

# Studying Overlapping Online Communities

**Nathan TeBlunthuis**<sup>1</sup> **Charles Kiene**<sup>2</sup>

February 11<sup>th</sup> 2022

<sup>1</sup>**Northwestern University**  
Department of Communication Studies  
*Postdoctoral Scholar*

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Department of Communication  
*PhD Candidate*



2022-02-11

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[Revision: 84bed05 (2021/10/09)]

I'm Nathan TeBlunthuis, I earned my PhD from UW Communication and I am a Postdoctoral scholar at Northwestern, joined by Charles Kiene, a 4th year PhD student in UW Communication, and we're really excited to be here at the first Community Conversations workshop to talk about our research that applies ideas of organizational ecology to the organization of online communities.

## Introduction: Why study overlapping online communities?

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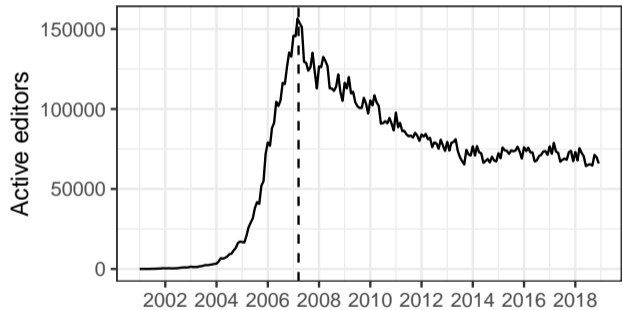
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This talk includes material from two different empirical papers, in the first we use a large-scale data analysis to study relationships within hundreds of clusters of overlapping online communities. The second is an interview study where we talked to members of these overlapping communities to find out why they exist and help explain the quantitative findings. We're going to gloss over technical and methodological details and focus on the motivation for these studies and the key substantive and theoretical takeaways.

# Why study overlapping communities? The rise and decline of Wikipedia

Internal explanation:

- Barriers to newcomers
- Hierarchy and “calcification”

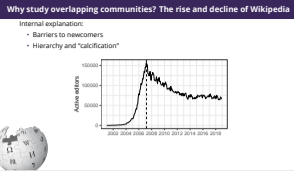


## Studying Overlapping Online Communities

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└ Introduction: Why study overlapping online communities?

└ Why study overlapping communities? The rise and decline of Wikipedia



Most attempts to explain the growth or decline of online communities look to internal factors like leaders, rules, and technology design.

But online communities are highly interdependent. Individuals often participate in many communities about similar topics or in different communities on different platforms.

I don't intend to suggest that internal factors aren't unimportant. My own research supports the idea that hostility to newcomers plays a role in wide-spread rise-and-decline patterns.

I'm just trying to illustrate the difference between internal and ecological explanation. [SLIDE]

And, as shown on this plot, The Facebook outage earlier this month had an outage which led to a very clear jump in Wikipedia traffic by about 7% beginning exactly at the time of the outage and ending shortly afterwards.

So I want to understand how these kinds of environmental changes and competitive or mutualistic forces shape the development and success of online communities.

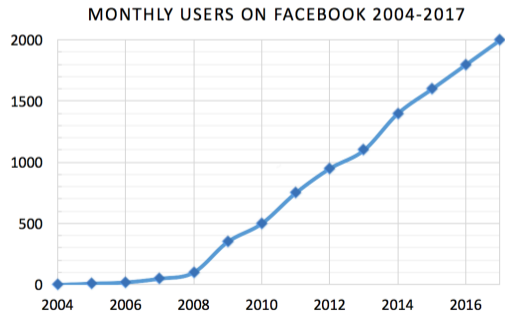
# Why study overlapping communities? The rise and decline of Wikipedia

## Internal explanation:

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## Ecological explanation:

- Changing environment: rise of Facebook and contemporary social media sites

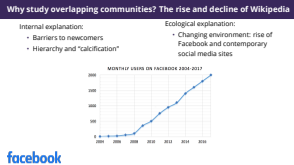


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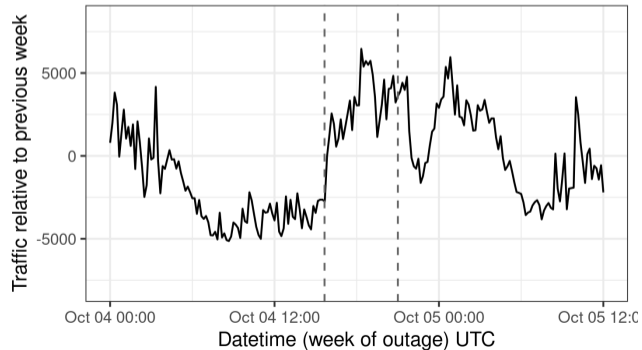
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Wikipedia traffic during facebook outage



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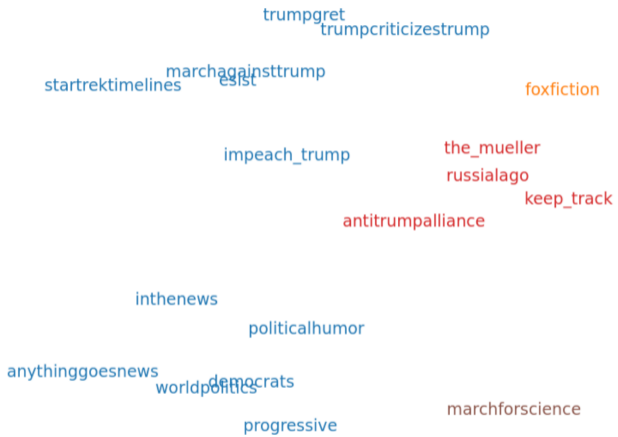
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# Overlapping online communities are very common



1. People participate in multiple communities at once.
2. Communities often have overlapping topics.
3. Interactions between related communities may be important to understanding their performance and how they are organized.

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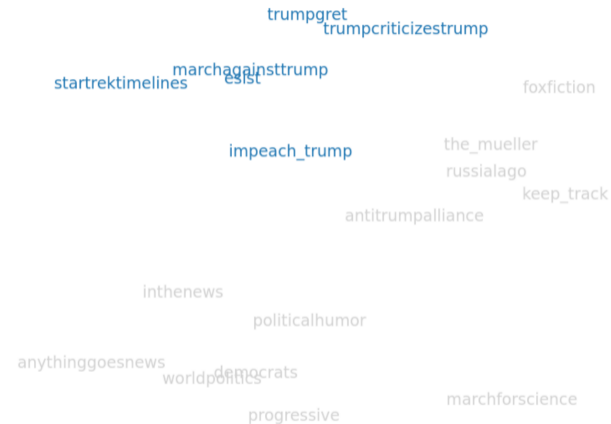
I used the example of Wikipedia to motivate the study of relationships between different online communities. Overlapping communities are very common and common-sense intuitions might suggest that they would compete with each other over users, the same way that platforms do. In this first study I set out to test whether overlapping communities typically compete or not.

Reddit is a platform that hosts tens of thousands of active online communities and has allowed users to create online communities on the platform since 2008.

For example I'm showing some results from my computational clustering analysis of subreddits with overlapping users. We can see three clusters of political subreddits. The first is broadly anti-Trump and includes "/r/resist" and "marchagainstrump." The second is specifically focused on the Russian election interference scandal and investigation and include "the\_mueller" and "russialago." The final one is a cluster of broader liberal/progressive news discussion and humor subreddits.

These groups all have highly overlapping users. We can also see they have highly overlapping topics. How do they influence each others growths?

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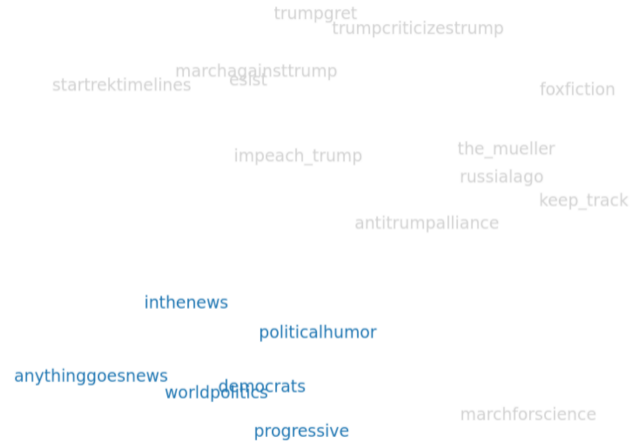
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In broad strokes, there are two kinds of ecological relationships.

**Competition:** An ecological dynamic among groups that *hurts growth*.

**Mutualism:** An ecological dynamic among groups that *supports growth*.

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## Studying Overlapping Online Communities

└ Introduction: Why study overlapping online communities?

└ Studying ecological relationships

We're using concepts of competition and mutualism drawn from ecology. This might be surprising or exotic, but actually this style of thinking is very important in management and organizational sociology a literature called "organizational ecology." Part of what we're doing is to try out ideas from organizational ecology in the context of online communities.

My goal is infer directed weighted networks like this one. This is one of the more interesting networks of ecological interactions I have found. Edges are ecological interactions inferred using a method I will describe in a moment. Notice that they can be competitive or mutualistic as well as reciprocal or asymmetric. The mental health subreddits interact with each other a lot and mostly mutualistically.

I don't have time to really explain how I go about inferring these relationships from data because I want to focus on the interview study.

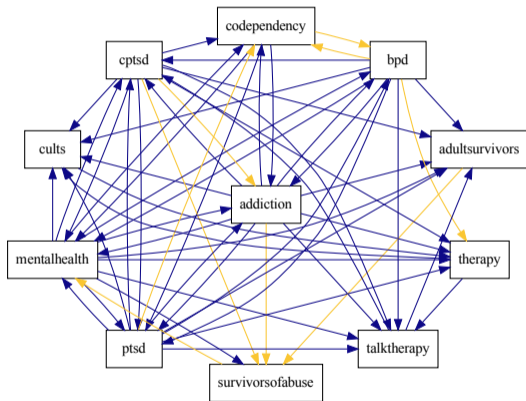
In broad strokes, there are two kinds of ecological relationships.  
**Competition:** An ecological dynamic among groups that hurts growth.  
**Mutualism:** An ecological dynamic among groups that supports growth.

# Inferring competitive and mutualistic interactions

**Data:** 542 clusters including 4090 subreddits.

**Subreddit size:** Number of unique weekly posters.

**Vector autoregression (VAR) models** infer competition-mutualism networks by predicting subreddit size as a function of the past size of every other subreddit in the cluster.



competition | mutualism

## Studying Overlapping Online Communities

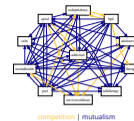
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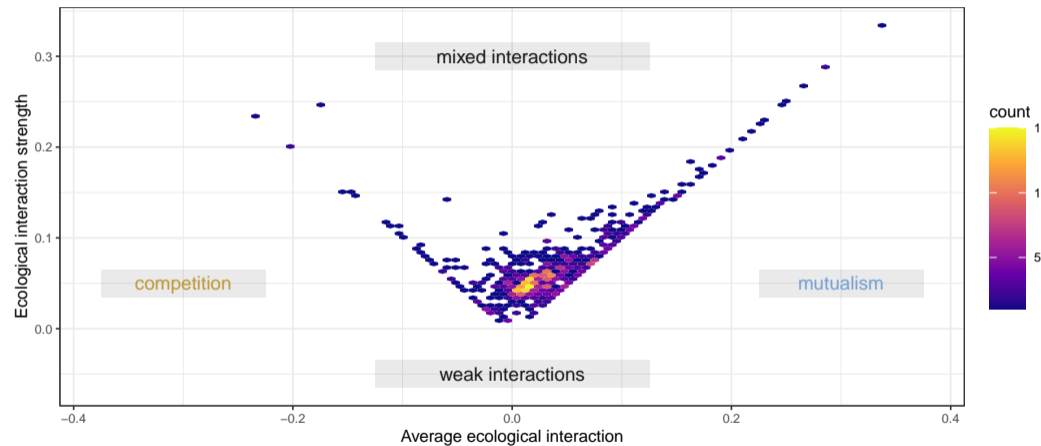
This approach comes from biological ecology where it's been used to estimate interactions between species of animals and microorganisms in natural systems. You get an interaction for each pair of subreddits.

Just because two species share food doesn't mean they are competitors. The population of one species might be limited by something else like a disease or a predator and there can be enough food to go around. Ecologists have put a lot of effort into inferring competitive and mutualistic interactions in complex ecosystems. VAR models just scratch the surface.

The intuition of a var model is if an unusually big increase in the size of one subreddit predicts an unusually big increase in another then we infer a mutualistic tie from the first to the second. If the signs are flipped that's interpreted as competition. There are some details under the hood to deal with growth trends over time and subreddits that were created at different points in time.

Stack  $\Phi_j$  into a matrix of inter-group ecological interactions  $\Phi$ . If  $\phi_{i,j} > 0$  then the community interaction network  $j$  has a mutualistic tie from  $i$  to  $j$ . If  $\phi_{i,j} < 0$  the tie from  $i$  to  $j$  is competitive.

# There's a lot of mutualism!

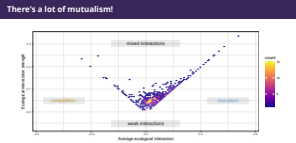


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└ There's a lot of mutualism!



Two-dimensional histogram showing clusters of subreddits.

The X-axis shows the overall degree of mutualism or competition in clusters of subreddits with high user overlap based on the average ecological interaction.

The Y-axis shows the overall magnitude of ecological interactions in the cluster.

So on the left hand side we have competitive clusters. On the right hand side we have mutualistic clusters. Toward the top we have very strong interactions. Near the bottom we have relatively weak interactions. A large majority of clusters (81.7%) are mutualistic.

**Why are online communities so mutualistic?  
Why are the same people talking to each other about  
similar things in multiple online communities?**

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Studying Overlapping Online Communities

Equalogy

Why are online communities so mutualistic?  
Why are the same people talking to each other about  
similar things in multiple online communities?

The first study found that mutualism was pretty common among subreddits, but its methods don't have much ability to explain why overlapping subreddits would be complementary. So we conducted an interview study to help understand *Why are the same people talking to each other about similar things in multiple online communities?*

We selected 9 clusters: *climbing, drag, indie music, middle age dating, painting, podcasting, rollercoasters, streetwear, and vintage audio.*

We interviewed a total of 20 participants from these clusters. Participants received a 20\$ gift card in compensation.

With a team at UW, including three undergrads, we talked to people who belong to overlapping subreddits. Again, we didn't set out to strictly do a Reddit paper but instead to use Reddit as a setting with an abundance of examples to study to help answer our research questions.

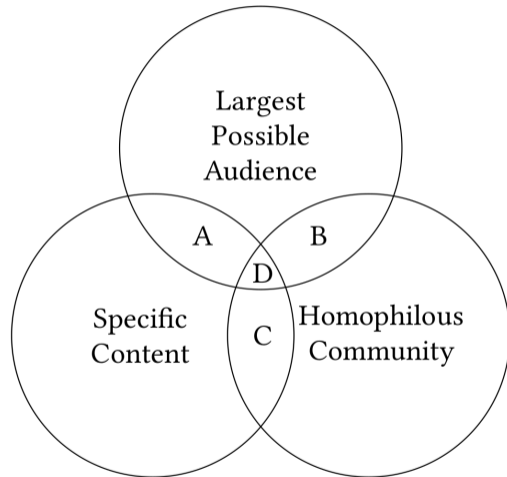
We picked out 9 groups of subreddits from the clusters that we described in previous slides. The 9 clusters of subreddits centered on topics related to: climbing, drag show performance, indie music, middle age dating, podcasting, rollercoasters, streetwear fashion, and vintage audio enthusiasts.

We identified three high-level types benefits that people seek in their participation in online communities. These are:

1. Specific kinds of information and content.
2. A tight-knit *homophilous* community.
  - *homophily*: the tendency of individuals to associate and bond with similar others
3. Large audiences for their content.

After rigorously analyzing our interview data, we identified three types of benefits that people seek when deciding to participate in online communities: specific kinds of information and content, a tight-knit, homophilous (like-minded) community, and large audiences for their content to get engagement. Although it isn't news that people seek these kinds of benefits from online communities, what we think is new here is finding tensions between these benefits.

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  - *homophily*: the tendency of individuals to associate and bond with similar others
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## Studying Overlapping Online Communities

└ Equalogy

└ Tensions between the benefits



This is a diagram that we call a trilemma, showing the three benefits in tension with each other. Each community is somewhere in this "trilemma" and can provide some or even all of these three benefits. But when one community doesn't provide one of these benefits to someone's satisfaction, they turn to a related community that does a better job.

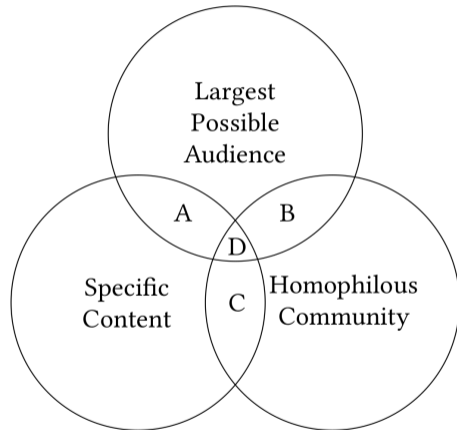


# Tensions between the benefits

Large audiences create **background noise**, making it difficult to find desired content.

Large groups are less homophilous and less friendly.

Often important content, discussion, and information can only come from diverse groups.



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## Studying Overlapping Online Communities

↳ Equalogy

↳ Tensions between the benefits

So, a system of overlapping communities can help resolve these tensions.

Large audiences create background noise. But breaking down broad topical areas into specific community of varying levels of granularity makes finding desired content easier because it means that users do not need to sift through unrelated material in a community with a broader topic.

Large groups seem less homophilous and seem less friendly, but the very same people who are rude in large subreddits might be friendly in smaller subreddits where people have repeated encounters with one another and have a stronger sense of knowing each other and smaller communities can define their scopes to be more homophilous. In the next few slides, we'll go over some examples of a few of these tensions that emerged from our interviews.

Tensions between the benefits

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Often important content, discussion, and information can only come from diverse groups.



## Larger groups make homophilousness more difficult

*"I live in the middle of nowhere. And every so often, before the pandemic, I would visit the [large city several hours away]. Now I found there were very polite people, both in [the city] and in [my rural area]. But the tone by which people carried themselves changes in their environment: that's kind of one of the big changing factors. So, in the city, people are in a rush, they're about their business. We don't really have time to chat. . . . **The big subreddits might seem unfriendly [But] it's not that so much. Individual members are impolite or unfriendly. But it's almost as though people carry themselves differently when we're in different subreddits.**"*

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Studying Overlapping Online Communities

└─ Equalogy

└─ Larger groups make homophilousness more difficult

In this example, this interviewee describes people as carrying themselves differently in large and small subreddits as their behavior changes when they move between different communities, even though the same people may interact with each other in communities with similar topics. **The big subreddits might seem unfriendly [But] it's not that so much. Individual members are impolite or unfriendly. But it's almost as though people carry themselves differently when we're in different subreddits.** The very same people who are rude in large subreddits might be friendly in smaller subreddits where people have repeated encounters with one another and have a stronger sense of knowing each other.

"I live in the middle of nowhere. And every so often, before the pandemic, I would visit the [large city several hours away]. Now I found there were very polite people, both in [the city] and in [my rural area]. But the tone by which people carried themselves changes in their environment: that's kind of one of the big changing factors. So, in the city, people are in a rush, they're about their business. We don't really have time to chat. . . . **The big subreddits might seem unfriendly [But] it's not that so much. Individual members are impolite or unfriendly. But it's almost as though people carry themselves differently when we're in different subreddits.**"

*“Somebody will post asking for advice in r/climbing and oftentimes, somebody will comment and be like, **‘Hey, you know? You’re welcome to ask this here, but you might get more and better responses at r/climbharder.’**”*

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└ Equalogy

└ Specific kinds of content

Specific kinds of content

“Somebody will post asking for advice in r/climbing and oftentimes, somebody will comment and be like, **‘Hey, you know? You’re welcome to ask this here, but you might get more and better responses at r/climbharder.’**”

An ecosystem of subreddits about similar topics provides more opportunities for people to find specific desired discussions.

In this quote, a member of multiple rock climbing subreddits describes how two different subreddits have different purposes. There’s a general-purpose /r/climbing that has all kinds of rock climbing content and discussion. But people looking for in-depth conversations about training for rock climbing are more likely to find them in the specialized /r/climbharder subreddit. When people ask about training in the general purpose subreddit, they get told **“Hey, you know? You’re welcome to ask this here, but you might get more and better responses at r/climbharder.”**

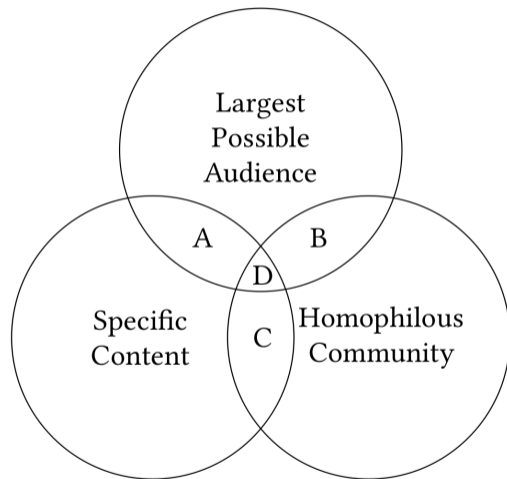
*"Likes are just kind of fake: fake social currency. But yeah, when you get a charge out of it, yeah, I love it. Most of the time, painting is a really busy sub. I mean, like, in any given hour, the new page is already replaced. . . . **If you can get something that gets a hold there and stays on the front page for a little while, [if] it gets up in even the top five, I've had a handful do that. That's kind of cool."***

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In this example, the interviewee describes the thrill of reaching top positions in r/painting with posts of their paintings. gets from the subreddit is desirable. **"If you can get something that gets a hold there and stays on the front page for a little while, [if] it gets up in even the top five, I've had a handful do that. That's kind of cool"**

So this sends traffic to their websites, raises their artistic profile, and helps them sell their art. While these incentives are important, part of the thrill comes from knowing that a given subreddit is competitive as users essentially "compete" for engagement with their content.

# No community can do everything



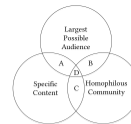
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## Studying Overlapping Online Communities

↳ Equalogy

↳ No community can do everything

No community can do everything



We think these tensions are not necessarily insurmountable and that online communities can actually be creative and flexible. It seems like the easiest way to deal with the limitations of one community is to create a complementary one. In short, no community can do everything. Our interview data suggests that as communities grow, they become more able to provide a steady stream of more general content and a larger audience, and less able to provide very niche content and homophilous community. This suggests that the ecosystem develops as communities grow large and then spin off smaller ones.

## Conclusion: Complementary communities

People use **portfolios of communities** to obtain a greater range of benefits. These portfolios often contain **small communities** which more often provide homophilous community and specific content.

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└ Equalogy

└ Conclusion: Complementary communities

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We find that people use diverse portfolios of communities having varying sizes topical scopes and cultures in order to obtain a full range of benefits from online communities. [SLIDE]

The earlier presentation by Sohyeon and Jeremy focused on how small communities complement large ones.

Sohyeon and Jeremy told us why people participate in persistently small communities and conclude that smallness offers a range of benefits, but we see size as just one way that overlapping communities differentiate from one another in order to provide complementary benefits. [slide]

Our findings suggest that individuals seek out benefits that happen to be incompatible with largeness and participate in portfolios of communities that, because of the tensions we described earlier, will almost certainly include small communities.

## Conclusion: Complementary communities

People use **portfolios of communities** to obtain a greater range of benefits.

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However, **size is often a side-effect** of the other ways that communities differentiate from each other such as their rules and topics.

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Conclusion: Complementary communities

People use **portfolios of communities** to obtain a greater range of benefits. These portfolios often contain **small communities** which more often provide homophilous community and specific content. However, **size is often a side-effect** of the other ways that communities differentiate from each other such as their rules and topics.

We find that people use diverse portfolios of communities having varying sizes topical scopes and cultures in order to obtain a full range of benefits from online communities. [SLIDE]

The earlier presentation by Sohyeon and Jeremy focused on how small communities complement large ones.

Sohyeon and Jeremy told us why people participate in persistently small communities and conclude that smallness offers a range of benefits, but we see size as just one way that overlapping communities differentiate from one another in order to provide complementary benefits. [slide]

Our findings suggest that individuals seek out benefits that happen to be incompatible with largeness and participate in portfolios of communities that, because of the tensions we described earlier, will almost certainly include small communities.

In *Building Successful Online Communities*, Resnick et al. (2012) recommend that new online communities “carve out a useful and defensible (sic) niche in the ecology of competing communities.”

One of our goals is to inform the design and management of online communities. The highly cited textbook *Building Successful Online Communities* recommends that new online communities “carve out a useful and defensible (sic) niche in the ecology of competing communities.” [SLIDE]

We think these authors are more worried about competition between platforms than between communities. [SLIDE]

However, we think it’s important to design with the expectation that people will create and participate in multiple online communities as a part of pursuing their related interests and goals. [SLIDE]



## Key takeaways

In *Building Successful Online Communities*, Resnick et al. (2012) recommend that new online communities “carve out a useful and defensible (sic) niche in the ecology of competing communities.”

Don't be so afraid of competition between existing communities. Overlapping communities are [often mutualistic](#).

2022-02-11

## Studying Overlapping Online Communities

└ Equalogy

└ Key takeaways

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Don't be so afraid of competition between existing communities. Overlapping communities are **often mutualistic**.

**No community can do everything**. Design for people who participate in ecosystems of overlapping online communities.

Design formalized or automated practices for communities to collaborate on sharing content in complementary ways.

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Thank you!

Thanks to the NSF for financial support through grants  
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<https://communitydata.science>

2022-02-11

## Studying Overlapping Online Communities

Equalogy

Thank you very much for your attention. We'd love to connect with you after this workshop through email or social media.

Thank you!  
Thanks to the NSF for financial support through grants  
IIS:1908850;1910202;GRFP #2016220885  
nathante@uw.edu  
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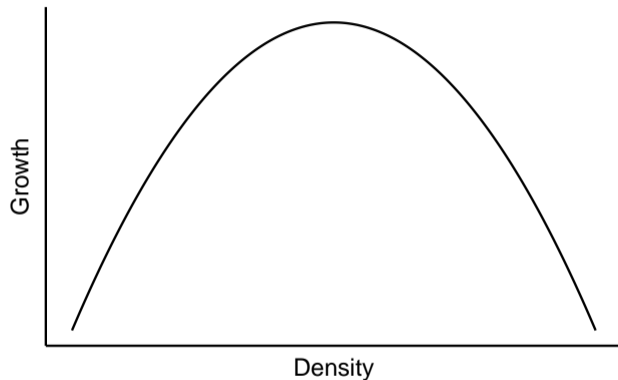
## Prior ecological studies of online communities: Density dependence theory

**Competition:** An ecological dynamic among groups that *hurts growth*.

**Mutualism:** An ecological dynamic among groups that *supports growth*.

**Density:** How much groups' niches overlap.

**Density Dependence:** Trade-off between competition and legitimacy.



[Wang et al. 2012; Zhu et al. 2014]

## Studying Overlapping Online Communities

2022-02-11

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[Wang et al. 2012; Zhu et al. 2014]

Prior researchers have applied organizational ecology to online communities. In particular, they have investigated dependence theory, a central, widely tested and elaborated theory in organizational ecology that was developed more for classical organizations.

Density is the amount that different organizational niches overlap. The idea is that density has a  $\cap$ -shaped relationship with competitive and mutualistic forces.

Density dependence theory says that the number of organizations in an organizational field is regulated by forces of competition and mutualism in the environment.

The intuition is that lower degrees of overlap reflect unfavorable environmental conditions (i.e., a less popular topic, a business model is brand new and therefore risky).

When there are more communities with greater overlaps, the amount of density increases, environmental conditions improve and in theory, subreddits grow more on average.

At the extreme levels of overlap, environmental conditions may be favorable, but competition limits growth.

For example (Show My Plot For Reddit), when subreddits have very low user overlap with other subreddits they grow less on average.

This plot shows density, measured as author overlap on the x-axis and a subreddit's 6 month growth on the Y axis. If you squint at that regression line you'll see that it's  $\cap$ -shaped so the prediction of the theory is correct. Low density reflects a lack of opportunity but high density reflects crowding and competition. Subreddits grow the most at a "sweet spot" of moderate "density." But the correlation is very weak!

I'll bring this up again, but I think that what's most unsatisfying about density dependence theory for explaining why there are so many

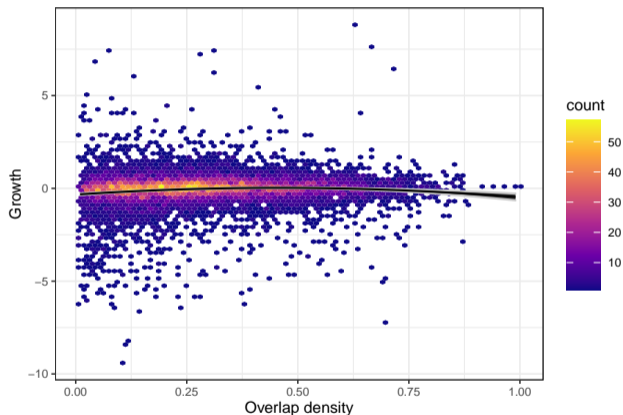
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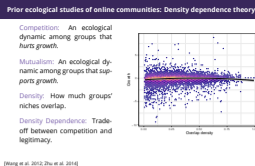


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## How are overlapping online communities related to each other?

2022-02-11

### Studying Overlapping Online Communities

How are overlapping online communities related to each other?

This density dependence model doesn't actually tell us much about the clusters I showed before. The notion of "density" mixes up all these relationships into an aggregated value. It provides no way to answer "are these two communities competitors or mutualists?"

### Advancing the ecology of online communities

Three empirical studies:

1. *No Community Can Do Everything: Why People Participate in Similar Online Communities* with Charles Kiene, Isabella Brown, Laura (Alia) Levi, Nicole McGinnis, and Benjamin Mako Hill.
2. *Identifying Competition and Mutualism Between Online Groups* with Benjamin Mako Hill.
3. *Dynamics of Ecological Adaptation in Online Communities*

First, I'm going to talk about a study where I use clustering analysis and time series models to infer competitive and mutualistic interactions among overlapping communities.

Then, charlie will talk about an interview-based study where we talked to people who participate in overlapping online communities to learn about how they understand the relationships between these communities.

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## Large audiences create background noise

*"I see **this background noise problem building [in] r/climbing, the main climbing community, [which] has just become less and less and less interesting and less relevant as it's gotten bigger.** That's not really a problem. Right? That's probably has more to do with my interest level and how long I've been on it. And my experience level with climbing. I'm just a little bit more crusty about it, you know?"*

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## Studying Overlapping Online Communities

└ Large audiences create background noise

This quote is an example of idea held by many of our interviewees that larger subreddits are simply not the best place for enthusiasts to have discussions. **this background noise problem building [in] r/climbing, the main climbing community, [which] has just become less and less and less interesting and less relevant as it's gotten bigger.**

Large audiences create background noise

"I see this background noise problem building [in] r/climbing, the main climbing community, [which] has just become less and less and less interesting and less relevant as it's gotten bigger. That's not really a problem. Right? That's probably has more to do with my interest level and how long I've been on it. And my experience level with climbing. I'm just a little bit more crusty about it, you know?"

## Larger groups make homophilousness more difficult

*"I live in the middle of nowhere. And every so often, before the pandemic, I would visit the [large city several hours away]. Now I found there were very polite people, both in [the city] and in [my rural area]. But the tone by which people carried themselves changes in their environment: that's kind of one of the big changing factors. So, in the city, people are in a rush, they're about their business. We don't really have time to chat. . . . **The big subreddits might seem unfriendly [But] it's not that so much. Individual members are impolite or unfriendly. But it's almost as though people carry themselves differently when we're in different subreddits.**"*

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## Studying Overlapping Online Communities

└ Larger groups make homophilousness more difficult

Even though the same people may interact with each other in communities with similar topics, this interviewee describes people as carrying themselves differently in large and small subreddits as their behavior changes when they move between different environments. **The big subreddits might seem unfriendly [But] it's not that so much. Individual members are impolite or unfriendly. But it's almost as though people carry themselves differently when we're in different subreddits.** The very same people who are rude in large subreddits might be friendly in smaller subreddits where people have repeated encounters with one another and have a stronger sense of knowing each other.

Larger groups make homophilousness more difficult

"I live in the middle of nowhere. And every so often, before the pandemic, I would visit the [large city several hours away]. Now I found there were very polite people, both in [the city] and in [my rural area]. But the tone by which people carried themselves changes in their environment: that's kind of one of the big changing factors. So, in the city, people are in a rush, they're about their business. We don't really have time to chat. . . . **The big subreddits might seem unfriendly [But] it's not that so much. Individual members are impolite or unfriendly. But it's almost as though people carry themselves differently when we're in different subreddits.**"

### └ Specific kinds of content

*"Somebody will post asking for advice in r/climbing and oftentimes, somebody will comment and be like, 'Hey, you know? You're welcome to ask this here, but you might get more and better responses at r/climbharder.'"*

The ecosystem of subreddits about similar topics provides more opportunities for people to find specific desired discussions.

People receive positive feedback and engagement That said, the subreddit where a particular piece of content will be best received is often not clear to the person posting it. Cross-posting provides multiple chances to start a desired discussion.

In this quote, a member of rock climbing subreddits describes how two different subreddits have different purposes. There's a general-purpose /r/climbing that has all kinds of rock climbing content and discussion. But people looking for in-depth conversations about training for rock climbing are more likely to find them in the specialized /r/climbharder subreddit. When people ask about training in the main subreddit they get told **"Hey, you know? You're welcome to ask this here, but you might get more and better responses at r/climbharder."**

*"[As for subreddits about] the drag race (r/rupaulsdragrace), Drag Race UK (r/DPDR\_ - UK), and the spoiled drag race (r/SpoiledDragRace). . . . Most of [followers in these63 other groups] don't do drag. **Most of them are, I think, white gay men, or straight women who see drag with a very narrow view of what drag is.** Hegemonic? I don't know if that's the word, but they apply the same standards of beauty that are applied to women and men and artists and performers to this art form. **And it limits a lot what you would consider pretty, or you would like, or you will enjoy.**"*

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### └ Homophilous community

Online communities have long been recognized as a way to “find my people” by bringing together users sharing a psychiatric diagnosis, enthusiasm for a hobby, age group, or membership in a subculture or identity group.

In this quote, a member of the subreddits about Drag performance and culture describes how they don't identify as much with the largest subreddits because **“Most of them are, I think, white gay men, or straight women who see drag with a very narrow view of what drag is”** and it **“limits a lot what you would consider pretty or you would like, or your will enjoy.”** They more strongly identify with a smaller, horror-themed community /r/Dragula that embraces transgressing hegemonic beauty norms.

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*“Likes are just kind of fake: fake social currency. But yeah, when you get a charge out of it, yeah, I love it. Most of the time, painting is a really busy sub. I mean, like, in any given hour, the new page is already replaced. . . . **If you can get something that gets a hold there and stays on the front page for a little while, [if] it gets up in even the top five, I’ve had a handful do that. That’s kind of cool.”***

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### └ Finding the largest possible audience

This interview describes the thrill of reaching top positions in r/painting with posts of their paintings. Even though they are dismissive of likes on Reddit, they admit that the attention their work gets from the subreddit is desirable. **“If you can get something that gets a hold there and stays on the front page for a little while, [if] it gets up in even the top five, I’ve had a handful do that. That’s kind of cool”**

It sends traffic to their websites, raises their artistic profile, and helps them sell their art. While these material incentives are important, part of the thrill comes from knowing that a given subreddit is competitive.

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# Where do systems of overlapping communities come from?

Up to this point, we've been talking *statics*.

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## Studying Overlapping Online Communities

└ Where do systems of overlapping communities come from?

So far, this discussion has been largely static. We're looking at a system of online communities that is already quite developed. [SLIDE]

The VAR models are pretty simple linear models designed to infer static relationships between online communities. This seems pretty unrealistic. Dynamics of attention online are pretty complex, they are bursty, seasonal, and there are often "shocks" or "trends" like sudden events that generate shape activity. These all suggest that, like in biological ecological systems, ecological interactions might change over time. [SLIDE]

The interviews surfaced some discussion of how communities changed, but were retrospective and don't provide very strong evidence about how overlapping communities develop.

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## How are systems of mutualistic overlapping communities constructed?

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### Studying Overlapping Online Communities

How are systems of mutualistic overlapping communities constructed?

Now, I'm going to turn to the third study. As part of explaining why there are so many overlapping online communities, I think its important to understand the process by which the overlapping communities come to be. I'm pretty far from fully answering this question. I think it's a pretty hard question to find a satisfying answer for empirically. I took up one possible answer, by asking if online communities become mutualistic through an adaptation process.

# Does mutualism become widespread through adaptation?

Do communities specialize in response to competition?

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Studying Overlapping Online Communities

└ Does mutualism become widespread through adaptation?

There are a few ways that

I used non-linear time series models developed by biological ecologists called regularized S-map models.

The VAR models are simple. The S-map models are very complex and have different assumptions. I used the VAR models first as a sort of stepping stone. They are better understood than S-map, especially by social scientists and the HCI community.

I used panel regression models to test hypotheses and answer these latter questions.

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**The principle of competitive exclusion:** Strong competition is unlikely to exist and persist because it is so damaging.

**Regularized S-Map models** ask “What usually happens when the system is in a state similar to this?” to model non-linear dynamics (see Eq. 9-13).

I also construct measures of **user overlap** and **topic overlap** between communities over time and test hypotheses using panel regression models

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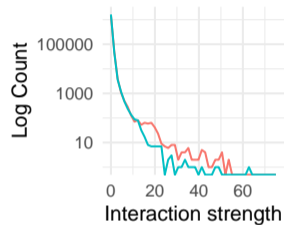
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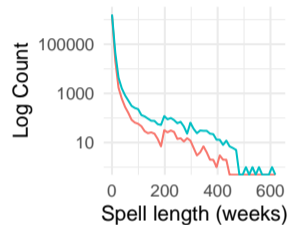
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# Ecological interactions change over time



Interaction type  
— competition  
— mutualism



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Ecological interactions are usually *bursty*.

Competitive spells have slightly stronger interactions.

Mutualistic spells last considerably longer (20%; 0.4 weeks) longer on average.

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## Studying Overlapping Online Communities

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Ecological interactions are usually *bursty*.  
Competitive spells have slightly stronger interactions.  
Mutualistic spells last considerably longer (20%; 0.4 weeks) longer on average.

This provides additional evidence and nuance to claims that mutualism is more common than competition.

Mutualistic interactions are slightly more common than competitive interactions, and competitive interactions are slightly stronger on average (as shown on the left), but mutualistic interactions survive over half a week longer on average (as shown on the right).

This provides some additional nuance to the findings from the VAR models. The prevalence of mutualism is primarily because mutualistic interactions last longer.

## Online communities seem to ineffectively adapt

Online communities that are more competitive have decreasing topic overlap ( $B = 0.014$ ;  $CI = [0.0102, 0.017]$ ) and user overlap ( $B = 0.009$ ;  $CI = [0.0062, 0.0121]$ ).

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Studying Overlapping Online Communities

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Studying Overlapping Online Communities

└ Discussion

Discussion

## Discussion

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# Evidence against mutualism emerging through an adaptive process

**Structural inertia** limits rational organizational change. Even though communities seem to change in response to competition, this doesn't seem to explain the preponderance of mutualism.

A **selection process** provides a possible alternative ecological explanation. But how do people collectively develop communities to fill available niches?

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## Studying Overlapping Online Communities

- Discussion

- Evidence against mutualism emerging through an adaptive process

Widespread mutualism among overlapping online communities seems related to ways that online communities are different from classical organizations, but a lack of capacity to effectively position themselves relative to competitors is something that they seem to share with classical organizations.

One of the things that we know pretty well about online communities. Something that I've found in my earlier research is that online communities seem to become inflexible over time. Organizational ecologists call forces that limit organizational adaptability "structural inertia." In classical organizations, inertia arises from internal and external constraints like organizational routines, pressures to conform to institutions, and the need for dependability.

Some of the same pressure seem to apply to online communities as well. Other work by myself and others has found that online communities seem to adapt less as they age, even though doing so might help them attract newcomers. Other mechanisms of structural inertia found in classical organizations may also appear to have analogs in online communities such as roles and routines. Moreover, online communities typically have a much weaker hold on their members compared to classical organizations and have limited means available to compel change. This suggests that if online communities adapt in response to competition, they will change through a bottom-up process driven by the choices of individual members or small groups of them.

This suggests that overlapping mutualistic online communities probably emerge through a selection process instead. But future work still needs to demonstrate how that process works.

*Structural inertia* limits rational organizational change. Even though communities seem to change in response to competition, this doesn't seem to explain the preponderance of mutualism.

A *selection process* provides a possible alternative ecological explanation. But how do people collectively develop communities to fill available niches?