

# Deep Twitter Diving: Exploring Topical Groups in Microblogs at Scale

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# The Twitter Stereotype

“Twitter provides us with a wonderful platform to discuss/confront societal problems. We trend Justin Bieber instead.”

– @LaurenLeto

# Outline

- Methodology – Finding Topical Groups
  - Finding Experts
  - Finding Seekers
- How Diverse are the Topical Groups?
- Topical Groups: Identity or Bond based?

# What are Topical Groups?

Topical Groups = Experts + Seekers

Experts: Users **with** topical knowledge

Seekers: Users **interested** in topical knowledge



@BarackObama  
Expert on Politics

@BarackObama  
Seeker on Basketball



# Detecting Groups: Prior Approaches

- Graph based approaches
  - Not good for detecting “Identity based groups” [1]
- Tweet or Profile based approaches
  - Profiles: not always meaningful, not vetted
  - Tweets: small, contain lot of chatter

[1] Grabowicz et. al., “Distinguishing topical and social groups based on common identity and bond theory”, WSDM 2013

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# Twitter Lists

- Feature for organizing followings in Twitter
- Lists have a name and description
- Tweets of the members shown separately

Name	Description	Members
News	News media accounts	NYTimes, BBCNews, WSJ, CNNBrk, CBSNews
Music	Musicians	Eminem, BritneySpears, LadyGaga, BonJovi
Politics	Politicians and people who talk about them	BarackObama, NPRPolitics, WhiteHouse, BillMaher



**Sophia B Liu**

@sophiabliu

USGS Mendenhall Postdoc Fellow; Technology, Media & Society PhD; Crisis Informatics  
Researcher; Social Artist; Temple Dancer; Rollerblader; Tweets = My Opinions  
St. Petersburg, FL, USA · [sophiabliu.com](http://sophiabliu.com)

TWEETS  
**5,175**

FOLLOWING  
**1,081**

FOLLOWERS  
**2,087**

 **Follow**



**ProjectEPIC** by Sophia B Liu  
12 members



**CSCW** by Sophia B Liu  
131 members



**Tedect** by BeauBouchard  
Tedect scripts  
3 members



**USGSOfficialAccounts** by USGS  
51 members



## CSCW

A public list by Sophia B Liu



MEMBERS

131

SUBSCRIBERS

14

@sophiabliu

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I'm an assistant professor at Georgia Tech who works on social computing. I should, therefore, be better at Twitter than I am.



**Kate Starbird** @katestarbird

Asst. Professor of Human Centered Design & Engineering at UW. Researcher of crisis informatics and crowdwork. Aging athlete.



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Stanford, Assistant Professor of Computer Science. Human-computer interaction, social computing and crowdsourcing.



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If one is included in a number of lists,  
on the same topic,  
one is likely to be an expert on the topic.

Topic	Experts
Music	Lady Gaga, ColdPlay, Katy Perry, Dallas Martin [VP Warner Records]
Politics	Barack Obama, Al Gore, Scott Fluhr [Harrison County GOP chairman]
Forensics	Sans Institute, Forensic Focus, Michael Murr [Forensic Scientist]
Geology	GeoSociety, Kim Hannula [Geology Prof.], Garry Hayes [Geology Teacher]

Ghosh et. al., “Cognos: Crowdsourcing search for Topic Experts in Microblogs”, SIGIR 2012

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Seattle, WA



**Abraham Flaxman** @healthyalgo  
Math/TCS applied to Global Health



Follow



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National Center for Human Factors in  
Healthcare @MedStarHealth: Industrial  
Systems Eng|Cog Psych|Syst Safety  
Eng|#Simulation|#PtSafety|#HFsafety|#Huma  
nFactors



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and 2010 WNBA champions. Owned by  
Force 10 Hoops. Est. 2000. [instagram.com](https://www.instagram.com/seattlestorm)  
[/seattlestorm](https://www.instagram.com/seattlestorm)



Follow



**Sarah Webber** @sarahwebber01  
I love exploring technology and helping  
people put it to good use. Volunteer techie.  
UX consultant. BA. HCI student. Tech writer.



Follow



**Mathias Klang** @Klangable  
Associate Professor, Research on Technology  
Regulation, Rights, Social Media, Privacy,  
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Follow



**Marta Dydek** @mdydek

Retired basketball player. NBA and WNBA commentator at Canal+Sport.



**Kate**

@ka

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**Rushia Brown** @RushiaB

WNBA Vet. President/Founder of Women's Professional Basketball Alumni Association . Paying it Forward by molding the lives of young ladies ON & OFF the court!



**Debbie Antonelli** @debbieantonelli

College bball/WNBA analyst/co-host ESPN Women's Bball podcast/mom to 3 boys/can still run post pattern, hook slide and knock down 3 pters



**Chantelle** @MissChantelle

Jesus saves! Disciple. Former WNBA. Vandy WBB Alum. Corporate America. Call Me Miss. John 1:5. Check out my blog



**WNBA** @WNBA

News & notes directly from the WNBA.



**Mary Murphy** @realmarymurphy

Basketball is my life! Cover the Pac-12, Big Ten. BTW...I like other sports too. NFL, MLB, NBA...follow them all.



**Evan** @USCCoachEvan

Assistant Coach at USC! Basketball has taken me on an incredible ride at Santa Clara, UCSB, Stanford and Missouri! Love the journey!



**Stanford WBasketball** @StanfordWBB

The official Twitter account for the two-time National Champion Stanford Women's Basketball team. #gostanford



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**Medical HumanFactors** @MedicalHFE

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Seattle Storm

Seattle Storm,

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000. [instagram](#)

**Sarah Webber** @sarahwebber01

I love exploring technology and helping

people put it to good use. Volunteer techn

UX consultan

**Mathias Kla**

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e-books, Copyright & more



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If one is following many experts,  
on the same topic,  
one is likely to be interested in the topic.

# Who likes What - Infer Topical interests of Twitter Users



Kate Starbird

@katestarbird

Asst. Professor of Human Centered Design & Engineering at UW. Researcher of crisis informatics and crowdwork. Aging athlete.

Seattle, WA

Interests of: *Kate Starbird*



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Seattle, WA

Interests of: *Kate Starbird*

WNBA

news politics  
earthquake  
seattle area  
academics  
crisis  
stanford  
revolution  
influential men  
ict4d  
researchers  
disaster  
hci  
wnba  
new media  
govt  
public safety  
preparedness  
humanitarian mapping  
geospatial  
response  
mem

# Who likes What - Infer Topical interests of Twitter Users



critical play

@criticalplay

game design  
game dev  
games industry  
gamification  
gaming news  
digital humanities  
innovators  
videogame  
art museums  
indie game  
academics  
foundations  
humanities  
social enterprise



Patrick Meier

@PatrickMeier

social entrepreneurs  
international development  
academics  
global health  
voices  
open data  
smem  
ngos  
techies  
ict  
disaster  
response  
humanitarian  
emergency management  
new media  
qatar  
gov20  
innovators  
mapping  
privacy  
democracy  
aid  
ict4d  
crisis  
doha  
do

# Topical Groups

Topical Group = Experts + Seekers

Experts and Seeker sets overlap.

# Outline

- Methodology – Finding Topical Groups
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- How Diverse are the Topical Groups?
- Topical Groups: Identity or Bond based?

# Scalability of our Approach

- First 38 Million users in Twitter
- 88 Million lists. 1.5 Billion links
- 36 Thousand Topical Groups
- Covering 49.5% users
- Covering 94.3% links

# Diversity: Topics and Group Size

No. of seekers	Number of experts					
	< 100	100 – 500	500 – 1K	1K – 5K	5K – 10K	> 10K
< 1K	(5416) <i>geology, karate, malaria, neurology, tsunami, psychiatry, radiology, pediatrics, dermatology, dentistry</i>	(132) <i>volleyball, philosophers, tarot, perfume, florists, copy-writers, taxi, esperanto</i>				
1K – 5K	(915) <i>biology, chemistry, swimmers, astrophysics, multimedia, semiconductor, renewable-energy, breast-cancer, judaism</i>	(428) <i>painters, astrology, sociology, geography, forensics, anthropology, genealogy, archaeology, gluten, diabetes, neuroscience</i>	(17) <i>architects, insurance, second-life, police, progressives, creativity</i>			
5K – 10K	(166) <i>malware, gnu, robot, chicago-sports, gospel-music, space-exploration, wall-street</i>	(202) <i>horror, agriculture, atheism, attorneys, furniture, art-galleries, ubuntu</i>	(34) <i>psychology, poetry, catholic, hospitals, autism, jazz</i>	(2) <i>coffee, dealers</i>		
10K – 50K	(174) <i>ipod, ipad, virus, Liverpool-FC, choreographers, heavy-metal, backstreet-boys, world-cup,</i>	(312) <i>olympics, physics, theology, earthquake, opera, makeup, Adobe, wrestlers, typography, american-idol</i>	(146) <i>tennis, linux, astronomy, yoga, animation, manga, doctors, realtors, wildlife, rugby, forex, php, java,</i>	(67) <i>law, history, beer, golf, librarians, theatre, military, poker, conservatives, vegan</i>		
50K–100K	(7) <i>bbc-radio, UK-celebs, christian-leaders, superstars</i>	(61) <i>hackers, programmers, bicycle, GOP, fantasy-football, NCAA, wwe, sci-fi</i>	(35) <i>medicine, cyclists, investors, recipes, NHL, xbox, triathlon, Google</i>	(37) <i>hotels, museums, hockey, architecture, charities, weather, space</i>		
> 100K	(3) <i>headlines, brits</i>	(49) <i>pop-culture, gospel, BBC, reality-tv, bollywood</i>	(58) <i>religion, actresses, gadgets, graphic-design, directors, lifestyle, gossip, commentators, youtube</i>	(140) <i>books, government, comedy, environment, baseball, soccer, hollywood, iphone, economics, money</i>	(25) <i>fashion, education, wine, photography, radio, restaurants, science, SEO</i>	(17) <i>music, tech, business, politics, food, sports, celebs, health, media, bloggers, travel, writers</i>

# A Small Number of Very Popular Groups

No. of seekers	Number of experts					
	< 100	100 – 500	500 – 1K	1K – 5K	5K – 10K	> 10K
< 1K	(5416) <i>geology, karate, malaria, neurology, tsunامي, psychiatry, radiology, dermatology</i>	(132) <i>volleyball, philosophers, tarot, perfume, florists, copy-writers, taxi, esperanto</i>				
1K – 5K	(915) <i>industry, astrology, media, renewal, breast-c</i>	(37) <i>hotels, museums, hockey, architecture, charities, weather, space</i>				
5K – 10K	(166) <i>robot, gospel-explora</i>	(140) <i>books, government, comedy, environment, baseball, soccer, hollywood, iphone, economics, money</i>	(25) <i>fashion, education, wine, photography, radio, restaurants, science, SEO</i>	(17) <i>music, tech, business, politics, food, sports, celebs, health, media, bloggers, travel, writers</i>		
10K – 50K	(174) <i>virus, choreog metal, world-c</i>					
50K – 100K	(7) <i>bl celebs, leaders, superstars</i>					
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# Thousands of Specialized Niche Groups

No. of seekers	Number of experts					
	< 100	100 – 500	500 – 1K	1K – 5K	5K – 10K	> 10K
< 1K	(5416) <i>geology, karate, malaria, neurology, tsunامي, psychiatry, radiology, ped dermatology, der</i>	(132) <i>volleyball, philosophers, tarot, perfume, florists, copy-</i>				
1K – 5K	(915) <i>biology, istry, swi astrophysics, media, semicon renewable-energy breast-cancer, ju</i>	(5416) <i>geology, karate, malaria, neurology, tsunامي, psychiatry, radiology, pediatrics, dermatology, dentistry</i>	(132) <i>volleyball, philosophers, tarot, perfume, florists, copy-writers, taxi, esperanto</i>			
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# The Twitter Stereotype

popular news, celebrities,  
current events, and chatter

- “What is Twitter”, Kwak et. al., WWW 2010
  - “Who says What to Whom on Twitter”,  
Wu et. al., WWW 2011

# Breaking the Stereotype

- Exploring Topical Groups at Scale
- Groups Include
  - Politics, music, ...
  - Geology, neurology, karate, malaria, astrophysics, renewable energy, judaism, forensics, genealogy, esperanto, ...

# Outline

- Methodology – Finding Topical Groups
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  - Finding Seekers
- How Diverse are the Topical Groups?
- Topical Groups: Identity or Bond based?

# Why do groups and communities form?

## “Common Identity and Bond Theory”

Prentice et. al. “Asymmetries in Attachments to Groups and to Their Members: Distinguishing Between Common-Identity and Common-Bond Groups”, Personality and Social Psychology Bulletin, 1994

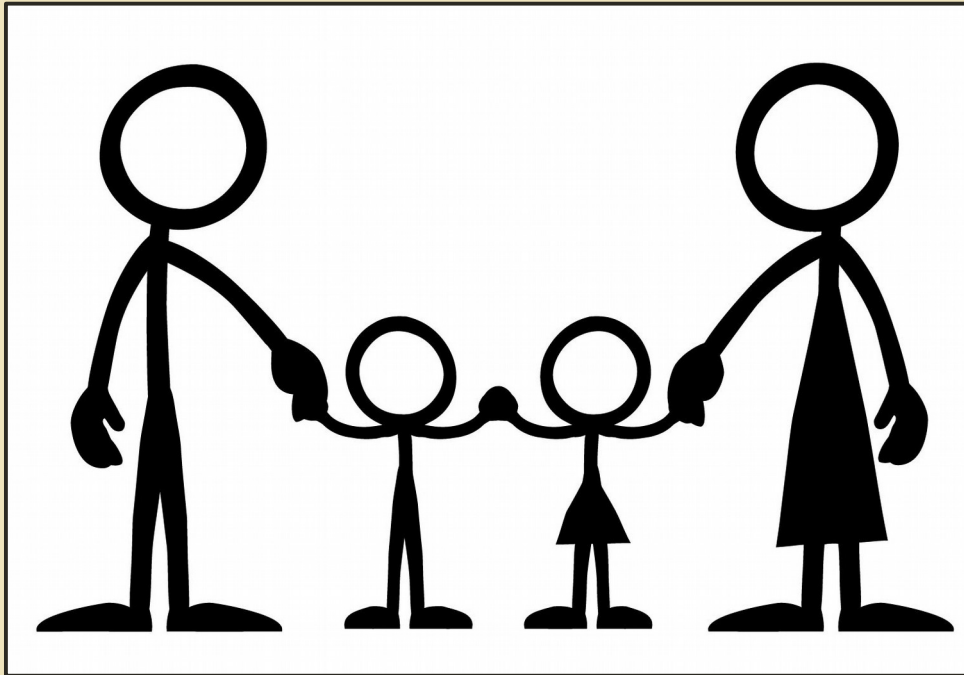
# Identity Based Groups: Sports Fans



# Identity Based Groups: Professional Groups e.g. CSCW



# Bond Based Groups: Family and Friends



# Common Identity vs. Common Bond Theory

## Identity Based Groups

Low Reciprocity

Low Personal Interactions

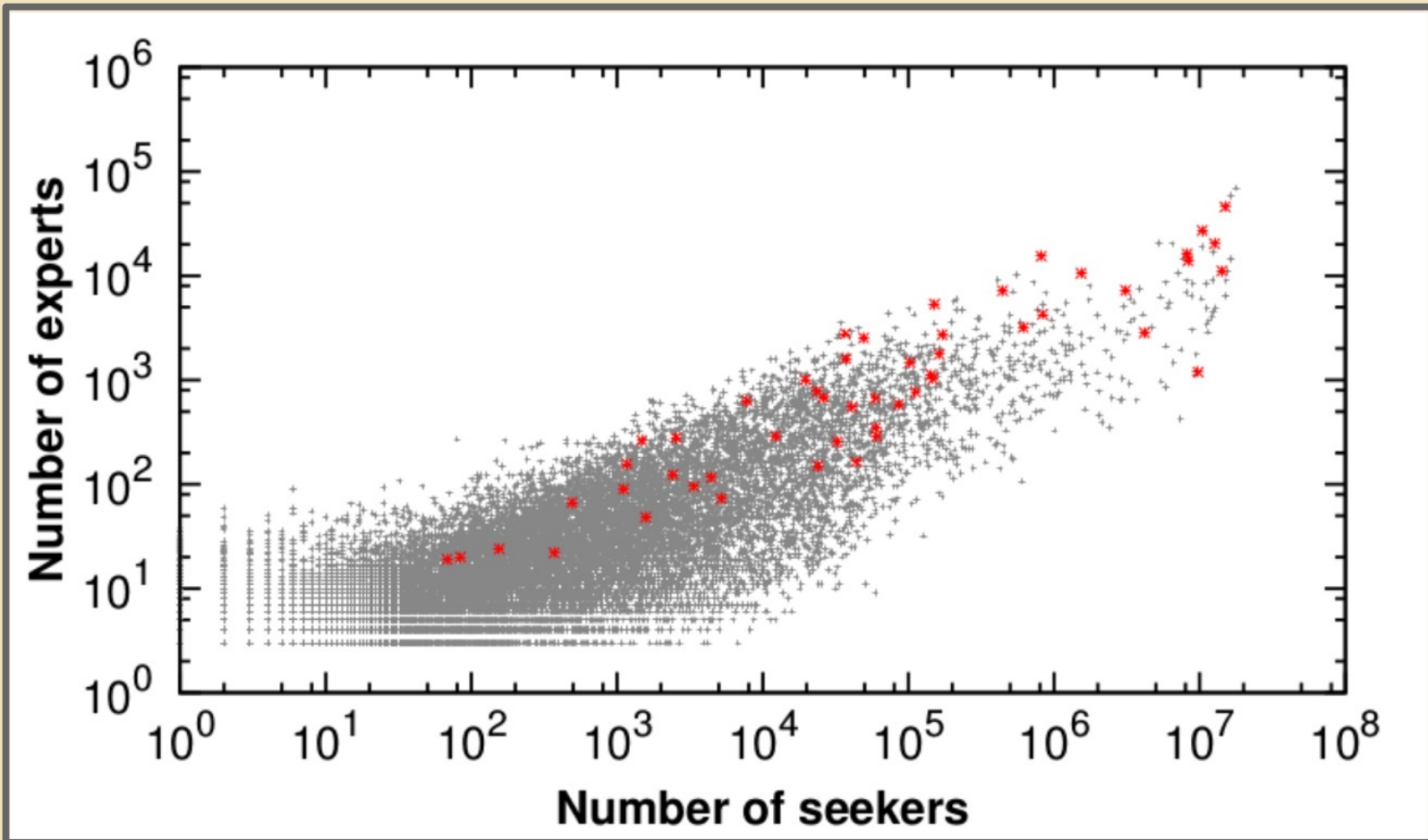
High Topicality

## Bond Based Groups

High Reciprocity

High Personal Interactions

Low Topicality



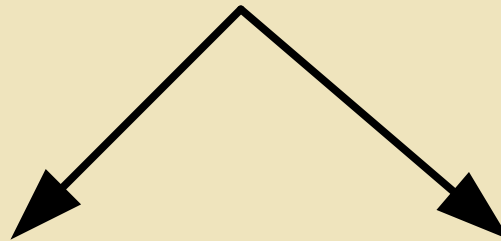
We picked 50 topical groups for detailed analysis  
The 50 groups are spread across the spectrum

# Reciprocity and Interactions

- Reciprocity in Topical Groups is **Low**
  - **High** between experts (0.3-0.6)
  - **Low** between experts and seekers (0.2)
- One-to-one interaction is **Low**
  - Further details in paper

# Topicality of Discussions

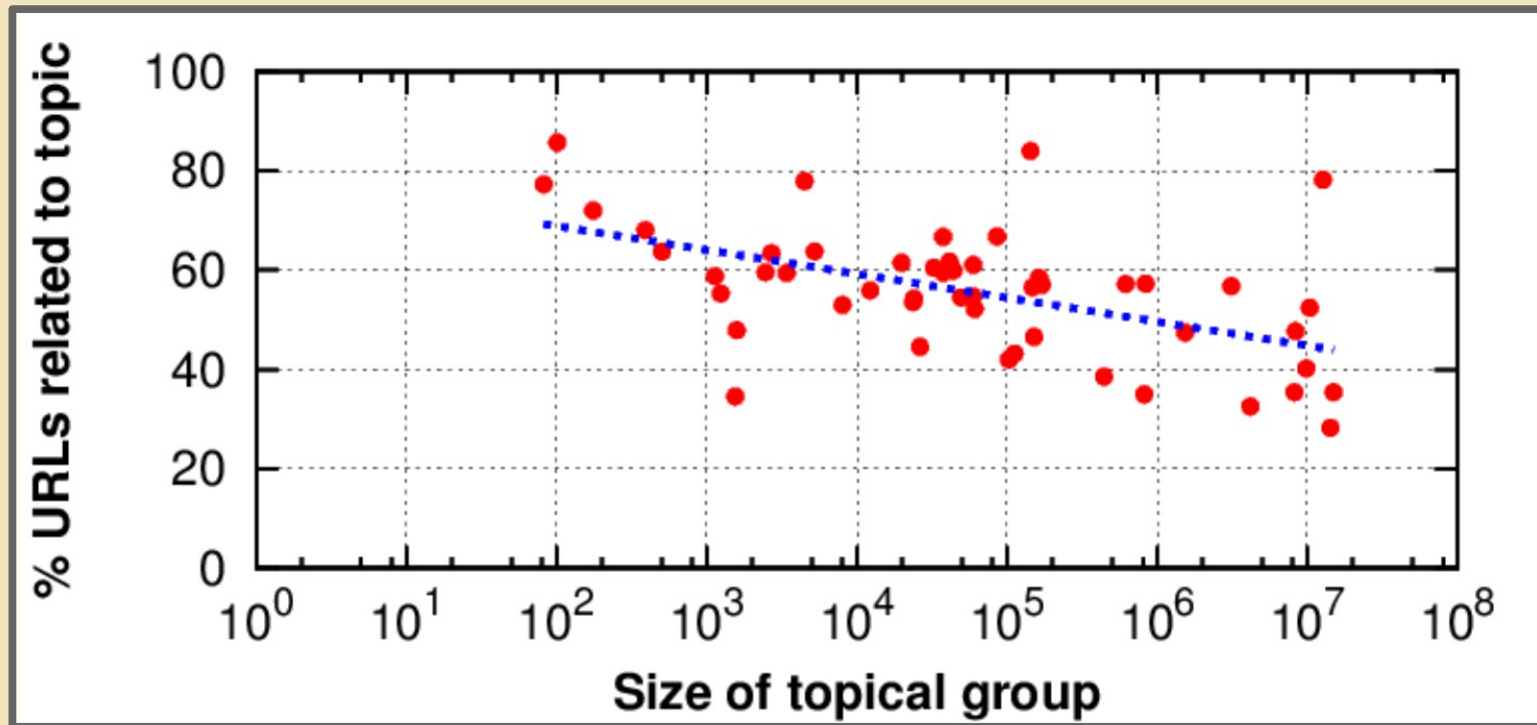
http:// ...



Named Entities

Keywords

# Expert's Tweets are very Topical



Related urls are more than 50% for 36 groups.

Implication: Useful for content mining systems.

# Topical Groups are Identity Based

Low Overall Reciprocity

Low Personal Interactions

Highly Topical Tweets

Implications: Difficult to detect via community detection

# Implications

- Topical News and Search Systems
- Topical Recommender Systems
- Emerging Expert Detection Systems

# Conclusion

- Twitter is a rich source of niche content
  - We found thousands of groups on niche topics
- Topical Groups are Identity Based Groups
  - With low connectivity and high topicality

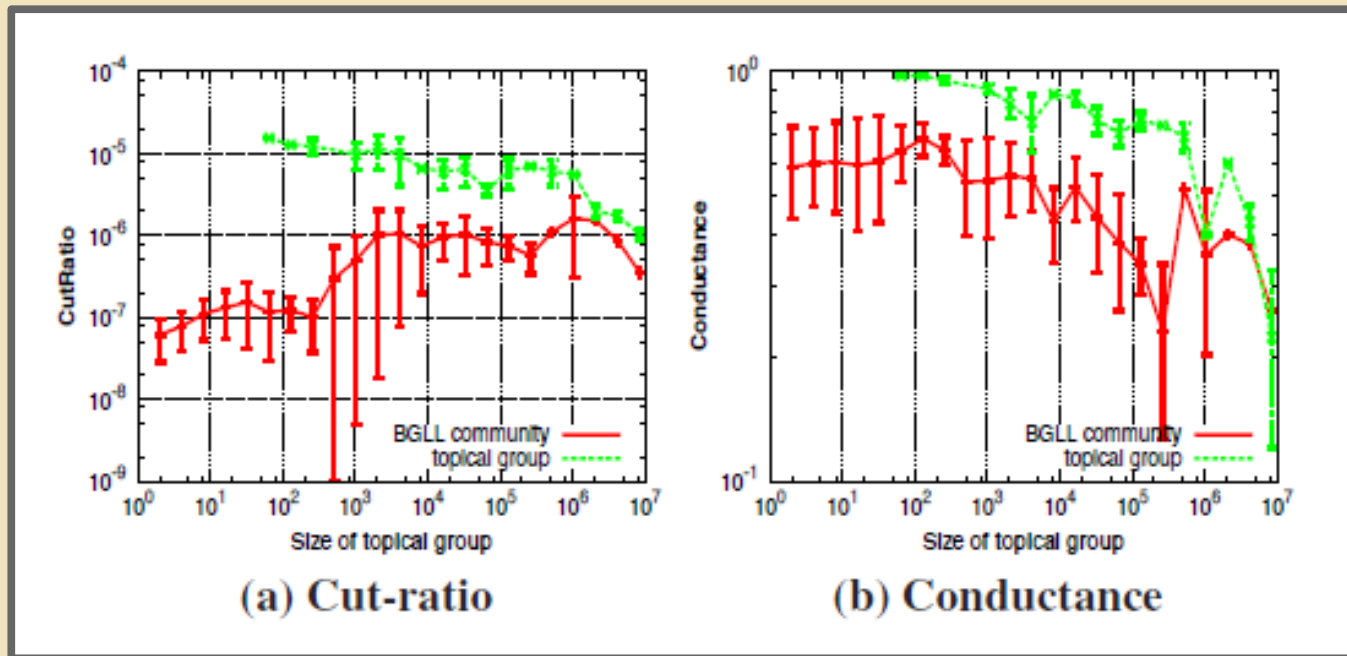
# Conclusion

- Twitter is a rich source of niche content
  - We found thousands of groups on niche topics
- Topical Groups are Identity Based Groups
  - With low connectivity and high topicality

Thank You!

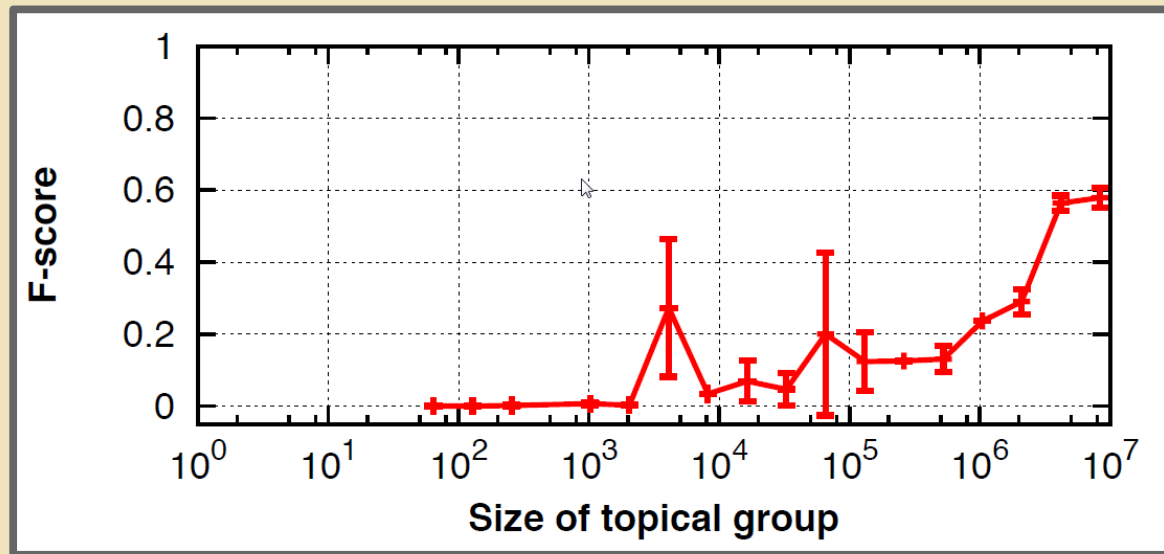
Backup Slides

# Cut Ratio and Conductance of Topical Groups



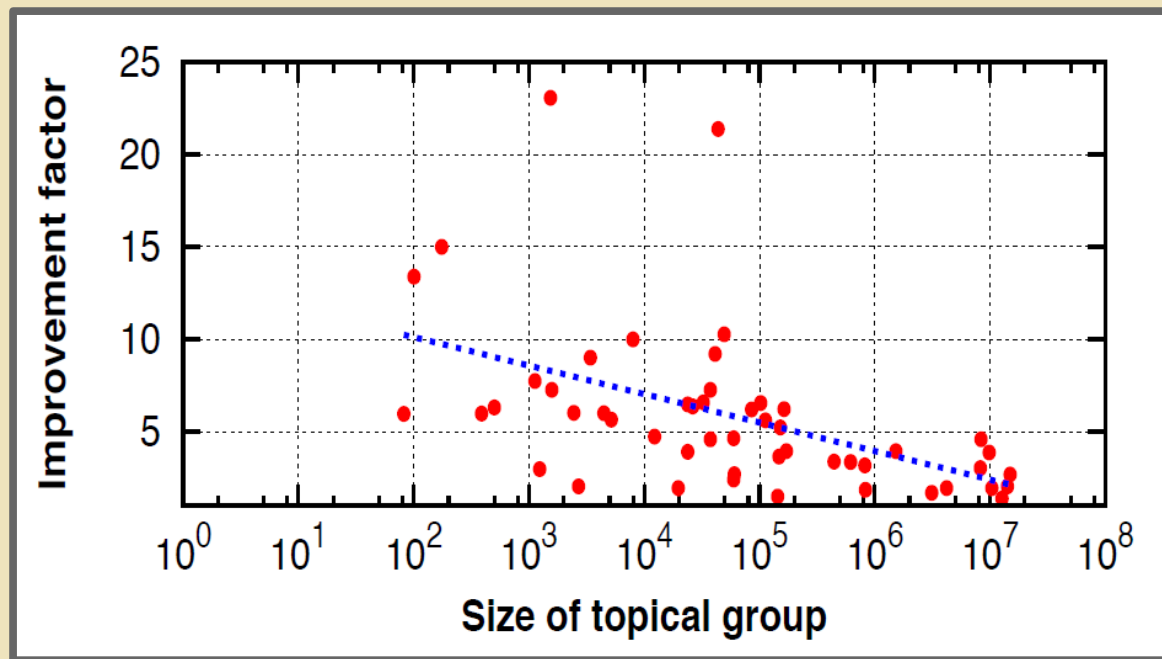
BGLL communities have much lower cut ratio and conductance.

# F-Score between Topical Groups and Best Matching BGLL Groups



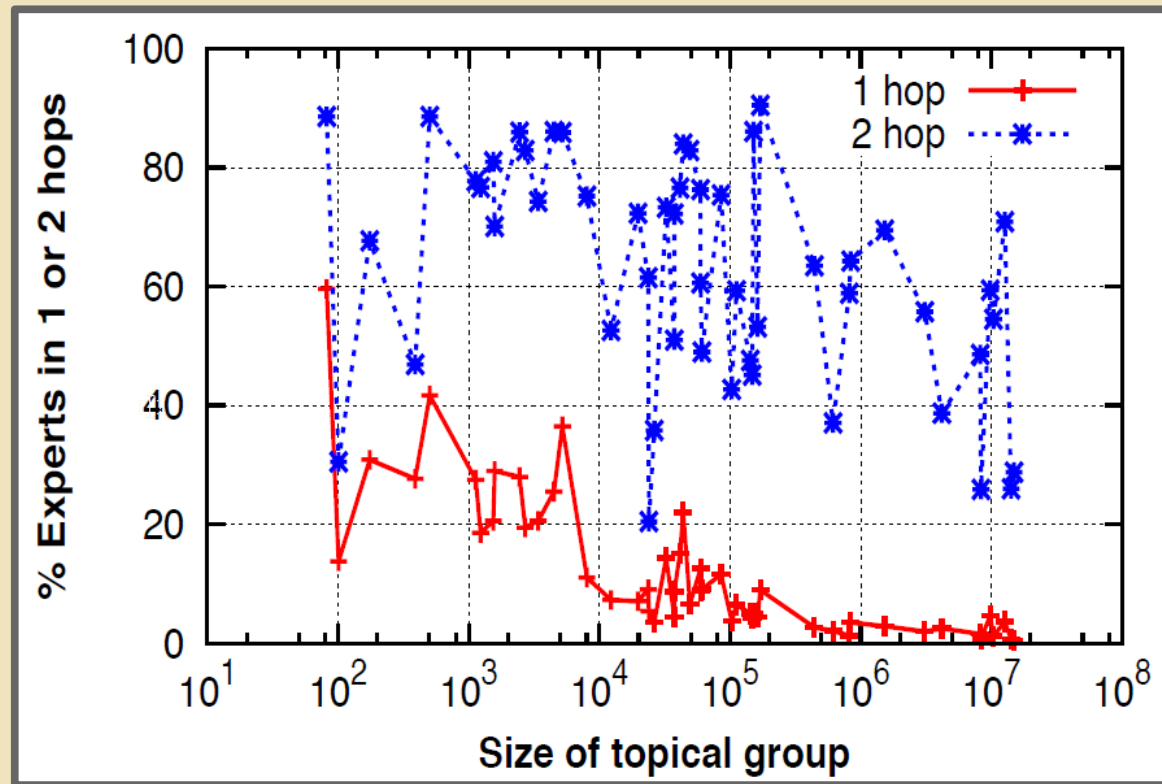
Topical Groups and BGLL communities don't match.

# Expert URLs vs. Random URLs



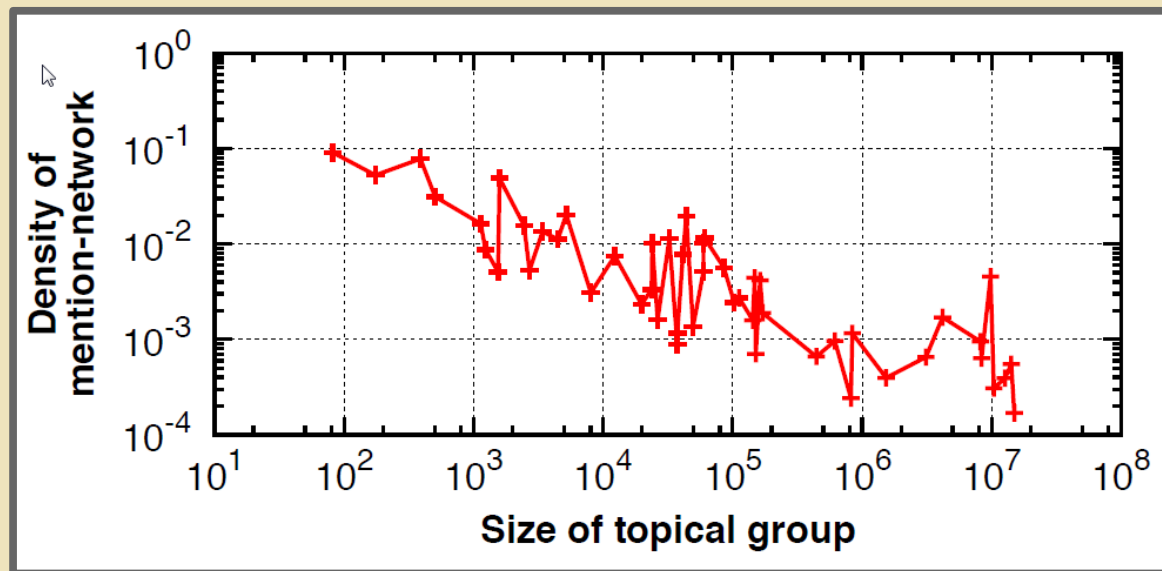
For niche topics, expert urls are 10 times more on topic.

# Expert Proximity



Experts are within two hops of 60-80% other experts.

# Density of Expert Mention Network



Destiny of mentions is much lower than connections.

# Mashable Lists



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@mashable

News, resources, inspiration and fun for the connected generation. Tweets by @mashable staff.

mashable.com

94,211

TWEETS

2,733

FOLLOWING

3,712,263

FOLLOWERS



Following

**Health** by Mashable

News sources and individuals tweeting on health info, tips & news.

19 members



**Web** by Mashable

Wanna stay up on Web news? This is your list.

43 members



**News** by Mashable

A curated list of news organization's Twitter accounts.

34 members



**Tech** by Mashable

Experts and sources to keep up with the latest in tech.

69 members



**Design** by Mashable

Tweets and tips from designers.

40 members



**Food** by Mashable

Love food? Here are chef's, cooks and others in food to follow.

14 members



**Tech** by Mashable

Experts and sources to keep up with the latest in tech.

69 members



News, resources, inspiration and fun for the connected generation. Tweets by  
@mashable staff.  
mashable.com

94,211

2,733

3,712,263



Following



**Tim O'Reilly** ✓ @timoreilly

Founder and CEO, O'Reilly Media.  
Watching the alpha geeks, sharing  
their stories, helping the future unfold.



**Cory Doctorow** ✓ @doctorow

Writer, blogger, activist. If you want a  
reply, use email. Blog suggestions  
here: <http://www.boingboing.net/suggest.html>

**News** by Mashable

A curated list of news organization's Twitter a  
34 members

**Tech** by Mashable



**Guy Kawasaki** ✓ @GuyKawasaki

Advises Motorola. Author of APE:  
Author, Publisher, Entrepreneur. Free  
Kindle version here  
<http://apethebook.com/anniversary/>  
Former chief evangelist of Apple.



**Tech** by Mashable

Experts and sources to keep up with the latest in tech.

69 members



News, resources, inspiration and fun for the connected generation. Tweets by  
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Co-Host of The Kitchen on Food Network, and author of Groundswell, The Comfort Table, and The Comfort Table: Recipes for Everyday Occasions



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