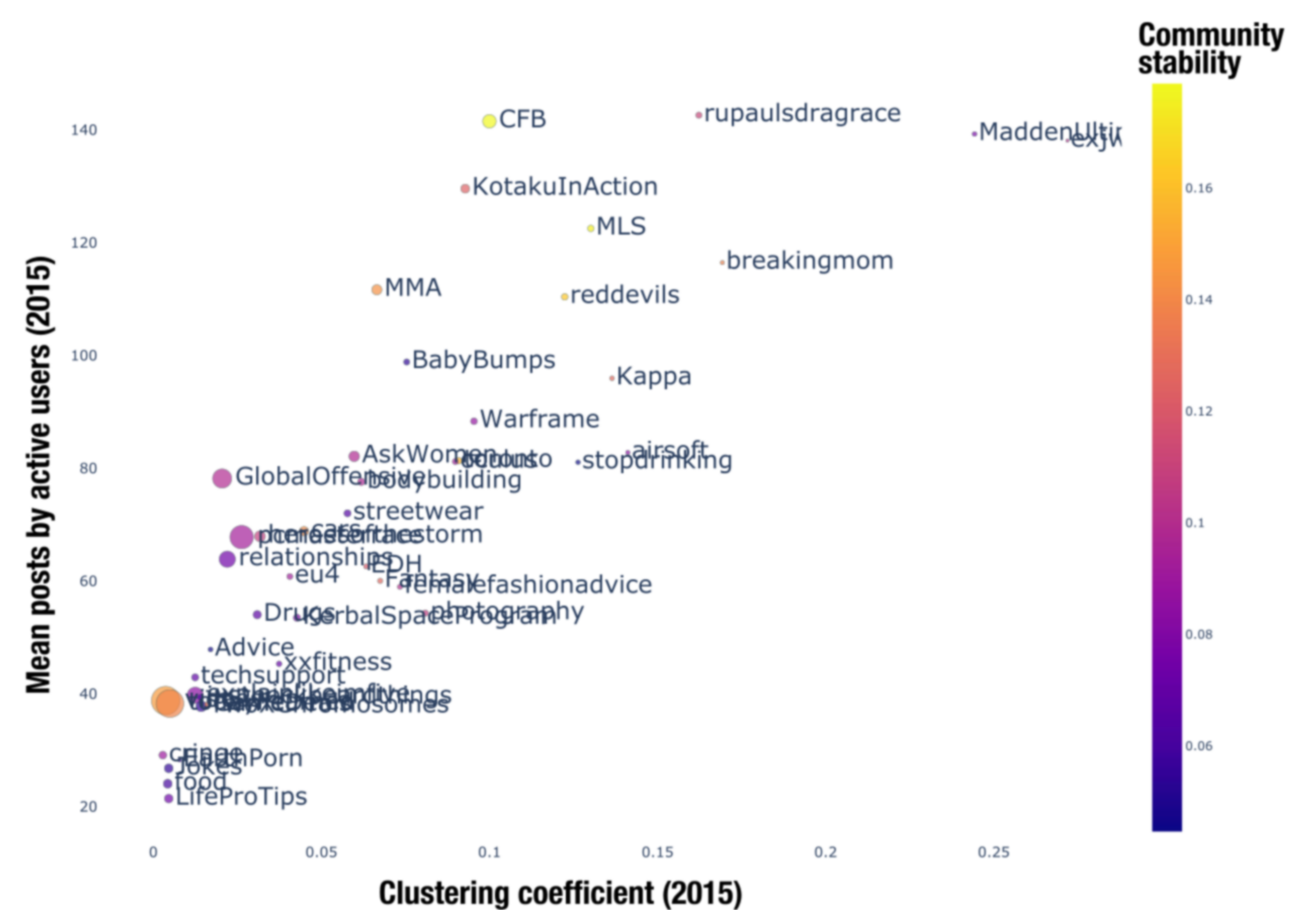

RESULTS

We did not find a significant effect of any of the community-level features on their own, but we did find a significant three-way interaction between **clustering**, **stability**, and **size**.

For sparse communities (with low clustering coefficients) stability is positively correlated with rectified change (regardless of community size).

When there is more clustering, larger communities no longer exhibit the positive relationship betweeen stability and semantic change.
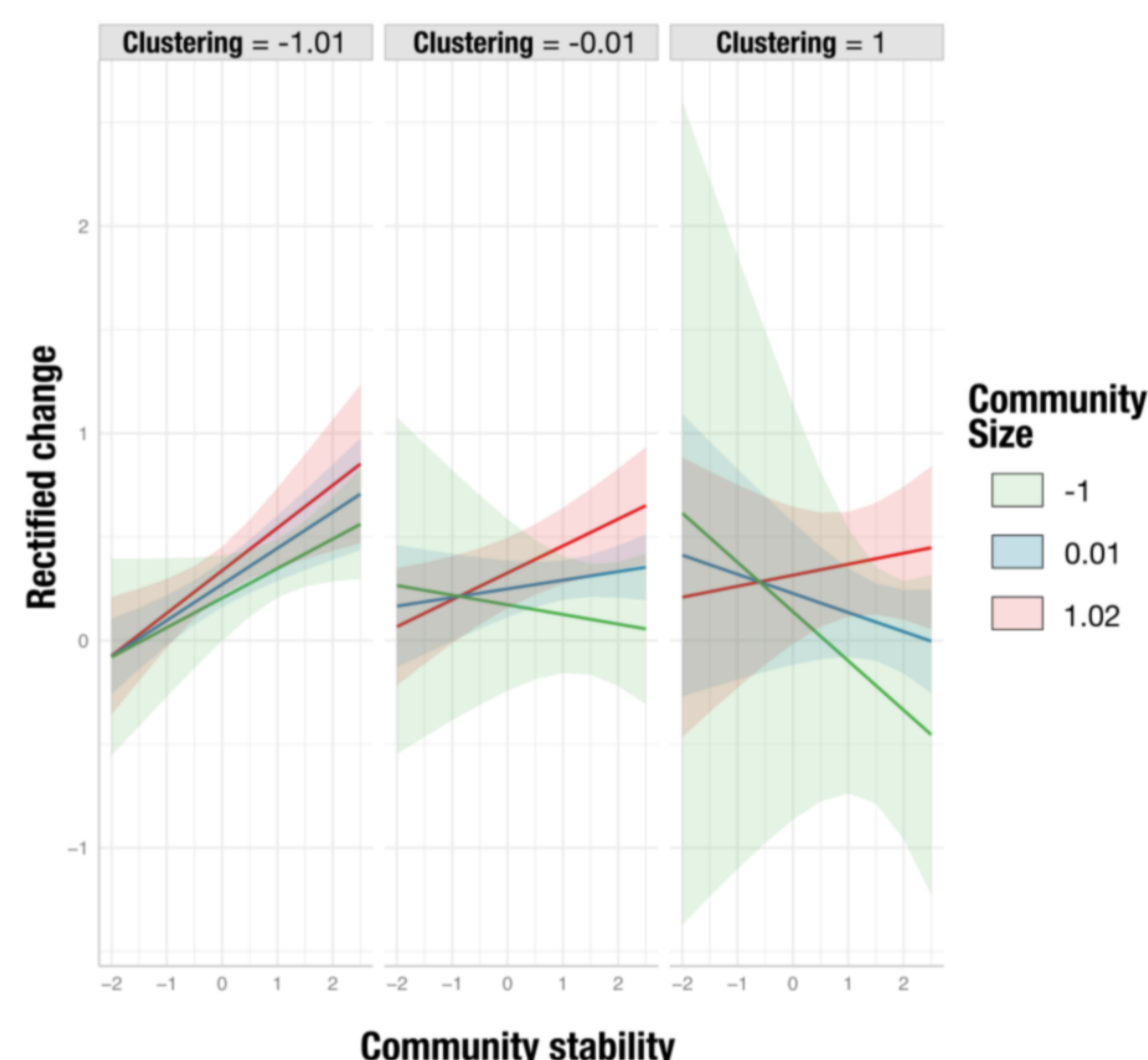
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