NASN 2017

1st North American Social Networks Conference – NASN2017

Kimpton Palomar, Washington, DC, 26-30 July 2017

2017 Conference Organizers

Ian McCulloh, Johns Hopkins University

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ABSTRACTS

INSNA
INTERNATIONAL NETWORK FOR SOCIAL NETWORK ANALYSIS

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Parallel Oral Presentations

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1010-1040	Coffee Break		

Thursday AM2

	LGBTQ Networks, Health, and Social Support	Assessing Credibility and Responding to Misinformation in Online Social Platforms	Defense
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1120-1140	HIV-related behaviors and peer network exposure on Facebook: The networked contexts of peer influence in a multidimensional online social networking environment among young Black men who have sex with men (YBMSM) *(Lindsay Young, Kayo Fujimoto and John Schneider)*	Botnets and Propaganda Dissemination *(Rick Galeano, Dr. Nitin Agarwal and Samer Al-Khateeb)*	Department of Defense Funders Panel (Andrew Slaughter, ARI Edward Palazollo, ARO Liz Bowman, ARL Ben Knott, AFOSR)
1140-1200	Social capital and HIV-serodiscordance: Differences in the access to personal and professional resources for HIV-positive and HIV-negative partners *(James Iveniuk, Liviana Calzavara, Sandra Bullock, Joshua Mendelsohn, Dan Allman, Ann Burchell, Laura Bisaillon, Amrita Daftary, Bertrand Lebouché, Renée Masching, Tamara Thompson, Jocelyn Watchorn and The Positive Plus One Team)*	Framing and Collective Action *(Gunes Ertan)*	
1200-1220	"Everybody puts their whole life on Facebook": Identity management and the online social networks of LGBTQ youth (*Elizabeth McConnell, Balint Neray, Kai Korpak, Antonia Clifford and Michelle Birkett*)	Exploring Alt-News Article Citation Network *(Janis Butkevics and Beatrice Garcia)*	
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Thursday PM1

	Financial Networks	Modeling Networks	Health
Time	National Ballroom	Corcoran	Kreeger
1400-1420	Pricing Network Effects: Competition *(Itay Fainmesser and Andrea Galeotti)*	Network Influences on Policy Implementation: Evidence from a Global Health Treaty *(Thomas Valente, Stephanie Pitts, Heather Wipfli and George G. Vega Yon)*	The Diffusion of EHR Incentive Programs in Physician Patient-Sharing Networks *(Meng-Hao Li)*
1420-1440	Network Reactions to Banking Regulations *(Selman Erol and Guillermo Ordonez)*	Analyzing Published Global Ebola Virus Disease Research Using Social Network Analysis *(Christiane Hagel, Peter Tinnemann, Felix Weidemann, Stephan Gauch and Suzanne Edwards)*	Bringing voice in policy building: Using Group Concept Mapping to create a cross-population multi-stakeholder conceptual model for management of acute unscheduled care in the United States. *(Gaetano Romano Lotrecchiano, Mary Kane, Mark S Zocchi, Jessica Gosa, Danielle Lazar, Jesse Pines)*
1440-1500	Stable Networks with Local Social Rankings *(Chen Cheng and Yiqing Xing)*	Global Networks of Science and Future Science Policy: The Role of U.S. Research Universities in Collaboration and Internationalization of New Scientific Knowledge *(Alina Lungeanu, Yuan-Chih Fu, Liang Zhang and David Baker)*	National Institute of Health (NIH) Funders Panel (Kayla de la Haye)
1500-1520	Sustaining Cooperation with Multiple Relationships *(Chen Cheng, Wei Huang and Yiqing Xing)*	Approximate Variational Estimation for a Model of Network Formation *(Angelo Mele and Lingjiong Zhu)*	
1520-1540	Director Appointments – It is Who You Know *(Jay Cai, Tu Nguyen and Ralph Walkling)*	Modeling the Effects of Research Assessments on Scientific Collaboration. The Case of the British "Research Excellence Framework" *(Raphael H. Heiberger and Oliver Wieczorek)*	
1540-1600	Coffee Break		

Poster Session, Wine Reception, and Network Slam

1700-1800 Phillips Ballroom

Hospitality Suite

2100-2400 Penthouse Suite

Friday AM1

	Political Discourse	Global Conflicts 1	Organizational Networks
Time	National Ballroom	Corcoran	Kreeger
0730-0830	Breakfast		
0830-0850	Digital Media in Greece: Cyberconflict, networks and discourse *(Ioanna Ferra)*	Infighting and Network Structure in the Syrian Insurgency *(Michael Gabbay, Emily Gade and Mohammed Hafez)*	Contingent Career Benefits of Information Diversity and Information Novelty During an Organizational Merger *(Jesse Fagan, Andrew Shipilov and Joe Labianca)*
0850-0910	Radical Right Media and Politicians within the Hungarian Media Network *(Attila Farkas)*	Creating Network-Based Communication Interventions to Increase Community Resilience: A Demonstration for an African Nation Recovering from Muslim-Christian Civil War *(James Danowski)*	Using electronic trace data to study social network changes related to an open office environment *(Alex Perrone, Nathan Bos and Ariel Greenberg)*
0910-0930	"Voters of the Year": 19 Voters Who Were Unintentional Election Poll Sensors on Twitter *(William Hobbs, Lisa Friedland, Kenneth Joseph, Oren Tsur, Stefan Wojcik and David Lazer)*	War by Other Means: Networks of Diplomacy and their Effects on War and Peace, 1648-1815 *(Michael Schultz and Jonah Stuart Brundage)*	Characterization of the strength of ties in the context of evaluating the Children's Mental Health Initiative Systems of Care *(Grace Huang, Sushama Rajapaksa, Joselin Bravo, Preethy George and Chandria Jones)*
0930-0950	A Twitter Social Contagion Monitor *(Vladimir Barash, Aurora Schmidt, Clayton Fink, Christopher Cameron, Wei Dong, John Kelly and Michael Macy)*	Evaluating Policy Networks in Afghanistan and Pakistan: A Relational Assessment of Aid-Impact in Fragile States *(Elsa T. Khwaja)*	Self-Organised Networks at the Edge of Chaos: A New Perspective for Managing Complex Construction Projects *(Huda Almadhoob and Stephen Pryke)*
0950-1010	Social Media Firestorms *(Alicia Bargar, Rich Takacs, Brant Chee, David Silberberg, and Ian McCulloh)*	Combining Agent-based Modeling with Social Network Analysis to Reproduce an ISIS Social Media Network *(Joseph Shaheen)*	Evaluating Institutional Coalescence with the Aid of Exponential Random Graph Models *(Philip Murphy, Fernando Depaolis, and Brendan Knapp)*
1010-1040	Coffee Break		

Friday AM2

	Theory	Network Dynamics	Model Validity
Time	National Ballroom	Corcoran	Kreeger
1040-1100	PDGM: Percolation-based Directed Graph Matching in Social Networks *(Lijing Wang, Jin-Hee Cho, Ing-Ray Chen and Jiangzhuo Chen)*	How I stopped worrying and learned to love the passage of time *(Maksim Tsvetovat)*	On the Validity of the Bayesian Network Accuracy Model *(Francis Lee and Carter T. Butts)*
1100-1120	Graph properties affecting link analysis *(Anthony Johnson, Nathan Bos, Rebecca Rhodes, Isaiah Harbison)*	The role of temporal data and the patterns of interaction in the interpretation tie strength and stability. *(Michael Penta)*	Tools for Assessing the Model Adequacy of Exponential Graph Models (ERGMs) and Comparing Sets of Networks Using Labeled Features *(Nolan Phillips and Carter Butts)*
1120-1140	Vertex Nomination Via Local Neighborhood Matching *(Heather Patsolic, Youngser Park, Vince Lyzinski and Carey Priebe)*	Varying-Coefficient Models for Dynamic Networks *(Jihui Lee, Gen Li and James D. Wilson)*	Determining consistency of a network model with a particular contact network *(Madhurima Nath, Yihui Ren and Stephen Eubank)*
1140-1200	An efficient counting method for the colored triad census *(Jeffrey Lienert, Laura Koehly, John Finney, Christopher Marcum and Felix Reed-Tsochas)*	N-Human Dynamical Influential System and Model *(Ridwan Jalali)*	Goodness-of-Fit Testing for Behavior in Joint Dynamic Network/Behavior Models with an Extension to Two-Mode Networks *(Cheng Wang, Carter T. Butts, John R. Hipp, Rupa Jose and Cynthia M. Lakon)*
1200-1220	Matched bipartite block model with covariates *(Zahra Razaee, Arash Amini and Jingyi Jessica Li)*	Alignment-induced analysis of Dynamics in Spatial Social Networks *(Edwin Vargas)*	Comparing network clustering methods with human perception *(Nathan Bos, Anthony Johnson, Rebecca Rhodes, Isaiah Harbison)*
1220-1400	Lunch		

Friday PM1

	Management and Influence	Adolescent Networks	Global Conflicts 2
Time	National Ballroom	Corcoran	Kreeger
1400-1420	Leveraging Social Network Analysis & Cyber Forensics Approaches to Study Cyber Propaganda Campaigns *(Samer Al-Khateeb, Muhammad Hussain and Nitin Agarwal)*	The diffusion of smoking initiation among diverse, urban American adolescents over the high school period *(Kayla de La Haye, Hee-Sung Shin, George Vega Yon and Thomas Valente)*	Cyber Aggression and the Language of Dark Personalities among Russian Facebook Users *(Olga Bogolyubova, Yanina Ledovaya, Polina Panicheva and Roman Tikhonov)*
1420-1440	The effect of FDA recalls on the strategic alliance networks in the medical device industry *(Angelo Mele and Shweta Gaonkar)*	Popularity in Context: Global and Local Status in Adolescent Friendship Networks *(James Murphy)*	Influence Power and Allegiances: Let the Model Fit the Culture *(Gwyneth Sutherlin)*
1440-1500	The Role of Twitter in the 2016 U.S. Congressional Races *(Yotam Shmargad, Jordan Bruce, Zuleima Cota, Erman Gurses, Jeff Jensen, Colin Kyle, Don-E Merson, Lance Sacknoff, Farig Sadeque, Karthik Srinivasan and Limin Zhang)*	Roma Undergraduates' Personal Network in the Process of College Transition. A Social Capital Approach. *(Bea David and Agnes Lukacs)*	Transitivity of Joint Interests among Key Actors in Conflict Syria and Iraq: Implications for a Post-ISIS Middle East *(Lawrence A. Kuznar and Allison Astorino-Courtois)*
1500-1520	Mapping the Political Economic Landscape of Educational Technology: A Networks Perspective *(Priscilla M. Regan and Elsa T. Khwaja)*	Friendship relationship formation in Year 1 students *(Daniel Tischer and David Hughes)*	Network visualization for military planners *(Ian McCulloh)*
1520-1540	Oligarch Networks *(John Sutherland Earle, Scott Gehlbach, Anton Shirikov and Solomiya Shpak)*	Caregiving networks of children affected by inborn errors of metabolism *(Laura Koehly, Kathleen Marcum, Mindy Perilla, Hena Thakur, Jennifer Cleary, Sarah Sadozai, Dawn Lea, Betina Hollstein and Christopher Marcum)*	Geospatial and Social Network Causes of Group Violence *(Christopher J. Callaghan, Daniel Cunningham, Sean F. Everton, and Kristen Tsolis)*
1540-1600	Coffee Break		

Friday PM2

	Political Discourse	Health	Panel
Time	National Ballroom	Corcoran	Kreeger
1600-1620	Evaluating Political Party Cohesion Using Exponential Random Graph Modeling *(Shambavi Sadayappan and Ian McCulloh)*	A Bayesian Model for Multiple Informant Family Health History Prediction *(Christopher Marcum, Jielu Lin, Melanie Myers and Laura Koehly)*	Exploring Network Approaches to Science and Innovation (Jonathon E. Mote, & C. Scott Dempwolf)
1620-1640	Detecting and Exploring Networks of Justice Discourse in Social Media *(Kimberly Glasgow)*	Disparities in Slum Health and Its Impact on Larger Urban Regions *(Shuyu Chu, Christopher Kuhlman and Achla Marathe)*	
1640-1700	Group Polarization in Opinion Network Dynamics *(Michael Gabbay, Zane Kelly, Justin Reedy and John Gastil)*	A Framework for Learning Health Disparities Among Cohorts in An Influenza Epidemic *(Lijing Wang, Jiangzhuo Chen and Achla Marathe)*	

Keynote Speaker

1730-1830 National Ballroom

Banquet

1900-2030 Phillips Ballroom

Hospitality Suite

2100-2400 Penthouse Suite

Saturday AM1

	Teams	Social Experience	Vizards
Time	National Ballroom	Corcoran	Kreeger
0730-0830	Breakfast		
0830-0850	Network Structure Explains the Relationship between Social Abilities and Team Performance *(Jennifer Labrecque and Kayla de La Haye)*	Secondhand Social Capital: Boundary Spanning, Secondhand Closure, and Individual Performance *(Neha Shah, Daniel Levin and Rob Cross)*	Vizards Session (Ian McCulloh)
0850-0910		The Friend of My Friend is My Enemy?: Modeling and Analyzing Social Balance in an Online Community *(Christine Sowa, Ian McCulloh)*	
0910-0930	Coevolution of interpersonal perceptions and team structure in long-duration space exploration missions *(Igor Zakhlebin, Alla Vinokhodova, Vadim Gushin, Suzanne Bell, Leslie Dechurch and Noshir Contractor)*	The social consequences of networked individualization *(Snorre Ralund)*	
0930-0950	Looking across borders: Antecedents of interterm advice seeking *(Evgenia Dolgova, Dianne Bevelander, Michael Page and Karen Stephenson)*	Corrosive Density *(Yotam Shmargad and Jameson Watts)*	
0950-1010	"Social smarts" shape social networks (*Kayla de La Haye and Jennifer Labrecque*)	Collectivism, Social Stigma, and Structural Holes among Old Female Sex Workers in China. *(Yuruo Li and Hongjie Liu)*	
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Saturday AM2

	Workplace and Academia	Activism	Local Resiliency
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1100-1120	The Role of Brokers in Academic Network Building *(Diego Gomez-Zara, Wouter Vermeer, Zachary Gibson, Connor Bain, Gabriella Anton, Leslie Dechurch, Uri Wilensky and Noshir Contractor)*	When Theory Meets Practice: Exploring Challenges to Information Sharing Networks for Community Change *(Jennifer Lawlor and Zachary Neal)*	Cancer communication networks of rural Appalachian women *(Kate Eddens and Jesse Fagan)*
1120-1140	Modeling Network-level Effects on Subgroup Insularity *(Tracy Sweet and Qiwen Zheng)*	#Unite! Group Identity and Protests in the Internet Era *(Alicia Bargar and Jessica Kuperavage)*	Socio-Cultural Cognitive Maps *(Kathleen Carley)*
1140-1200	Academic Influence of Social Network Sites on the Collegiate Performance of Technical College Students *(Jameson Mcfarlane)*	An Analysis of the #BringBackOurGirls Movement Using Spectral Clustering of Tag Adoption *(Aurora Schmidt, Clay Fink, Vladimir Barash, Christopher Cameron and Michael Macy)*	The Effects of Lay and Formal Support Resources on Recovery from Serious Mental Illness *(Erin Pullen and Brea Perry)*
1200-1220	Structured Text Analysis for Evaluating Shared Cognition *(Michael Schultz, Leslie Dechurch and Noshir Contractor)*	Networks, Epidemics, and the Rise of Christianity *(Sean F. Everton and Robert Schroeder)*	Modelling the resilience of coastal communities: the co-evolution of cultural views and stakeholder networks *(Christina Prell, Michael Paolisso, Katherine Johnson, Klaus Hubacek and Brian Needleman)*
1220-1400	Lunch		

Saturday PM1

Time	National Ballroom	Corcoran	Kreeger
1400-1420	Research Speed Dating (Ian and Kim)	Making SNA Elementary Middle/High School Outreach STEM Education Reaching Underserved Populations with SNA (Tony Johnson & Cory Bradley)	Dark Networks Panel (Adam Jonas, TRADOC Tom Valente, USC Jon Roginski, USMA Kathleen Carley, CMU Sean Everton, NPS)
1420-1440			
1440-1500			
1500-1520			
1520-1540			
1540-1600	Coffee Break		

Saturday PM2

	Diversity in Research	Categorical Data	Trade and Transporation
Time	National Ballroom	Corcoran	Kreeger
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1620-1640	Cultivating the Conference Culture: The Role of Diversity in Interdisciplinary Meetings *(Zachary Gibson, Gabriella Anton, Wouter Vermeer, Diego Gómez-Zará, Connor Bain, Leslie Dechurch, Uri Wilensky and Noshir Contractor)*	Author Attibute Classification for Social Media *(Thomas Lippincott, Nicholas Andrews and Benjamin Van Durme)*	Globalization, Trade Networks, and Regional Trade Blocs: Alternative Routes to Development *(Martin Jacinto)*
1640-1700	Assessing Race Differences and Experimental Effects of Question Phrasing on Personal Networks using Mechanical Turk. *(Jerreed Ivanich, Michael Siciliano and Marina Stavrakantonaki)*	Image Classification Based Social Network Analysis Constructs *(Rich Takacs, Janis Butkevics, Christine Sowa, Stephanie Pitts, and Ian McCulloh)*	All Roads Lead to Rome: The Story of How Transportation Network Induces Agglomeration *(Ahmed Mahmud and Sumit Joshi)*

Hospitality Suite

2100-2400 Penthouse Suite

Posters

Thursday, 27 JULY, 5PM-6PM, Phillips Ballroom

Wine reception will be held during the poster session

Title	Authors
An Analysis of Network Structure and Characteristics of Academic Areas in Korea	Minki Kim
Analysis of Network Influence on Legislation of Science and Technology in Korea – Focused on National Assembly Members	Seung Tai Kim and Su Hyeon Jung
The Social Networks of Individuals with Down Syndrome	Anne Roll
Measuring Relationalized Respeto and Understanding Its Impact on Smoking Behavior Among Mexican Heritage Adults Residing in the United States	Hena Thakur, Jeffrey Lienert, Christopher Marcum, Alexander Prokhorov, Anna Wilkinson and Laura Koehly
Using a Network Approach to Explore Coping Resources Needed by Families Affected by Inborn Errors of Metabolism	Jennifer Cleary, Hena Thakur, Pearl Eni, Jeffrey Lienert, Dawn Lea, Christopher Marcum and Laura Koehly
An Applied Social Network Analysis of how College Application Patterns vary by Geography and Information	Daniel Klasik
Agricultural Resource Networks of Kenyan Smallholder Farmers	Stacey Giroux and Tom Evans
Socioeconomic disparities in geographic access to HIV/AIDS prevention and care services provided by a health service network serving young Latino MSM	Mariano Kanamori, Kayo Fujimoto, Mark Williams, Sheyla Aguilar de Santana, John Schneider, Mary Jo Trepka and Mario De La Rosa
Network Canvas: A comprehensive suite for capturing network data	Patrick Janulis, Gregory Phillips, Joshua Melville, Bernie Hogan, Noshir Contractor, Michael Bass and Michelle Birkett
A Rationale for Using Social Network Analysis To Examine The Influence of Social Networks On The Resilience of Grandparents Raising Grandchildren	Nancy Mendoza and Christine A. Fruhauf
Venue avoidance and impact on HIV risk and prevention behavior among young Black MSM	Kayo Fujimoto, Peng Wang, Lisa Kuhns and John Schneiders
Organization network analysis, community detection and modularity in graphs	Anshuman Guha and Eyob Gebremariam
A comprehensive study on improving supervised feature based link prediction in social networks.	Christian Haas, and Lale Madahali

Abstracts

#Unite! Group Identity and Protests in the Internet Era

Alicia Bargar and Jessica Kuperavage

In this research, we explore how self-identity and group identification play into the spread of negative word-of-mouth campaigns on social media. Online protests spread rapidly despite the lack of a clear social structure or promotional strategy. We believe that a key component of this process is self-editing by social media users, which may say less about the individual's commitment to a cause than about how this action fits into the individual's self-constructed identity as a member of certain groups (i.e. LGBT, Asian-American, professional journalist) or as a person with certain characteristics (i.e. empathetic, politically-conscious). The design of social media platforms like Twitter or Reddit may further exaggerate similarities among users and therefore inflate the appearance of a cohesive social group among independent actors. Here, we consider whether there is a correlation between the growth patterns of a given protest and the emergence of a cohesive group identity.

We examine the following questions: do characteristic identity markers appear across the user-generated content of early protest adopters? Are these identity markers indicative of the characteristics of later adopters? We also examine cases where participants with alternate agendas emerge, including counter-protestors or news media organizations.

We will address these questions using a blend of social scientific theory, social network analysis, and natural language processing to analyze user content during an online protest. In doing so, we aim to better understand the dynamics that contribute to viral online movements, including personal characteristics of early and late protest joiners and the role of group identity as a predictor of participation.

A Bayesian Model for Multiple Informant Family Health History Prediction

Christopher Marcum, Jielu Lin, Melanie Myers and Laura Koehly

Family Health Histories (FHH) are widely used in clinical and research practice to evaluate the shared genetic and environmental risk for common complex diseases. FHH data may be captured from a single patient or research subject's verbal or written report on the health and disease status of their first and second degree relatives (e.g., biological siblings, parents, aunts/uncles, and grandparents). This information may then be used to estimate risk for that individual (or a relative, such as a child) by one or more algorithms. Past research on informant accuracy, however, suggests that this single informant approach may not yield high quality data. For instance, many individuals may be unaware about the disease diagnoses, causes of death, and health behaviors of their family members, or may be subject to other cognitive processes (i.e., subterfuge, social desirability) that bias their responses. Our past work has taken steps to address informant inaccuracy by collecting FHH data from multiple informants in the same family network, representing a novel approach to

improve risk assessments. One open question, however, is how to optimally integrate these multiply-sourced data into individual risk assessments. To address this question, we developed and evaluated a dyadic (informant-informee) model based on a Bayesian hierarchical logistic regression classifier. The model has the advantage of incorporating meaningful priors on population-level parameters (such as disease prevalence uncertainty) while accounting for sources of predictive heterogeneity at the level of the informant-informee dyad simultaneously with that at the level of the informant. Our example data are drawn from 45 families with high diabetes prevalence (37% vs 12% in the population). Each family had an average of 2.8 informants and 28.3 informees (including loops). Preliminary results predicting type-2 diabetes status (for example) indicate our best fitting model includes gender homophily and absolute generational difference, as well as informant knowledge of informee health behaviors (i.e., tobacco use, weight management, and alcohol use) at the dyadic level while adjusting for variation in obesity status and gender at the level of the informant. This preliminary model yields very good dyadic and individual level classification (AUC=0.82 and AUC=0.85, respectively). How these results shed light on reconciling multiply-sourced FHH, specifically, and network informant accuracy problems, generally, will be discussed.

A Framework for Learning Health Disparities Among Cohorts in An Influenza Epidemic

Lijing Wang, Jiangzhuo Chen and Achla Marathe

Infectious disease epidemics such as influenza and Ebola pose a serious threat to global public health. Certain demographics and cohorts have higher risks of getting infected than others due to a variety of factors.

This research builds a computational framework that provides a general methodology for learning disparities in different dimensions based on individual level features (e.g., age or income, etc.). Specifically, in this research, the framework is applied to study health disparities arising from an influenza epidemic in the Montgomery county of Southwest Virginia. In one scenario, no interventions are applied to control the epidemic (base case) and in the other scenario vaccine-based intervention is applied to cohorts that are split by age and income. Age cohorts are: 0-4 year olds (preschool); 5-19 year olds (school); 20-64 year olds (adult); and above 65 years (senior); and income cohorts correspond to 4 income quartiles.

We apply an SEIR (Susceptible, Exposed, Infected and Recovered) disease model to the social contact network of the Montgormery county to simulate the health states of each individual under each scenario. For each case we run 30 replicates. The transmission rate is calibrated to have an overall attack rate (or cumulative infection rate) of 40%. The vaccination intervention is assumed to have 50% compliance rate. After each simulation, the infected cases are assigned one of the four outcomes: death following hospitalization; hospitalization resulting in discharge; medically attended but not involving hospitalization; and illness not medically attended. These outcomes are assigned by using predefined probability distribution of risk level and age, as provided by the Center for Disease Control and Prevention.

Our results show significant health disparities in terms of attack rate across age groups and income groups, and economic disparities among age groups. The metrics for measuring the economic disparities include net return per capita, net return per vaccinated person, and net return per dollar spent. We also find that if vaccines are assigned randomly without priorities, then the intervention is least effective for school-aged children cohort. Given the high connectivity of school-aged children in the social contact network, they are at a disadvantage if the vaccine assignment is random. Simulations show that if priorities are considered for vaccine assignment, then the school-age group should be given the highest priority for maximizing net returns and minimizing death rate, especially during an influenza season that has high transmissibility and low compliance to vaccination. Our research provides a general method to studying health disparities among subpopulations. Furthermore, it provides a methodology for evaluating different intervention strategies in terms of specific objectives, through simulations. Sensitivity analysis on attack rate and compliance rate also shows the robustness and reliability of the framework.

A Network View of Epistemology: Uncovering Patterns of Race, Gender, and Sexuality Inequality in the Production of Knowledge

Jasmina Tacheva and Tanya Loughead
This paper investigates a dynamic meta-network of scientists, philosophers, and artists over the course of several centuries where nodes are individuals and edges represent three types of relations: 1) ""direct influence"" derived from references and bibliographies in the researchers' works, 2) ""mentored by"" and intellectual friendship relationships recovered from biographical records, and 3) familial ties such as ""married to"" or ""child of,"" among others. We focus on several network- and node-level properties such as community structure, multiplexity, and centrality measures in order to flesh out processes of knowledge formation with a two-fold goal: 1) demonstrate the usefulness of a network approach to epistemology for both research and learning, and 2) use the network view to uncover concrete structural and relational causes of the race-, gender-, and sexuality-gaps in research and culture. Regarding the first goal, we argue that a network view of the history of knowledge helps learners see connections (both direct and direct) among different thinkers spanning multiple time periods that remain hidden in the traditional, overly individualist framework focusing on intellectuals as solitary, self-sufficient producers of knowledge and culture. A way to demonstrate the advantages of an social network analysis (SNA) approach to epistemology is through our second objective, for instance in the case of women. Far from being devoid of women's presence, our network approach to epistemology shows the intellectual canvas of humanity was studded with women, active in philosophy (e.g. Aspasia), the sciences (Laura Bassi in the 18th c.), and arts (Dhuoda). These are not isolated cases but rather a constant presence; what SNA helps uncover however, is systematic underreporting on the part of men of the intellectual influences of women (sparse direct influence ties between the two genders) that can nonetheless be gleaned from the other edge types (friendship and family). We also know that women were the cohesive structural support for the

network, pivotal in bringing male thinkers together by hosting regular salons (in the past) or maintaining cultural milieus such as retreats and bars nowadays, thus assuming the network role of brokers spanning structural holes. The individualist view of knowledge production ubiquitous today, however, has relegated this cultural work to oblivion, which sparks a debate about whether traditional SNA concepts such as brokerage apply equally to representatives of the dominant culture and minorities. We apply the same analytical approach to researching issues of race and sexuality. While we are aware of the inevitable bounding and sampling issues with this network, we also believe it is an important example of employing SNA methodology to issues of justice.

A Pilot Test of a Motivational Interviewing Social Network Intervention to Reduce Substance Use among Housing First Residents

David Kennedy, Karen Osilla, Hunter Sarah, Daniela Golinelli, Ervant Maksabedian and Joan Tucker

This presentation describes findings of a pilot test of a Motivational Interviewing social network intervention (MI-SNI) to enhance motivation to reduce high risk alcohol and other drug (AOD) use among formerly homeless individuals transitioning to housing. Delivered in-person by a facilitator trained in MI, this four-session computer-assisted intervention provides personalized social network visualization feedback to help participants understand the people in their network who trigger their alcohol and other drug (AOD) use and those who support abstinence. If ready, participants are encouraged to make changes to their social network to help reduce their own high-risk behavior. Participants were 41 individuals (33 male, 23 African-American) who were transitioning from homelessness to permanent supportive housing. They were randomly assigned to either the MI-SNI condition or usual care. Readiness to change, abstinence self-efficacy, and AOD use were assessed at baseline and 3 month follow-up. Acceptability of the intervention was also evaluated. MI-SNI participants reported increased readiness to change AOD use compared to control participants. We also conducted a subsample analysis for participants at one housing program and found a significant intervention effect on readiness to change, abstinence self-efficacy, and alcohol use compared to control participants. Participants rated the intervention as highly acceptable. We conclude that a brief computer-assisted Motivational Interviewing social network intervention has potential to efficaciously impact readiness to change, abstinence self-efficacy, and AOD use among formerly homeless individuals transitioning to permanent supportive housing, and warrants future study in larger clinical trials.

A Rationale for Using Social Network Analysis To Examine The Influence of Social Networks On The Resilience of Grandparents Raising Grandchildren

Nancy Mendoza and Christine A. Fruhauf

The importance of social support and resilience are well documented in the literature addressing grandparents raising grandchildren (GRG). Yet,

little is known about the influence grandparent caregivers' social network has on their resilience. Further, some researchers have used basic research methodology and have not approached their work utilizing new, innovative methods when examining GRG. As a result, the purpose of this presentation is to explore how social network analysis (SNA) may be applied to future research addressing social support and resilience of grandparent caregivers.

In particular, SNA has been commonly used in research addressing social media and organizational networks, but has not been utilized to understand GRG's social support and resilience. SNA is based on the assumption that an individual's relations are important and focuses on the effects of an individual's social network. More specifically, utilizing egocentric network research may provide insights into grandparent caregiver's social network and how it influences their resilience as SNA also addresses the social connections a person (identified as a node) has and the strength of these connections (i.e. ties). These connections are then represented visually using network diagrams, thus providing both a visual and a mathematical analysis of the networks of interest.

The use of SNA may be valuable in understanding the structure of GRG's social network, and its consequences on grandparent caregivers' resilience. Using SNA may then lead to new discoveries related to identifying the most helpful social support services among grandparents which may enable practitioners to tailor services, resources, and interventions for GRG.

A sign of the times? Alliances and antagonisms in the U.S. Congress, 1973-2016

Zachary Neal

Networks of political alliances and antagonisms are difficult to collect directly both because politicians are busy and have little time to participate in research, and because they have motivations to conceal their actual alliances and antagonisms. To overcome this challenge, many have turned to one-mode projections as a solution. In particular, in the past decade, several analyses of bill co-sponsorship networks have emerged that examine the structure of political ties. In these networks, legislators are viewed as having a tie or alliance if they co-sponsor many of the same pieces of legislation.

This approach, while promising, has two important drawbacks. First, ordinary one-mode projections may have the potential to identify political alliances (i.e. positive ties), but they cannot identify political antagonisms (i.e. negative ties). Second, valued one-mode projections and their non-valued counterparts generated by applying a universal binarizing threshold are subject to a number of structural distortions including inflated clustering, transitivity, and density.

The Stochastic Degree Sequence Model (SDSM) offers a solution to both of these challenges. In this presentation, I use the SDSM to construct a longitudinal time-series of signed networks based on bill co-sponsorship in both the U.S. House of Representatives and the U.S. Senate in each Session of Congress from 1973 to present (22 waves). This approach controls for variation in legislators' sponsoring activity, and for

variation in the popularity of specific pieces of legislation. Using unique empirical sampling distributions for the weight of each edge in the projected network, political alliances (and antagonisms) are identified by edges whose weights are statistically significantly greater (or smaller) than expected in a null model. These data represent one of the largest (in nodes) and longest (in time series) signed networks, which will be made publicly available through this paper/presentation.

In each of these networks, I conduct a signed triad census and compute a measure of structural balance. As would be expected from theory, the amount of structural balance in these networks increases over time. However, a closer look at why balance increases reveals a more troubling pattern. In both chambers of congress, the increase in structural balance is due to growth in ""mutual enemy"" triads (+--) and not to growth in ""mutual friend"" triads (+++). Thus, greater structural balance in the U.S. Congress since 1973 has been achieved through polarization and the growth of political antagonisms. I conclude with a discussion of the implications of these findings for efforts to reduce political polarization, and of the prospect of using signed one-mode projections to facilitate the study of signed networks, balance, and polarization in other contexts.

A Triadic View of Political Power in Signed Graphs: Exploring the Political Independence Index in the International Geopolitical Context

Giuseppe Labianca, Filip Agneessens, Jesse Fagan, Daniel Halgin, Theresa Floyd, Alexandra Gerbasi and Carlo Labianca

Interest has grown in understanding which nodal positions in a network of positive and negative ties are in a favorable power position. One new measure of nodal power in signed graphs, the political independence index (Smith, et al., 2014) employs a dependence perspective to determine nodal power. However, it does not take into account whether alters are themselves connected by positive or negative ties. We introduce a new version of the political independence index which takes into account whether the alters are involved in closed triads of different types; this version does a better job of accounting for nations' changes to their military in the post-World War II period than the original version of PII. We then extend the use of this new version in an interpersonal network within an organization.

A Twitter Social Contagion Monitor

Vladimir Barash, Aurora Schmidt, Clayton Fink, Christopher Cameron, Wei Dong, John Kelly and Michael Macy

Our objective is to study the relative impacts of social reinforcement in the evolution of social contagions. We describe a system for monitoring social contagions on Twitter: social movements, rumors, and emotional outbursts that spread from person to person in a viral manner. We use Twitter streams to monitor the spread of these phenomena through human social and information networks. The monitor parses a stream of Twitter posts to identify popular phenomena and then determines the extent to

which a particular phenomenon spreads through the social network (as opposed to via news broadcasts or independent adoption) and locates the contagion within Twitter communities. The monitor approximates the adoption threshold of a social contagion by measuring the fraction of Twitter users who were ""infected"" by the contagion (e.g., joined a particular social movement) after more than one of their friends had done so. Finally, the monitor makes a judgment about whether the phenomenon has reached critical mass (Barash et al. 2012), which is defined as the point where a social contagion begins spreading rapidly and breaches the social boundaries of its early adopter group. Our prototype monitor successfully extracts social contagions from an ongoing stream of Twitter posts grouped by user-added tags. The monitor has processed over five hundred thousand hashtags as of February 15, 2017, and has identified over three dozen high-threshold contagions that have reached critical mass.

Academic Influence of Social Network Sites on the Collegiate Performance of Technical College Students

Jameson Mcfarlane

Social network sites (SNS) is an emerging phenomenon that is here to stay. The popularity and the ubiquity of the SNS technology is undeniable. Because most SNS are free and easy to use people from all walks of life and from almost any age are attracted to that technology. College age students are by far the largest segment of the population using SNS. Since most SNS have been adapted for mobile devices, not only do you find students using this technology in their study, while working on labs or on projects, a substantial number of students have been found to use SNS even while listening to lecture. This study found that SNS use has a significant negative impact on the grade point average of college students particularly in the first semester. However, this negative impact is greatly diminished by the end of the third semester partly because the students have adjusted satisfactorily to the challenges of college or because they have learned how to adequately manage their time. It was established that the kinds of activities the students are engaged in during the SNS use are the leading factor affecting academic performance. Of those activities, using SNS during a lecture or while studying is the foremost contributing factor to lower academic performance. This is due to "cognitive" or "information" bottleneck, a condition in which the students find it very difficult to multitask or to switch between resources leading to inefficiency in information retention and thus, educational performance.

Agricultural Resource Networks of Kenyan Smallholder Farmers

Stacey Giroux and Tom Evans

We present a sociocentric network analysis examining the sharing and exchange of two specific types of agricultural resources among smallholder farmers in Kenya: maize seed information and on-farm labor, or piecework. We interviewed 108 out of 113 farmer households (95.6% of households) in a single Community Water Project located in the Likii River subcatchment on the northwestern slopes of Mount Kenya, in the Upper Ewaso Ng'iro Basin.

We seek to understand the nature of the relationship between the structure of this network of households and the dynamics of on-farm piecework and seed information flows. This research is part of a larger project whose overarching goal is to assess the adaptive capacity of smallholder farmers to hydrologic shocks such as drought, which seriously impact their levels of food security. Prior work has shown the importance of social networks for resilience of rural households and communities, and our analysis will contribute to understanding the ways in which smallholders leverage others in the community to help cope with and adapt to changing weather conditions.
We will address the following questions: Do farmers more often exchange information or labor, or do these resources travel in a unidirectional manner? Are there farmers who serve as crucial nodes for information dissemination? What is the nature of piecework in this community, that is, is it a livelihood strategy and measure of vulnerability, or is there evidence that it may function more as a type of general social capital, as some researchers have posited? Do households with multiplex ties experience different outcomes in terms of their maize harvest or seed choice than those who are less connected? To what extent does co-membership in the Community Water Project facilitate communication among these households, and to what degree do households leverage network resources outside the Project for seed advice or labor?

Alignment-induced analysis of Dynamics in Spatial Social Networks

Edwin Vargas

Network alignment, and its exploit of graph-theoretical properties such as topology, is an important mathematical and computational problem, with implications in a variety of fields such as Social Sciences [1] economics [2], and the biological sciences [3]. Further, the development of network alignment as an analysis technique has enabled the efficient mining of complex information from vast sets of data, such as those generated in the field of proteomics [4]. However, network alignment methods have mainly focused on the analysis of fixed networks, usually belonging to different entities, whether they are individuals or groups, under static conditions. Our research explores the application of network alignment to the identification of dynamics in spatially distributed, real world networks. As a result, we have developed a number of novel comparison metrics, as well as suitable algorithms. Further, we have successfully applied our methods to the detection of patterns in network changes for synthetic, physical, and social network structures.

All Roads Lead to Rome: The Story of How Transportation Network Induces Agglomeration

Ahmed Mahmud and Sumit Joshi

Despite being empirically evident as well as relevant in the real world, theoretical literature associating urban agglomeration and transportation network is scant. We want to combine insights from network formation and economics of agglomeration to shed some light on this missing link. Urban areas are mainly production centers of manufacturing goods, and rural

areas are that of agriculture. Both regions need to form a network to trade with one another. Network formation occurs in the presence of cost to transport manufacturing goods and the cost of forming links. The questions addressed in the paper are as follows:

What is the equilibrium rural-urban network when manufacturing firms attempt to minimize transportation cost as well as the cost of forming a link in a network? When the transaction cost saved from a direct link to a rural area is greater than the expense of the link itself, all regions are connected via direct links. If the cost of forming a link is higher, it becomes worthwhile to maintain a direct link to an urban area but not to a rural region. Therefore, rural areas are linked to a particular urban center, and the cities themselves form a complete network. When the cost of forming a direct connection rises even further, all regions become minimally connected (hub and spoke network) and every region conducts trade through the hub. A hub can also be an urban area to which all other areas are directly linked.

What is the incentive of manufacturing firms residing in urban areas to agglomerate within a given network? Previous models emphasized various agglomeration externalities such as the prospect of a better match, more efficient sharing of infrastructure, a larger pool of workers and aggregate demand externality. The present endeavor focuses upon transportation network as the motivation behind agglomeration. One aspect of the transportation system is the transportation cost to rural regions. By locating to a single urban region, firms can access to rural areas directly (without any intermediaries). Another impact of mono-centric equilibrium stems from reducing the network cost. The main impetus behind agglomeration in our paper is to create a hub and spoke network. Therefore even when agglomeration above externalities ceases to exist, urban agglomeration occurs via other channels.

An Analysis of Network Structure and Characteristics of Academic Areas in Korea

Minki Kim

To create new values in the knowledge-based economies, the knowledge creation from the interdisciplinary research, knowledge sharing and transfer are important. Many precedent studies have showed the complexity of the academic disciplines among interdisciplinary researches. However, these studies did not explain well the linkages among various research fields because these focused on the researchers' or research organizations' joint studies. Increasing interdisciplinary researches and joint researches has expanded science knowledge. Many previous studies found out the networks between researchers and institutes in these joint projects. However, the precedent researches have ignored the researchers and institutes studied the specific research attributes. Thus, this paper analyzes the network structure of interdisciplinary research by teams from different study fields. This study focused on a network, the features of the network structure and the correlations between study disciples and scholastic influences. It downloaded Korean national researchers' papers (listed at SCIE DB) from Web of Science, and used them for social network analysis. This analysis found out the network structure variables' influences on the interdisciplinary researches and paper citations.

An Analysis of the #BringBackOurGirls Movement Using Spectral Clustering of Tag Adoption

Aurora Schmidt, Clay Fink, Vladimir Barash, Christopher Cameron and Michael Macy

We investigate the use of hashtags related to sociopolitical issues in a population of Nigerian Twitter users between October 2013 and November 2014. This period is of interest due to the online campaign centered around the #BringBackOurGirls hashtag which called for the of rescue of 276 schoolgirls who were kidnapped by the Boko Haram extremist group. We examine the adoption of hashtags during the six months before, the month after, and the six months following the kidnapping to study the impact of the social movement on Twitter discussions concerning violence against women (VAW). Based on manually constructed queries, we find that users adopting VAW tags prior to the kidnapping used related tags for a longer time after the kidnapping than users who newly adopted this topic. We also see evidence that the #BringBackOurGirls movement temporarily increased VAW tag usage among users that did not previously use VAW tags, demonstrating a case where a focused social movement can shine a light on broader social issues. We propose an unsupervised spectral clustering approach that groups users based on hashtag adoptions prior to the kidnapping. Unlike network-based clusters, these adoption-based clusters reveal groups of users with similar interests and prove to be more predictive of interest in future topics. We compare this unsupervised spectral clustering to two others: spectral clustering based on symmetrized follow network relations and clusters induced by latent Dirichlet allocation (LDA) topics. We find that adoption-based clusters perform similarly to LDA at identifying key interest groups that differently adopt #BringBackOurGirls, as well tags related to corruption and politics.

An Applied Social Network Analysis of how College Application Patterns vary by Geography and Information

Daniel Klasik

An increasing number of policy efforts aim to help students make better decisions about whether and where to attend college. Under the best circumstances, college counselors and other sources of college information can help students balance translate their college preferences into a thoughtful portfolio of college applications. But it is becoming clear that not all students receive the information they need about choosing colleges, making it all the more critical that those who try to remedy this gap can do it in a way that authentically represents the interests of college-seeking students. While we understand some of the basic preferences of students, we ultimately do not understand very well how students pick the colleges to which they apply.

In this study, I conduct a social network analysis using college application data from a nationally representative sample of high school students to understand student college preferences better. In this single-

mode network, connections are created between every pair of colleges to which a student applies. When these connections are aggregated for all students in the sample (or a given subsample), the resulting network reveals clusters of specific colleges that students apply to in common which, in turn, allows for the careful analysis of the characteristics that describe those clusters.

With a recognition that students care strongly about geography in their college choices, and that their choices may vary depending on whether they have sought the advice of a college counselor, this work presents preliminary results of my investigation of two questions: (1) What do regional patterns of application submission look like? And (2) do students who visit their college counselor or have other college information sources have systematically different patterns of application than those who do not? For the analysis, I use the nationally representative Education Longitudinal Study of 2002, which includes the specific colleges to which the students in the study applied. In short, this analysis uses data on 25,670 college applications submitted by 7,430 students to 2,080 colleges during the 2003-04 academic year. This sample is then broken down to study the specific networks created by the college application patterns of students from different geographic regions of the country, or who vary in their access to information about the college choice process (for example, students who have visited their college counselor or not). The results of this ongoing work start to provide a much-clarified picture of American colleges from a student perspective, providing the basis for further development of college choice theories and targeted college advising for students without access to quality college counseling.

An efficient counting method for the colored triad census

Jeffrey Lienert, Laura Koehly, John Finney, Christopher Marcum and Felix Reed-Tsochas

Substantial variation in higher-order network structure follows from the composition of very local structures (dyads and triads) and connections based on nodal attributes. To understand the complex interplay between very local structure and nodal attributes we evaluate the colored triad census. However, conducting a triad census is computationally difficult, unacceptably so for larger networks. Although methods exist to reduce this computational complexity considerably, such methods do not interrogate every triad individually, so coloration cannot be determined. Moody (1998) developed a linear algebraic method which falls in between these methods in terms of computational complexity, and interrogates every triad. Here, we expand Moody's approach to determine the colored triad census, either directed or undirected, for an arbitrary number of colors. By adopting Moody's algebra to the colored graph, we create an algorithm that can efficiently interrogate the colored triad census of a network. We then apply this method to two networks of varying size to showcase the conclusions that can be drawn when the colored triad census is efficiently performed. These networks are 1) a network of chemotherapy patient co-presence in a single hospital's chemotherapy ward, and 2) Add Health. These are networks that are large enough that the colored triad census based on the naïve method would be feasible, particularly for multiple

runs over similar networks. The colored triad census is based on various nodal attributes included in the networks. Further, we create a null distribution of the colored triad census for these networks based on the colored degree distribution, allowing hypothesis testing of over- or under-represented triads. Using these tests, we show that the colored triad census reveals interplay between structure and nodal attribute. Specific examples of triads which are over- or under-represented are also discussed.

Analysis of Network Influence on Legislation of Science and Technology in Korea – Focused on National Assembly Members

Seung Tai Kim and Su Hyeon Jung

In spite of the explosive growth of legislation since the 1990's, the productivity of legislative legislation is evaluated significantly lower than that of government legislation. In recent years, Korean National Assembly(KNA) is facing the criticism that the weakening of legislative functions has led to a weakening of checks and balances against the executive.
In this situation, several researchers are attempting to find drivers of legislative legislation to improve the legislative productivity of KNA. Previous studies of the legislative productivity have shown that the party affiliation is the absolute influence factor in legislation among the personal and institutional backgrounds. However, most of these studies have a limitation that the exploration are limited to ex ante factors at the time of election, like an education level, asset, ideology, and political party affiliation. The explanatory power of these studies still remains low level.
This study aims to improve the research model of the influencing factors on legislative productivity of Science and Technology in the 19th KNA(2012-2016). We attempted to elaborate the model by considering ex post factors after entering KNA such as the institutional and non-institutional activities. One of the notable variables among the non-institutional activities is the member's network in KNA measured by the co-authorship on the bill.
As a result, we can confirm that the member's network in KNA is one of the important influencing factors while the party affiliation is being the most important factor. And we observe that the explanation power of modified model has been significantly improved compared to the previous studies. This study contributes to broaden understanding the drivers of legislation from ex ante to ex post by network analysis in politics

Analyzing Published Global Ebola Virus Disease Research Using Social Network Analysis

Christiane Hagel, Peter Tinnemann, Felix Weidemann, Stephan Gauch and Suzanne Edwards

The 2014/2015 West African Ebola Virus Disease (EVD) outbreak attracted global attention. Numerous opinions claimed that EVD research was neglected, although quantitative or qualitative studies did not exist. Our objective was to analyze the evolving EVD research landscape by exploring

the existing research network and its communities before and during the outbreak in West Africa.

Social network analysis (SNA) was used to analyze collaborations between institutions named by co-authors as affiliation in publications on EVD. Bibliometric data of publications on Ebola between 1976 and 2015 was collected from Thomson Reuters' Web of Science Core Collection (WoS). Freely available software was used for a global and 10-year periods network evolution analysis. The networks are presented as undirected-weighted graphs. Rankings by degree and betweenness were calculated to identify central and powerful network positions; modularity function was used to identify research communities.

Overall 4,587 publications were identified, of which 2,528 were original research articles. Those yielded 1,644 authors' affiliated institutions and 9,907 connections for co-authorship network construction. The majority of institutions were from the USA, Canada and Europe. Collaborations with research partners on the African continent did exist, but less frequently. Highly connected organizations in the network were identified with powerful and broker positions. Network characteristics varied widely among the 10-year periods and evolved from 30 to 1,489 institutions and 60 to 9,176 connections respectively. Most influential actors are from public or governmental institutions whereas private sector actors, in particular the pharmaceutical industry, are largely missing.

Research output on EVD has increased over time and surged during the 2014/2015 outbreak. The overall EVD research network is organized around a few key actors, leaving room for increased cooperation with institutions from affected countries. Steering the global EVD research network towards an agenda driven research might accelerate the development of necessary live saving products for EVD diagnostics and treatment.

Approximate Variational Estimation For A Model Of Network Formation

Angelo Mele and Lingjiong Zhu

We study an equilibrium model of sequential network formation with heterogeneous players. The payoffs depend on the number and composition of direct connections, but also the number of indirect links. We show that the network formation process is a potential game and in the long run the model converges to an exponential random graph (ERGM). Since standard simulation-based inference methods for ERGMs could have exponentially slow convergence, we propose an alternative deterministic method, based on a variational approximation of the likelihood. We compute bounds for the approximation error for a given network size and we prove that our variational method is asymptotically exact, extending results from the large deviations and graph limits literature to allow for covariates in the ERGM. A simple Monte Carlo shows that our deterministic method provides more robust estimates than standard simulation based inference.

Assessing Race Differences and Experimental Effects of Question Phrasing on Personal Networks using Mechanical Turk

Jerreed Ivanich, Michael Siciliano and Marina Stavrakantonaki

Little research has explored the race differences of personal networks. Specifically, the name generators predominately used in the social science field have not received scientific exploration to determine if these name generators produce meaningful differences in personal networks by race. Within social science research, conducting experiments is the gold standard – yet ethical consideration and resource considerations prohibit this study design for many scholars. In the wake of these limitations, scholars have turned to non-traditional methods of collecting data within an experimental design framework. One recent and growing method for social scientists to collect experimental data is through the use of Amazon's Mechanical Turk. A web-based platform for collecting diverse, yet targeted data. Utilizing this promising data collection mechanism, this study aims to explore the breadth of Mechanical Turk's platform by implementing a social network experiment.
For this study, respondents were randomly assigned one of three name generators. Name generators include 1) The National Longitudinal Study of Adolescent to Adult Health (Add Health) name generator, 2) the General Social Survey (GSS) name generator, and 3) an independently created name generator. The third name generator was implemented for two reasons. First, researchers often create and implement name generators for their specific studies without use of a "common" name generator. Second, our name generator was designed with the intention of capturing cultural differences across race. These name generators were used as the experimental conditions the respondent were randomly assigned to. Preliminary exploratory data suggest that racial differences are present based on which name generator one is assigned to. Implications for these findings are discussed.

Author Attibute Classification for Social Media

Thomas Lippincott, Nicholas Andrews and Benjamin Van Durme

Microblog content is often used to infer properties of users and messages, but presents unique challenges in the form of short, noisy, and multilingual text. At the same time, there are a broad array of machine learning models for performing simple text classification into a set of discrete labels, including recent developments in deep learning. The combinatorial explosion of classification tasks and models, and the infeasibility of researching optimal methods for each pairing, make it important to perform a broad study to make reasonable recommendations for new tasks. We describe a systematic comparison of six models, ranging from simple Naive Bayes and log-linear to modern neural networks, applied to six microblog classification tasks and across a range of data conditions. We find substantial variation in which model produces optimal results, although a handful of methods maintain consistent performance with minimal researcher effort. Surprisingly, we find that a recurrent

neural network also maintains consistent top performance across tasks even with small amounts of training data. Combined with timing and resource information for each model type, these results can help recommend optimal approaches to new sequence classification tasks. As part of this study we introduce SteamRoller, a build framework for bringing new classification tasks and machine learning algorithms under a fair, common rubrick, performing extensive experimentation distributed across an HPC grid, and comparing results across different experimental axes. Our future work includes expanding StreamRoller beyond simple classification, particularly into tasks where structure-aware models can benefit from the rich metadata and connectivity available in social media data.

Botnets and Propaganda Dissemination

Rick Galeano, Dr. Nitin Agarwal and Samer Al-Khateeb

Social media is increasingly used to communicate strategic information during crises and to enable authorities to act tactfully. Numerous journalistic accounts have highlighted the prolific and disturbing use of social media by deviant groups among state and non-state actors to influence public opinion and provoke hysteria among citizens through disseminating misinformation or propaganda about various influential events such as the 2014 Crimean Water Crisis or the 2015 Dragoon Ride Exercise. We study the strategic communication used by deviant groups within the social media ecosystem, especially examining the cross-influence between blogs and Twitter. We have collected and analysed data from blogs and Twitter during the two aforementioned events. Our study shows that networked computers running automated and coordinated programs to perform specific tasks, or 'botnets' have been extensively used during the two events, profoundly increasing the dissemination of propaganda. Furthermore, the behaviours of these botnets are becoming increasingly sophisticated over time, both from the perspective of information dissemination as well as coordination. The evolving behaviours of botnets make them constantly elusive to state-of-the-art detection techniques, warranting more sophisticated botnet detection methodologies. In this study, we present methodologies informed by social science and computational network analysis to study the information dissemination and coordination behaviours of botnets and to aid the development of detection tools ready for deployment in Cyber operations.

Cancer communication networks of rural Appalachian women

Kate Eddens and Jesse Fagan

The mountainous terrain of Appalachian Kentucky, along with a history of economic depression, has resulted in a population that is geographically, technologically, and economically isolated, leaving Appalachian residents difficult to reach with roads, phone, Internet, food, jobs, and scarce health and social services. However, this same terrain shapes the close-knit kinship and community ties, social cohesion, and strong sense of native Appalachian heritage that result in powerful social support networks in Appalachian communities. These networks, while strong in emotional support, are limited in access to formal social, health, and

economic resources. Few studies examine how network ties in Appalachian communities might be used to communicate information and norms about cancer screening and prevention behaviors, but those that do demonstrate network structures conducive to information diffusion by change agents and a willingness of Appalachian "key players" or opinion leaders to assume this role

We conducted a pilot study to explore peer word-of-mouth communication networks in rural Appalachian women who interacted with an innovative screening method for high-risk human papillomaviruses (HPV) that cause cervical cancer, to better understand how to activate networks to disseminate innovative cancer screening and prevention information.

We conducted ego network interviews with 168 rural Appalachian women: 71 egos who participated in an innovative study in which they used a self-collected vaginal swab (SCVS) for HPV testing were interviewed, as were 97 of their ego network members. Women were interviewed about health communication networks, resource acquisition/sharing networks (i.e., identifying market mavens in their network), alters they recruited into the SCVS study, and other measures (e.g., health care access, social capital, political engagement).

Due to substantial data loss, we have ego-level data on 84 egos, yet only 53 egos for whom we can connect to their alters and have complete alter-tie data. Preliminary results show a mean network size of 12.6 alters (sd 8.8), with a mean network density of 0.67 (sd 0.32). By the time of this presentation, we'll describe the social and communication networks and environment of rural Appalachian women who engaged with an innovative cancer screening methodology.
Discussion: We wanted to understand whether women are referring other women into the SCVS study along health communication or health-related networks, or along resource-acquisition networks, represented here as subnetworks of market mavens. Because of data loss, we can't connect the referees to the referrers in this study. We'll have rich data on the cancer information environment and networks of rural Appalachian women.

Capitalizing on small worlds: A network intervention to narrow the communication gap between researchers and public school educators

Jennifer Watling Neal, Zachary Neal, Jennifer Lawlor, Katie McAlindon and Kristen Mills

Despite the emergence of policies encouraging the use of evidence-based programs in schools, educators struggle to access evidence and integrate it into their decision-making. On the other hand, researchers also struggle to disseminate evidence to these educators. This research-practice gap in education is the focus of the Michigan School Program Information (MiSPI; www.msu.edu/~mispi) project, which seeks to improve the social networks through which educators acquire research evidence. In this presentation, we present findings from a replication of Milgram's Small World Experiment to understand the network barriers and facilitators of research evidence acquisition. We then illustrate how we are using

these findings to develop a network intervention designed to strengthen educators' networks, and help them search those networks more efficiently.

The MiSPI project conducted a statewide replication of Milgram's Small World Experiment. A random sample of 382 superintendents and principals in the U.S. state of Michigan were asked: ""If you were looking for information about school programs, who would you talk to first."" Subsequent survey waves have traced these network chains, with the goal of identifying three key outcomes: (a) whether the chain reaches an educational researcher or other high-quality information source, (b) the length of such successful chains, and (c) the types of intermediaries that appear in these chains. Although network chains have the potential to transfer research evidence to educators, our preliminary findings suggest that communication often breaks down. We present evidence of three problematic types of network chains in our data that led to these communication breakdowns. First, some educators had no one to go to for information about school programs. Second, some educators' network chains ended in self-ties where an intermediary reported going to him/herself for information. Third, other educators' network chains ended in echo chambers where individuals sought information from each other in closed loops. Echo chambers circulate information within a school or district, but do not provide access to novel outside information. In addition, we provide data on the characteristics of successful network chains that resulted in educators' access to research evidence.

Next, we demonstrate how we are using findings from our small world experiment to develop a network intervention designed to improve educators' access to research evidence. First, we plan to strengthen existing networks by encouraging educators to strategically build a small number of new ties to key intermediaries that were common in successful network chains in our small world experiment. This may involve calling educators' attention to, and creating opportunities to interact with, staff at their county-level intermediate school district and key personnel in relevant professional associations. Conceptually, this component of the intervention corresponds to the random re-wirings that the Watts-Strogatz model illustrates yields a small world network structure. Second, we plan to help educators think about ways to more strategically search their existing networks for evidence. This will focus on raising educators' awareness of their existing networks, and avoiding echo chambers by encouraging information searching via intermediaries that occupy different roles from themselves.

Caregiving networks of children affected by inborn errors of metabolism

Laura Koehly, Kathleen Marcum, Mindy Perilla, Hena Thakur, Jennifer Cleary, Sarah Sadozai, Dawn Lea, Betina Hollstein and Christopher Marcum

More than 66 million informal (unpaid) caregivers care for someone who is ill, disabled, or elderly in the United States. These caregivers report a range of experiences, from feelings of personal growth associated with caregiving to experiencing significant distress. Much of the previous literature on the personal effects of caregiving has focused on a single "primary" caregiver, rather than considering the potential broader effects

on a caregiving system. Previous research by our team has demonstrated the added value to caregiving research by using multi-informant social network approach within the context of Alzheimer's disease and related dementia (ADRD), a disease that largely impacts the elderly with spouses and those from younger generations largely being called to take on caregiving roles. Through this work, we showed that caregiving is a networked process, with multiple family members involved in care provision, whether providing direct care, making decisions about care, or caring for a care provider. However, those involved in care did not always share common mental models with respect to members' caregiving roles; such variability in perceived roles and expectations amongst family members can have significant influence on members' health and well-being. The caregiving experience may differ greatly according to the life stage of the care provider and care recipient. Here, we extend our previous research to consider the caregiving networks of children affected by autosomal recessive metabolic disorders. Members from 33 families with children diagnosed with one of several inherited inborn errors of metabolism completed a survey and interview assessing their family's experience caring for a chronically-ill child. Caregiving networks were assessed through multi-informant network approaches in which each member enumerated members of their own and the affected child's network using Antonnucci's convoy model. Participants indicated each enumerant's caregiving role, the tasks completed or resources exchanged within each role, and whether the enumerant was meeting expectations for the role. Using a mixed methods approach, we characterize these caregiving networks. Preliminary results suggest smaller caregiving networks when the care recipient is a chronically-ill child compared to an adult with ADRD; that is, there were fewer members involved in direct care and decisions about care. Additionally, in contrast to our previous work, participants largely agreed on members' caregiving roles, with parents often being the sole informal care providers and decision-makers. While a shared understanding of family members' caregiving roles may be adaptive, the small size of these networks may reveal substantial vulnerabilities to caregiver burden and social isolation. Future efforts will use what is learned here to develop appropriate interventions to address these vulnerabilities in an effort to build resilient caregiving network systems.

Characterization of the strength of ties in the context of evaluating the Children's Mental Health Initiative Systems of Care

Grace Huang, Sushama Rajapaksa, Joselin Bravo, Preethy George, Chandria Jones and Abram Rosenblatt

The strength of ties have been widely used in characterizing collaborative relationships among agencies and organizations. The composition of strong and weak ties in a network can reveal information about the collaborative and structural capital among its members. Strong ties often signify relationships between network entities that are centrally positioned in the network. On the other hand, weak ties have been shown to exert particular advantages for serving as conduits to information and resources beyond the core network of organizations, and can play a critical role in efforts to promote system-wide changes. While the construct of tie

strength is undoubtedly recognized as an important feature of any network, few studies provide empirical testing of its operationalization, particularly in the context of inter-organizational collaboration networks.
In this paper, we provide a case study using data from the National Evaluation of the Children's Mental Health Initiative (CMHI) funded by the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA). The CMHI program supports grantees across the country in their efforts to implement and expand systems of care (SOC), an approach used in children's mental health that emphasizes collaboration across child-serving agencies and organizations to provide an array of community-based services and supports that improve outcomes for children and youth with serious emotional disturbances (SED) and their families.
Cross-sectional network data were collected from 31 systems of care in the U.S. to assess inter-organizational collaborations among partners on 12 types of SOC expansion activities such as integrating funding sources, determining eligibility criteria, holding joint case consultation meetings or trainings, and involving youth and families in the evaluation. Respondents represented agencies and organizations across three levels of jurisdiction (state, county, tribal) and 10 sectors (i.e. mental health, education, juvenile justice, child welfare, family and youth advocacy, social services). The resulting dataset includes approximately 600 agencies and organizations and over 25,000 reported collaborative ties.
Following Granovetter (1973), tie strength was quantified in four ways by using: 1) valued ties describing the frequency of collaboration; 2) a multiplexity score on the number of collaboration types shared by two organizations; 3) reciprocity of ties; and 4) the homogeneity of ties based on the organization's sector and jurisdiction.
We quantitatively compare these four conceptualizations of tie strength and assess their associations with structural network properties and implementation outcomes. Furthermore, we qualitatively distinguish the different functions of strong and weak ties in the context of collaborations to foster SOC expansion and implementation. We hypothesize that while strong ties reliably reflect a network core consisting of leaders and key partners, weak ties provide important information that can be leveraged for actionable network intervention strategies such as expanding boundaries, forming regional subgroups, bringing in diverse perspectives, and accessing new resources. We discuss for network-informed strategies that can enhance the functionality and efficiency of SOCs for meeting specific expansion and implementation goals.

Characterizing protected areas management using ego-networks

Andreea Nita, Steluta Manolache, Cristiana Ciocanea and Laurentiu Rozylowicz

In a world in a constant evolution the need for preserving biodiversity is a challenging task for governments and NGOs. The centerpiece of biodiversity conservation is ensuring cooperation among countless actors involved in the management of protected areas. Social network analysis is a suitable tool for securing essential information for social interactions during the environmental management process. To contribute to the debate in the field of protected areas management, we illustrate a new approach

in investigating management of Natura 2000 sites, by considering two real-world management settings in Romania. We evaluate the characteristics of two ego networks established for the management of two European Union Natura 2000 protected areas in Romania. The networks were created around administrative bodies of protected area (ego), and include management actors directly connected to the ego. After evaluating the most common ego-network metrics that demonstrate the characteristics of each network, we analyzed the strong ties by using Simmelian ties within protected areas management ego-networks and clustered the embedded links in primary Girvan Newman groups. The findings of this study suggest that the ego (administrative bodies of protected area) has a critical role in bridging other management actors. Our results demonstrated large variations in ego networks metrics, indicating that the ego networks properties depend on the ability of the ego to connect to organizations with different jurisdictions. In our case, the network coordinated by an NGO (Lower Siret Floodplain) is more fragmented, hence the collaboration and information flows are strongly influenced by the existence of one key actor only. Such networks are more vulnerable to disruptions of collaborations, for example when the management body tries to enforce more strict regulations on resource management to protect the biodiversity. This paper identifies models of environmental management control and provides insights regarding several means to improve the cooperation of environmental conservation in Natura 2000 areas. The study demonstrates that SNA can contribute to improve protected area management and may be a useful tool for systematic conservation planning. Our results could be further used also to minimize the protected area network's vulnerabilities and predict the potential for large-scale failure.

Closeness and role as key organizing principles in graph drawing

Bernie Hogan, Paolo Simonetto, Daniel Archambault, Helen Purchase, Stephen Kobourov, Patrick Janulis and Joshua Melville

The field of information visualization within computer science has a long history of interest in graph drawing. The features of interest typically focus on features of the graph topology. Rarely are attributes of the nodes given an equal weight. This is often on account of a lack of data access and an experimental methodology that fixes the topology of the graph.

This paper augments these experimental studies with secondary analysis of a field study. In the study, individuals were asked to arrange their ties using the logic of a participant aided sociogram. That is to say, first alters were nominated and some attributes were attached. The respondents laid out the alters in a 'target' or 'bullseye' diagram and linked people based on several criteria. As the respondents were working with a touchscreen-based layout, we were able to recover both the final layout as well as movements made during the layout stages. Using this data were were able to simultaneously examine the influence of both graph drawing properties and properties of the nodes on the resulting layout.

In real world conditions, it appears that a number of graph drawing properties (such as 'minimize edge crossings' and 'evenly disperse the

nodes') are not as salient in the overall layout. Instead, there is a strong association between alter closeness and distance to the center as well as alter role and clustering. Respondents preferred to have non-overlapping components. But with respect to role, for example, we can see that individuals would place isolates of the same role adjacent to each other.

Data for this analysis comes from RADAR, a longitudinal research project run by Northwestern University. The respondents are all young men who have sex with men (aged 18-25) who were selected from a variety of recruitment methods. Data was captured using a preliminary version of Network Canvas. While the sample would thus have some modest biases (for example, it is known that men prefer orthogonal edges when drawing a graph), we believe there are still several actionable insights for the future design of participant-aided sociogram methods. Most notably, even though closeness to ego was not given as an instruction, it was still a very strong organising principle for most respondents.

Coevolution of interpersonal perceptions and team structure in long-duration space exploration missions

Igor Zakhlebin, Alla Vinokhodova, Vadim Gushin, Suzanne Bell, Leslie Dechurch and Noshir Contractor

As of present, there is insufficient understanding of how to construct efficient teams with respect to personal traits like skills, nationality, and gender. This is especially important in context of Long-Distance Space Exploration (LDSE) missions, where crew members have to live together, communicate with mission control, and carry out the tasks in isolation, confinement, and high pressure for months without the possibility to opt out. In order to ensure the success of such missions, advanced models of team composition and team dynamics need to be developed that would address the unique challenges of LDSE missions.

In this study, we view teams from a networks perspective: individual participants interact with each other and their environment. As they interact, relations between team members change, which can be captured by creation and dissolution of network ties. Although changes in ties can often be explained by structural properties of the network itself, we examine the extent that models are improved by incorporating interpersonal perceptions of team members in them.

We utilize archival data from two previous LDSE simulations conducted at Institute for Biomedical Problems (IBMP) in Moscow. Data were collected from crews in isolation for long durations, all of which were longer than 3 months. During these simulations, information about interpersonal ties was collected with conventional sociometry in which crew members indicated which crew members they would participate with on a 3 year simulation. Interpersonal perceptions were captured by Personal Self-Perception and Attitudes (PSPA) computerized test developed at IBMP. The PSPA elicits a participant self-ratings and ratings of others in their environment (e.g., crew members, mission support), and creates a matrix of distances between self-perceptions and perceptions of others as well as distances between

arbitrary pairs of participants. Data were collected in waves at multiple time points during these long-duration simulations, so that each sociomatrix corresponds to a set of matrices of perceived distances collected using the PSPA. To model coevolution between distances and team structure, we employ two types of models: Exponential Random Graph models (ERGMs) to estimate a number of network effects and external covariates for static networks, and SIENA to model network evolution with a similar set of attributes as used in ERGM models.

Our results show how different factors influence the probabilities of tie formation and dissolution over long periods of time. For example, psychological distance as collected by the PSPA is the most significant factor for the work-related tie formation, and nationality is the most significant predictor of leisure-related ties. Our analyses also explore the asymmetries in interpersonal perceptions and the ways they can be exploited to produce new covariates for explaining the evolution of team structures.

Collectivism, Social Stigma, and Structural Holes among Old Female Sex Workers in China

Yuruo Li and Hongjie Liu

Collectivism is known to have a significant impact on people's interpersonal relationships within small environments. Previous studies have shown that collectivism is closely correlated with social stigma and social support. Female sex workers are highly stigmatized population and often could not receive adequate social support. However, adequate social support could positively influence HIV prevention behaviors and other health outcomes. Tie level network structure measures, Burt's structural holes (effectiveness, hierarchy, and constraint), could be used in describing the small interpersonal environment and predict social support. Bridging the structural holes could also directly improve the health outcomes5. However, the formation of structural holes within the support network remains unanswered. We hypothesize that the tendency of collectivism could result in higher level of perceived social stigma around female sex workers and produce more constraints within their support network.

A three-city (Hefei, Nanning, and Qingdao) cross-sectional study was conducted among old female sex workers in China. The network measures were collected from egocentric supporting network questionnaire. We used multivariate linear regression to explore the relationship between collectivism, occupational stigma and Burt's structural hole measures (hierarchy, constraint, and effectiveness size). UCINET 6.620 and SAS 9.4 were used in estimating network measures and regression analysis.

A total of 1187 female sex workers from three cities participate in the study had reported their support network. We found that after adjusting for age, marital status, migrant status (from rural to urban), the length of being a female sex worker, education level, and the study sites, collectivism tendency is positively correlated with perceived occupational stigma (= 0.31, p=0.0001), and network constraints ((= 0.0024, p=0.097), but negatively correlated with the effectiveness size (= -0.038,

p<0.0001). The results suggest no correlation between collectivism and hierarchy (= 0.000003, p=0.8120). No correlation between occupational stigma and network structural hole measures were found in this study.

The collectivism culture makes people more depending on their supporting network. Conceptually, stigma should be correlated with ego's social position within the small environment. The lack of correlation between social structural measures and perceived occupational stigma might be because the female sex workers hide their true occupation from the members from the support network to avoid potential discriminations.

Combining Agent-based Modeling with Social Network Analysis to Reproduce an ISIS Social Media Network

Joseph Shaheen

An agent-based model is developed to understand the behaviors and rule-sets that generate social media networks. Simple rules are used to synthetically generate a backcloth (friend/follow) network collected using the Twitter API. The Twitter network was collected using seed accounts for known terrorist propaganda accounts. Model parameter adjustments were made to reproduce the collected net-work's summary statistics and stylized specifics such as average degree, clustering, community size and distribution, as well as general structural metrics. An approximate network was produced in line with the general properties of our collected data. In this paper, we present our findings on the reproduction of a social media network with a focus on testing similarity of summary statistics and structural properties. We find that it is possible to generate a social media net-work utilizing a few simple rules and a unique time-rule which sets varying interaction rates on entry of new nodes in comparison to existing node activity. We call this time rule mechanism a coupled rule-set. We also present weaknesses in our reproduction and propose an extension of the model for future work which could better reproduce more exact network properties.

Comparing network clustering methods with human perception

Anthony Johnson

Network data can be divided into smaller units in many different ways, including but not limited to community detection algorithms, truss analysis, clique analysis and factions analysis. Humans also often perceive structure within larger graphs, influenced by the layout algorithm used. How does human perception of 'clusters' correspond to different clustering algorithms? Are some algorithms more similar to human perception? This paper will present results of a comparison of human reported clusters with clustering algorithms across several variations of datasets and layout parameters.

Connective Recovery in Social Networks After the Death of a Friend

William Hobbs and Moira Burke

Most individuals have few close friends, leading to potential isolation after a friend's death. Do social networks heal to fill the space left by the loss? We conduct such a study of self-healing and resilience in social networks. We compared de-identified, aggregate counts of monthly interactions in approximately 15,000 Facebook networks in which someone had died to similar friendship networks of living Facebook users. As expected, a substantial amount of social interaction was lost with the death of a friend. However, friends of the decedent immediately increased interactions with each other and maintained these added interactions for years after the loss. Through this, the social networks recovered approximately the same number of active connections that had been lost. Interactions between close friends of the decedent peaked immediately after the death and then reached stable levels after a year. Interactions between close friends of the decedent and acquaintances of the decedent stabilized sooner, within a few months. Networks of young adults, ages 18 to 24, were more likely to recover than all other age groups, but unexpected deaths resulted in larger increases in social interactions that did not differ by friends' ages. Suicides were associated with reduced social network recovery.
[note: This paper was published in Nature Human Behaviour in April 2017]

Contingent Career Benefits of Information Diversity and Information Novelty During an Organizational Merger

Jesse Fagan, Andrew Shipilov and Joe Labianca

Social network research has found that individual advantage is tied to the structure of personal networks; networks rich in structural holes expose brokers to new and diverse perspectives and ideas. These results are less clear in uncertain organizational environments, such as large-scale restructuring. We propose that under such conditions, brokers may benefit not from using diverse information, but rather from adopting novel ideas which their local network does not use. We measure the use of diverse and novel information of 609 organizational members by fitting a topic model (LDA) from a corpus of email content covering a 14-month period immediately following the merger of two large consumer product firms. Employees in the target firm succeed by exploring and adopting novel topics and ideas, while employees of the higher-status, acquiring firm benefited from maintaining a diverse repertoire of topics from different areas of the organization. Employing a combination of a company-wide, longitudinal survey and human resources archival data, this study contributes to research on M&As, organizational change, and network theory by elaborating the causal role of issue interpretations and knowledge exchange on individual outcomes.

Corrosive Density

Yotam Shmargad and Jameson Watts

Social psychologists have long argued that the strength of a social relationship depends on the extent that the people in it share intimate thoughts and feelings with each other. In order for such intimate exchanges to exist, the social environment within which people are embedded must exhibit some amount of privacy. If people are worried that the intimate information they share may leak to mutual contacts, or if mutual contacts can readily observe exchanges between people, this can decrease the amount of intimacy they practice. We call the intimacy-inhibiting effects of mutual contacts 'corrosive density,' and test for these effects using data from a large online social networking platform that provided its users the ability to buy and exchange electronic greeting cards (eCards) with each other. We find that people were less likely to buy eCards if they recently connected to friends of friends, suggesting that intimacy was lower in denser networks. However, we find that the effect of connecting to friends of friends was substantially larger than that of having two friends connect to each other, suggesting that not all density is equally corrosive. We argue that, by encouraging users to connect to friends of friends, an algorithm employed by the platform made eCard exchange visible to more people, which ultimately contributed to the deterioration of such intimate exchange on the platform.

Creating Network-Based Communication Interventions to Increase Community Resilience: A Demonstration for an African Nation Recovering from Muslim-Christian Civil War

James Danowski

As big data are marshalled to address big social problems, intervention solutions are particularly promising with multimodal network analyses of communication and technology processes. This paper applies network analysis to multiple domains: 1) to news texts, 2) to photos, 3) to ego networks constructed from mobile metadata, and 4) to produce optimal messages to increase community resilience after natural or man-made disasters. Not only is text important in such optimal messages, so are photos, particularly in social systems with low literacy or among people with low motivation to read, such as the U.S. or many African nations. Moreover, across the globe, tweets that include photos are retweeted more than five times as often. Communication research may gain greater internal validity and reduce measurement error by using the same analytical model – network analysis -- across domains, for example: the photos that photojournalists and others produce and distribute via social and other media, the texts with or without photos produced by media organizations and by individuals, and the effects on mobile calling and texting networks.

We develop and test a novel two-stage, empirically-based formative evaluation technique to increase the likely effectiveness of

automatically-created optimal messages to increase the interlocking of interpersonal communication ego networks, producing increasing bonding social capital. This improves community resilience in coping with major disruptions, such as natural disaster, terrorist attack, civil war, etc.

This study analyzes data from Cote d'Ivoire (Ivory Coast) as it was emerging from a Muslim-Christian civil war and presidential crisis in 2011-2012. As hypothesized, increased frequency of positive-sentiment media messages leads to greater community resiliency, indexed by the degree of interlocking in interpersonal (ego) networks measured from national mobile metadata. These messages have a lagged effect of approximately 40 days. Using the positive word pairs extracted from texts that are correlated above r = .70 with the extent of ego network interlock, we generate an optimal message based on frequency-weighted shortest paths between the seed word 'president' and the target: 'security:' "[The] President [is] determined [to have a] strong democracy to improve economic security." Optimal optics accompany the optimal text. This message is predicted to increase community resilience by stimulating more interlocking within people's ego networks and reducing mobility. If this political message were repeatedly disseminated through various media within Cote d'Ivoire, we hypothesize further increases in citizens staying close to home and feeling positive about the government, rather than traveling to create opposition rallies and violent or destructive acts.

This research demonstrates how aligning mediated sentiment word pairs with mobile phone metadata may produce optimal messages that are formatively tuned in a two-stage process for the strongest predicted effects. After an intervention disseminating these messages, they can be assessed for effectiveness through a post-test time-series analysis. In turn, the next waves of intervention messages can be further tuned in a continuing 42-day toroidic cycle of formative and summative evaluations of interventions based on daily measurements of ego-centric mobile phone networks and social and other media content.

Cultivating the Conference Culture: The Role of Diversity in Interdisciplinary Meetings

Zachary Gibson, Gabriella Anton, Wouter Vermeer, Diego Gómez-Zará, Connor Bain, Leslie Dechurch, Uri Wilensky and Noshir Contractor

For both academics and practitioners, conferences act as loci of information sharing. Scholars come together to share knowledge, form new lines of inquiry, and build new collaborations. In attempts to leverage knowledge beyond single domains and stimulate learning across disciplines, conferences with an inter-disciplinary focus have gained popularity. These conferences typically comprise a combination of participants from some focal domain and adjacent fields. Successful knowledge sharing in such scenarios depends on the right balance of exposure to intra- and inter-disciplinary research.

The attendance of a talk often indicates its perceived usefulness, and can be used by conference chairs to gain insight into the interests of its attendees. In turn, this information leads to decisions about which areas to highlight in following years and over time influences the culture of

the conference. However, attendance may be biased even prior to information about the content of a talk. Status theories and network theories, respectively, suggest that high-status (e.g., highly cited) and highly popular (i.e., highly connected) individuals tend to attract more people toward them. Thus, scholars' social status outside the conference and their popularity at the conference may play a major role in how talks are attended. Further, the interaction of multiple fields in inter-disciplinary conferences places attendees in a unique situation where they must choose whether to explore traditional, intra-disciplinary research or potentially new, innovative inter-disciplinary research. Thus, audience size may not always provide the most appropriate metric for evaluating talk interest and usefulness, and so we assert the need to also consider audience diversity. Understanding how interdisciplinarity, status, and popularity influence audience size and diversity will allow conference chairs to make more informed decisions about areas of emphasis in future conference programs.

Our study explores these concerns in the context of an interdisciplinary conference held in 2016. We collected data on 364 attendees (34% presenters) using multiple methods. We collected two-mode network data consisting of both interactions among attendees and their session attendance using electronic badges, a status measure using citation indices obtained through bibliometric searches, and a measure of interdisciplinarity through attendees' self-reported level of skill in CSS. We combine these network metrics and attendee attributes to explore the drivers of audience size and diversity.

Preliminary results provide support for our expectations. We find that inter-disciplinary scholars have higher social status ($r = 0.33$, $p < 0.01$), higher popularity ($r = 0.16$, $p < 0.01$), and draw larger audiences ($r = 0.24$, $p = 0.01$). However, we do not find differences in audience diversity between inter-disciplinary and intra-disciplinary scholars ($r = 0.13$, $p = 0.18$). These results suggest that inter-disciplinary scholars receive due attention in conferences tailored to their research. More broadly, they suggest that high-status, popular scholars draw attention away from talks given by lower-status, less-popular scholars. This reinforces the need to consider the effects of presenter status and popularity on conference culture as well as how audience diversity can shed light on seeming inequalities in talk attendance.

Cyber Aggression and the Language of Dark Personalities among Russian Facebook Users

Olga Bogolyubova, Yanina Ledovaya, Polina Panicheva and Roman Tikhonov

A growing body of research demonstrates that exposure to cyber aggression is associated with psychological distress, depression and suicidal behavior. Moreover, it has been demonstrated that engagement in harmful online behaviors also has detrimental consequences for users' mental health and adjustment. An additional body of research explores trolling and its psychological correlates. Trolling is a form of online harassment, where a "troll" behaves in disruptive ways (starting arguments, posting inflammatory messages, deliberately upsetting other users) with no instrumental goal.

In Russia, despite high popularity of social media sites, little research has addressed harmful online behaviors. The limited available data indicates high rates of cyberbullying in Russian adolescents. Rates of cyber aggression among adults are unknown, but Russian pro-governmental organizations have been implicated in hiring paid "trolls" for persecuting people with opposing views online as well as for discrediting ideas, values and individuals. The psychological impact of these activities, including potential social contagion of aggressive behaviors, is yet to be explored.

The goal of our study is to explore cyber aggression and the language of dark personality traits in a sample of Russian Facebook users. The term "dark traits" refers to a set of negative subclinical personality traits: narcissism, psychopathy and Machiavellianism.

Data collection relied on a Facebook application that was designed specifically for this project. The final sample included 6,724 individuals (Mage = 45, age range: 18–85, 77.9% female). Study participants consented to having their public wall posts downloaded. The obtained dataset consisted of 15281 posts, an average of 7.67 (SD =5.69) posts per participant. This is on average 24.77 sentences (SD=38.13) or 311.99 tokens (SD=565.56).

Morphological and semantic analysis were applied. Numeric characteristics of posts for each user were also analyzed. Morphological analysis was performed with PyMorphy analyzer for Russian language.

Compared to women, men were more psychopathic. All three dark traits were correlated with engaging in cyber aggression. Particularly, psychopathy was positively correlated with posting inflammatory messages or derogatory remarks ($r = .24$, $p < .001$) and sending threats or insults ($r = .19$, $p < .001$). Text volume characteristics: Russian-speaking Facebook users with higher scores on Machiavellianism were less likely to produce posts; the length of their posts and sentences was shorter in comparison with users characterized by lower scores of Machiavellianism. The posts and sentences of Facebook users scoring high on Narcissism were significantly longer than those of users scoring low on Narcissism. Lexical features: there were 18575 lexemes in the collected posts; a number of correlations between used words and Dark Trait characteristics were identified (e.g. the words "Russian", "USA", "Putin", "nation", "president" being positively correlated with psychopathy, whereas "mass", "my", "simultaneous", "important", "word" being positively correlated with narcissism; Macchiavelianism did not have positive lexical correlations except the words "Russian", "president"). Morphological and semantic features correlated with the Dark Traits were also obtained. The study shows significant value of social networks as both a tool and an environment of ecologically valid psychological and linguistic research.
Authors acknowledge Saint-Petersburg State University research grant 8.38.351.2015

Dealing with overlapping categorical attribute data

Martin Everett and Steve Borgatti,

Suppose you have a network of ties among individuals, along with their participation is various activities. If participation were mutually exclusive, you would have the simple situation of a single categorical variable that identifies which activity each node was associated with. We could, then, for example, look at the degree to which a node's alters belong to each category. We could also assess the overall heterogeneity of each person's alters with respect to these activities – are their friends split across many categories, or are most of their friends just one kind?

Consider now the possibility that each alter might be associated with multiple categories. For example, the categories may represent activities, and the alters may both play the piano and play tennis. The question is can we still calculate attribute-based measures such the diversity of activities participated in by ego's alters?

The question has bearing on a number of related analyses. A staple of ego network analysis is the assessment of ego-alter similarity ie homophily. When choices are mutually exclusive, we can record node choices as categorical variables, and it is easy to construct measures of ego-alter similarity. For example, the simplest measure is the proportion homophilous: what proportion of ego's alters made the same choice as ego? But again, what if the choices are not mutually exclusive, and an alter (not to mention ego) could have made multiple choices? In this paper, we consider a general approach to adapting measures conceived for categorical variables (i.e., partitions) to the case where we have instead node-by-category indicator matrices, as in the case of participation in multiple activities. We look at the Blau index, E-I, Yules Q and G-F brokerage. In addition we look at a form of Burt's structural holes which takes account of associations to different categories.

Defining r/The_Donald and r/ChangeMyView: An examination of the roles of moderators and users in the norm-setting of online communities

Ella Guest

Online communities often have the freedom, and responsibility, to define their own community norms. The social news site Reddit is an example of a platform that imposes no editorial control over content produced. Reddit's administers instead encourage users to create topic-based forums, called subreddits, according to their own desires and to develop unique standards of acceptable behaviours. A small number of community members who volunteer as moderators together with the wider community of non-moderating contributors work to define the purpose and tone of their subreddits, and detail a code of conduct for participating in the space. These developments are made both implicitly and explicitly and can highlight irreconcilable desires within the community. As such Reddit makes a fascinating subject of study for gaining understanding of the

techniques and methods members and moderators of online communities use in the delicate process of norm-setting.

This research is in the early stages of defining the theoretical and methodological considerations required in researching the processes of norm-setting by subreddit communities. I am currently piloting this work by studying two distinct subreddits; r/The_Donald - a community for ardent supporters of Donald Trump - and r/ChangeMyView – a forum where users actively encourage others to try to change their opinions on any given topic. The research uses social network analysis techniques to identify changes in the respective networks of r/The_Donald and r/ChangeMyView moderators over time, determining the presence of distinct moderation eras. It is hypothesised that these moderation eras will correspond with different eras of community norms and standards. Text analysis techniques are then used to examine whether shifts in the moderator network correspond to shifts in the informal community discussions and formal moderator controlled standards of behaviour – i.e. the implicit and explicit sources of community norms on r/The_Donald and r/ChangeMyView.

Detecting and Exploring Networks of Justice Discourse in Social Media

Kimberly Glasgow,

Social media can contribute to discourse around and framing of major societal issues, and can enable community formation, social change and activism. This work explores how justice, an important concept underlying social systems, is expressed in Twitter data in the context of a high-salience, galvanizing local event – the death of Freddie Gray from injuries sustained in police custody, and the protest and riots that followed in Baltimore in the spring of 2015. Rather than rely on hashtags as relevance indicators, our approach uses machine learning to detect justice-related Twitter activity, an advance that should provide a richer understanding of discourse around a complex, multifaceted topic like justice, and improve the networks we can derive from this discourse.

This work seeks to illuminate the networks of participation in justice discourse seen in that city, how they change over the course of these events, and the properties and positions of actors who become and stay engaged and embedded in the justice discourse network even after the event fades from national attention. To the degree that committed individuals are at the heart of social movements and other efforts to spur social change, and that forming and being embedded in appropriate network structures is critical for channeling commitment into action and eventual success, this work contributes to greater understanding of these phenomena.

Determining consistency of a network model with a particular contact network

Madhurima Nath, Yihui Ren and Stephen Eubank

The dynamics on a finite sized interacting system, modeled by a network, is affected by the underlying structure. The propagation of disease in a population as a diffusive process have been extensively studied using

networks. There are several methods proposed in the literature for building equivalence classes or families of networks based on the structural aspects of the system. It is observed that similarities in the local statistics of two networks are not sufficient to predict the dynamics on them. A global statistic, the Moore and Shannon's reliability polynomial, is suggested to explore the outbreak of an infectious disease on a network. It gives the probability that a system composed of many different interacting components has a desired property and depends on both the structure and the dynamics. The estimation of the reliability polynomial for networks with hundreds of millions of interactions is feasible using Monte-Carlo simulation as exact computations is often NP-hard. The network reliability as a function of the probability of transmission of a disease allows to map parameters of one network on to another using simple transformation which keeps the dynamics invariant.

Digital Media in Greece: Cyberconflict, networks and discourse

Ioanna Ferra,

Based on the theoretical framework of cyberconflict, the study of the digital media in Greece concentrated on the examination of two significant moments/events during the so-called crisis, and the examination of two different social media platforms (Facebook and Twitter). Starting with the first wave of the anti-austerity mobilizations in Greece in 2011, the examination of the Greek Indignados (Aganaktismenoi) developed through the understanding of online networks as developed online (Facebook) and offline. At this stage, using Netvizz and Gephi, data from 141 FB pages of the Greek Indignados collected and analysed, developing a page like network (depth 1). Then, focusing on the period 2012-2015, which characterized by four rounds of national legislative elections and the rise of Syriza, the study concentrated on the analysis of the Syriza Online Diaspora. Using Netvizz and Gephi and collecting material from 394 FB pages, a page-like network developed, including both the national and international online Syriza diaspora.

Then, the study focused on the Greek referendum mobilizations of 2015 and the usage of Twitter (#greferendum, #oxi, #grexit, etc.), examining the contribution of social media to the development of collective action and discourse. Focusing on the two antagonist campaigns of the Greek referendum, more than 235 hashtags collected periodically during the period of the referendum (6/2015 – 8/2015), using NodeXL and Gephi. The analysis of twitter included the in-depth investigation of the two antagonist campaigns, focusing both on networks and discourse. Therefore, after the selection of the most dominant/trending hashtags for the corpus, the analysis focused on the identification of dominant actors, and then, after the identification of semantic networks, the analysis of discourse. Then, the analysis developed further through the comparison of social and semantic networks of hashtags in three key dates of the referendum, including the day before and after of the referendum.

As an overall, the analysis of Facebook data created an insight into the online networks, pointing out online coalitions, communities and dominant actors (SNA), while the Twitter data supported the investigation of the

hashtags evolution and discourse (Semantic analysis). The collection and visualization of the data completed using Netvizz, NodeXL and Gephi, whereas the analysis of the data developed having based on the cyberconflict theory, indicating the contribution of digital media in socio-political conflict and the development of collective actions and social movements.

This study developed an insight on the usage of digital media in the Greek crisis context, while at the same time it situates the case of Greece into the contemporary consideration/debate on the digital media and the linkage to social movement, collective actions and resistance.

Director Appointments – It is Who You Know

Jay Cai, Tu Nguyen and Ralph Walkling

Corporate directors almost always run unopposed and are elected; yet shareholders have little if any say in their nomination or removal. Particularly controversial is the appointment of directors connected to the incumbent board. Connected directors could perpetuate cronyism, but could also reduce uncertainty and coordination costs of boardroom assimilation. Using 9,923 director appointments during 2003-2014, we document the dramatic impact of connections. Consistent with facilitating coordination, more complex firms and firms in more competitive environments are more likely to appoint connected directors. Such appointments receive better market reactions and higher shareholder votes. We also document limited evidence on agency motivations.

Disparities in Slum Health and Its Impact on Larger Urban Regions

Shuyu Chu, Christopher Kuhlman and Achla Marathe

Understanding and improving the health and lives of slum dwellers has been identified as one of the most pressing developmental challenges of the 21st century. Slums are characterized by overcrowding, lack of clean water, poor sanitation and poor medical facilities. This, combined with low vaccination rates, poor education, and self-medication, result in high vulnerability to infections.

Infectious diseases are one of the leading causes of human morbidity and mortality worldwide. Since Influenza spreads from person-to-person contact, population density is an important factor in its spread. However, currently there are no detailed models of the most densely populated regions, i.e. slums, that are embedded in large urban areas to study the spread and control of epidemics.

This work uses agent-based modeling to develop a highly resolved social contact network of the 13.8 million residents of Delhi, the National Capital Territory of India, by taking account of slum demographics and their residents' activities. Simulation-based results show that when slum attributes are ignored, the estimates of epidemic measures such as epidemic size, its peak value and time to peak are underestimated by magnitudes of 10%-50%.

A variety of pharmaceutical and social distancing strategies are analyzed under different scenarios and results show that the slum population sustains a much higher attack rate even when the ¬¬same control measures are applied to slums. If the effect of slums is omitted, the effectiveness of vaccination is overestimated by 30%-55%. The slum populations sustain a greater infection rate under all intervention scenarios compared to the non-slum population. In general, vaccination strategy performs better than social distancing strategies such as close schools, in slums. We also study the differential effect of seeding the epidemic in slum versus non-slum areas.

Unique network attributes of slum polygons will be described to highlight the differences in slum versus non-slum regions. For example, the average non-slum household size is 5.2 whereas in the slum regions it is 15.5. According to the activity survey, slum individuals have more varied activities than non-slum individuals, which translate into roughly 10% increases in average degree and average clustering coefficient in slums.

In conclusion, our study shows that the unique network characteristics of slum populations play a significant role in both the spread and control of infectious diseases. Modeling the slums and estimating their impact on epidemics will help policy makers and regulators more accurately prioritize the allocation of scarce medical resources and implement public health policies.
Currently, over a billion people reside in slums across the world and this population is expected to double by 2030. This study uses Influenza as an example to demonstrate the need to understand the role of slum populations in the spread and containment of infectious diseases.

Dynamics of Social Networks Following Adolescent Pregnancy

Elizabeth Humberstone

Despite public policy efforts, the U.S. remains the leader in adolescent pregnancy amongst industrialized nations, with approximately 5% of teen girls becoming pregnant each year. While the challenges facing pregnant teens are multiple, little attention has been paid to the impact of pregnancy on their social lives. There are multiple reasons to expect social network changes following a pregnancy. Pregnancy often brings with it: responsibilities and challenges that prevent regularly socialization, stigmatization that can negatively impact sustaining or forming friendships, and assignment to alternative educational tracks that remove girls from their previous social spaces and expose them to new peers. In cases of online courses or home schooling, social isolation risk also increases. While other teens may face some of these issues, pregnant teens regularly experience all three - often with sudden onset. Exploring the social networks of pregnant teens is important as social disadvantage may exacerbate inequalities and challenges faced by these teens.

This study seeks to understand how adolescent females' networks change after becoming pregnant. Taking advantage of the National Longitudinal Study of Adolescent to Adult Health's (Add Health) longitudinal network

data, I will compare friendship networks before and after a pregnancy for the subset of females (n=64) who become pregnant between waves of data collection. To this end, I will first use mean difference tests to assess the following network changes: (1) out-nominations, (2) in-nominations, (3) centrality, (4) academic success of friend network (i.e. average GPA of friends), and (5) delinquency of friends. I will also provide network graphs that illustrate network changes for select cases; if possible, these cases will illustrate observed differences in the extent of network changes based on characteristics of the pregnant teen.

Because changes in a network are dependent on the state of the network at a previous time point, I will also explore how friendship networks evolve following pregnancy using a stochastic actor based modeling (SABM). Modeling pregnancy introduces issues that require adjustments to the typical SABM procedure. First, boys cannot take on pregnancy as an attribute; as such, the model must be set to prevent boys from making any attribute (pregnancy) micro-step changes. Further, the evolution of pregnancy in the network can only change from never pregnant (0) to pregnant (1); once pregnant, actors cannot revert back to a never pregnant state. This modeling is comparable to studies of diffusion of innovation where a behavioral adoption is an all-or-nothing nonreversible change. As such, I intend to use the SABM adjustments with proportional hazards models detailed in Greenan (2015).

A change in pregnancy status is anticipated to be associated with decreased sizes of friendship networks and decreased connections to academically successful peers. Attending a school that teaches pregnant teens in regular classes or that provides childcare is expected to moderate this relationship between becoming pregnant and network change.

Estimating Spillover Effects in Network Interventions with Non-Random Assignment: The Effects of a Field Intervention on Gunshot Victimization

George Wood, Yanick Charette and Andrew Papachristos

More than 10,000 people are killed each year in gun-related homicides and another 60,000 are injured in non-fatal gun assaults in the United States. Recent research shows that gunshot victimization concentrates in social networks. Field interventions that aim to reduce the incidence of gunshot victimization by interacting with high-risk individuals have been implemented in several cities. Such interventions are characterized by non-random assignment to the treatment condition and the delivery of modules designed to transmit spillover effects to the non-treated peers of treated individuals. Consequently, any evaluation of the intervention effects must deal with three conditions: (1) there may be substantial mismatch in the probability distribution of victimization across the treatment and non-treatment groups due to non-random assignment; (2) any effects are subject to interference between units due to the network setting, which violates the stable unit treatment value assumption; (3) the interference is of direct interest, but the extent of interference varies across units due to the structure of the network. These conditions are typical of any non-randomized experiment or intervention in a network setting.

This paper presents the evaluation of a gunshot violence field intervention in Chicago, one of the largest of its kind. We apply a recently proposed framework (Aronow and Samii, forthcoming) for estimating causal effects under the above conditions. Using data on gunshot victimization outcomes and the social networks of high-risk individuals, we define a simple function for the exposure of non-treated individuals to the intervention through network spillover. We then estimate probability distributions of assignment to the treatment and the exposed conditions, and use these distributions to match treated and exposed units to non-treated and non-exposed units, respectively. Finally, we estimate the average causal effect of the intervention for treated individuals and the average spillover effects for individuals with varying levels of network exposure to the intervention. While our application is specific to gunshot violence, the methodological framework we employ has broad application to social network-based interventions.

Evaluating Institutional Coalescence with the Aid of Exponential Random Graph Models

Philip Murphy and Fernando Depaolis

Organizational health in the form of coalescence between units is an overarching concern for mergers and acquisitions between organizations. The incorporation of one organization into another can be an immensely complicated task, especially when the physical locations of the various units are geographically distant. It is clearly in the interest to foster such imperatives as unity of purpose between units and evolving efficiencies between units that share similar purposes.

This presentation highlights the use of exponential random graph models (ERGMs) for evaluating one such merged organization. The purpose of the evaluation was to reveal the degree to which the various units within the organization had coalesced, and the nature of that coalescence. In particular, it was deemed important to test for whether various attributes and structural effects may help explain tie formation within the organization for the purpose of strategic planning.

Roughly 30% of employees responded to a modified roster survey that elicited three aspects of interorganizational relations. Individual responses were aggregated to the office or department level, resulting in network representations of the communication, collaboration, and esteem relationships within the organization, as well as accompanying attributes for each unit. ERGMs were then used to evaluate the overall tendency for consolidation within the organization while testing for possible explanations of tie formation in the collaboration and esteem networks.

Evaluating Policy Networks in Afghanistan and Pakistan: A Relational Assessment of Aid-Impact in Fragile States

Elsa T. Khwaja,

This study addresses the challenges to state building in fragile and conflict-affected states (FCAS) through a relational lens. Investigating

development assistance in targeted conflict-affected zones in Afghanistan and Pakistan, the paper examines how development policy interventions are successful or ineffective in producing their intended impact. The heterogeneity of stakeholders present in the regions and the geostrategic importance of the two nations makes them prime countries for analysis. Demonstrating weak and corrupt governing institutions, limited transparency and accountability, and failure in basic service delivery, the countries receive massive aid infusions from various channels. Past policies show gradual progress but with limited sustainable outcomes. These countries, hence, demonstrate the vital need for innovative approaches to analyze interventions and enhance understanding of contextual influences on development policy initiatives in fragile spaces.

Through an integrated conceptual and methodological framework of social capital theory and social network analysis, the research provides critical insights on the development stakeholder relationships influencing aid-efficiency. Beginning with a preliminary content analysis of development program archives, the study conducts a two-step mixed methods design, with social network analysis (SNA) and qualitative comparative analysis (QCA) of prominent development programs administered by top donor organizations in Pakistan and Afghanistan: The World Bank and the United States Agency for International Development (USAID).

With shifting power dynamics and localization efforts, the research examines why certain structural properties and conditions are critical for development policy networks to work successfully in vulnerable conflict zones. Generating social capital in a policy network is a critical mechanism for successful, and hence, sustainable policy implementation. Power, brokerage, and cohesion among organizations at the whole-network level are the primary structural determinants influencing implementation efforts. A comparative analysis of network metrics and visualizations illustrate various attributes of local policy networks that have either succeeded and failed, and further identifies key structural determinants for aid outcomes.

Findings from this research provide meso-level insights on development policy network structures, involving primary exchanges among international actors and local counterparts, which often shape and influence diverging mandates and agendas. The qualitative archival analysis, along with the social network analysis of the case studies, maps the attributes of agents and the local context, providing insights often neglected in macro-level aid analyses. These network evaluations of policy interventions can thus serve as alternative or supplementary methods to enhance conventional development impact assessments.

As the 2030 United Nations development agenda promulgates the Sustainable Development Goals (SDGs), enhancing social inclusion for improving development efforts across all sectors remains vital. Challenges in global development policy require greater relational explanations. Measuring network structures involving multiple stakeholder participation in various development policy circumstances is an emerging and developing paradigm. Greater empirical evidence is necessary to examine power dynamics in aid processes within FCAS. New approaches integrating the proposed relational methods of SNA and QCA in policy evaluations can better address the

urgency and complexity in fragile contexts, alongside the appropriate transformational solutions to the ongoing challenges of empowerment, ownership and sustainability of development interventions.

Evaluating Political Party Cohesion Using Exponential Random Graph Modeling

Shambavi Sadayappan and Ian McCulloh

The United States is becoming increasingly politically divided. In addition to polarization between the two major political parties, there is also divisiveness in intra-party dynamics. In this paper we attempt to understand these intra-party divisions by using an exponential random graph model (ERGM) to compute a political cohesion metric to quantify the strength within the party at a given point in time. The analysis is applied to the 105th through 113th congressional sessions of the House of Representatives. We find that the Republican party not only generally exhibits stronger intra-party cohesion, but when voting patterns are broken out by topic, the party has a higher and more consistent cohesion factor compared to the Democratic Party.

"Everybody puts their whole life on Facebook": Identity management and the online social networks of LGBTQ youth

Elizabeth McConnell, Balint Neray, Kai Korpak, Antonia Clifford and Michelle Birkett

Given the burgeoning popularity of social networking sites in the past decade (Perrin, 2015), sites like Facebook are becoming important contexts for social science research (Drushel, 2010) and community psychology (Kornbluh, Neal, & Ozer, 2016). This is particularly true for research with LGBTQ youth, who may use online social networks to buffer offline support and access LGBTQ-specific resources and community (DeHaan, Kuper, Magee, Bigelow, & Mustanski, 2013; GLSEN, CiPHR, & CCRC, 2013) and who face unique challenges negotiating outness and managing their identities with respect to the multiple social groups who may comprise their Facebook networks (Cooper & Dzara, 2010; Duguay, 2016; Fox & Warber, 2015; Legate, Ryan, & Weinstein, 2012). In this study, we utilized survey and network data to examine the experiences of LGBT youth on Facebook. Participants were a community sample of 204 youth aged 19 to 28 who currently or formerly lived in the Chicago area and self-identify as LGBTQ or same-sex attracted. Participants completed survey measures and a social network interview using NameGenWeb, an Application Programming Interface (API) that visualized their Facebook networks and network subgroups. We examined patterns of outness to different subgroups using cluster analysis, and then examined and visualized differences in Facebook networks across these outness clusters. Findings illustrate how LGBTQ youth create community using social media platforms and underscore the importance of examining online social contexts to better understand health and wellbeing among LGBTQ youth. Implications for theory, research, and applied work with LGBTQ youth will be discussed.

Examining the Unique Properties of Negative Tie Cognitive Social Structure

Joshua Marineau

In this paper, we highlight important theoretical and methodological considerations and practices associated with Negative Tie Cognitive Social Structures (NTCSS). We believe the divergent properties of negative ties pose important challenges and opportunities in cognitive social network research. Thus, we provide a preliminary theoretical framework and empirical analysis with multiple NTCSS samples to investigate critical differences between positive and negative tie cognition among individuals and groups: such as, negative asymmetry in network perceptions, assumptions about accuracy and accuracy measurement, and general differences in perception of positive and negative tie structure. We seek to provide an empirical and theoretical framework for future research and a preliminary road map for tackling the unique challenges posed by a cognitive view of valenced social networks, some of which are not currently met by existent theory and methods.

Exploring Alt-News Article Citation Network

Janis Butkevics and Beatrice Garcia

The 2016 election has been unique with evidence of foreign intervention and the rise of alternative news networks that support both major sides of the US political system. The implication that select alternative news platforms have been directly influenced by foreign media and publications is often mentioned but proof has been limited.

In order to better understand the flow of information and ideas, various alternative news sources were scraped with the content of the article and included citations were extracted generating a network. An attempt was made to filter accidental collection of advertising and other links. In the collected data set we explore the structure and relations between popular alternative platforms and how they cite other alternative and mainstream media and attempt to understand how they relate to foreign and domestic news networks. The data set and collection is ongoing and incomplete.

Finding A Place: New Teachers' Integration Into Their Schools' Work-Related Social Networks

Matthew Shirrell

Entering a new organization, individuals encounter established networks of social and information-exchange relationships, which they must enter in order to establish ties to their new colleagues (Brass, 1995; Brass, Galakiewicz, Greve, & Tsai, 2004; Morrison, 2002). Establishing these ties is important, as these connections allow newcomers to access information that can help them successfully adapt to their new environments (Miller & Jablin, 1991; Morrison, 2002). Ties to colleagues are especially important for new teachers, as teaching is complex, unpredictable, and knowledge-

intensive work (Cohen, 1988; Lortie, 1975; Rowan, 1990) that requires teachers to rely on their colleagues to help solve problems of practice (Eraut & Hirsh, 2007; Frank et al., 2004). Indeed, teachers' interactions with their colleagues can shape their practices and beliefs in a variety of important ways (Parise & Spillane, 2010; Penuel, Frank, Sun, Kim, & Singleton 2013; Penuel, Sun, Frank, & Gallagher, 2012; Sun, Penuel, Frank, Gallagher, & Youngs, 2013). Despite the interconnected nature of teachers' work, however, little research on the socialization of new teachers has taken a "network perspective" (Robins, 2015) to examine how new teachers form—or do not form—relationships with their colleagues across their early careers. Examining teachers' work-related social networks in fourteen elementary schools in one suburban school district over four years, this paper explores new teachers' integration into their schools' work-related social networks. Specifically, the analysis compares the network centrality of new and incumbent teachers over time, and uses hierarchical latent space network models (Sweet, Thomas, & Junker, 2013) to examine whether being new to a school predicts either seeking or being sought out for advice, controlling for a variety of other factors known to predict ties. Analyses also explore how new teachers' integration into their schools' networks differ across schools and school subjects. Throughout the analysis, two types of new teachers are distinguished: "novice newcomers," who are new teachers that enter their school organizations entirely new to teaching, and "experienced newcomers," who enter their school organizations with prior experience in another school. Results indicate that novice newcomers are less integrated into their schools' work-related social networks than newcomers that arrive with prior experience in other schools, suggesting that new teacher socialization is focused on the adjustment to teaching generally, rather than the adjustment to a specific school. Results also show that although new teachers are sought out for advice more frequently after their first year in the school, the degree to which new teachers seek advice changes little across their first years on the job. These findings provide additional insight into the challenges that schools and school systems face in easing the organizational entry of new teachers.

Finding Strategic Locations for Planting Seeds of Contagion

Scott Feld

Finding Strategic Locations for Planting Seeds of Contagion

There are many reasons why one might want to maximize the diffusion of some "meme" using the opportunity to plant a "seed" at a strategic location within a network. This paper explores some strategic considerations for such interventions.

We begin with challenge of selecting a seed for simple contagion at one remove, and show that previous results indicate that choosing a random friend of a random node will tend to reach many more other nodes than choosing the random node itself. Then, we consider the challenge of selecting a seed for spreading to two removes, and we show that a random friend of friend of a random node tends to do much better than a random friend of a random node, even though the random friend of friend will not

generally have more friends than the random friend. We also show that a random friend of friend importantly differs from a random friend of a random friend, which does not do so well. Then we generalize these results to challenges of contagion at m removes.

Finally, we consider further issues. Specifically, we show that even as the numbers reached at specified removes may be important for many purposes, there are other purposes where the numbers of "unique" nodes reached may be more relevant. We suggest that redundancy is generally not nearly as big a problem as many analysts seem to expect, Nevertheless, it may be useful to change the unit of analysis from individuals to focused sets, i.e. intersecting clusters, where each focused set generally includes large numbers of paths between every pair of nodes within the set. Spread across focused sets is most important for reaching large numbers of new nodes. We also consider that complex contagion (where multiple exposures are required for adoption) often depends upon intersections between focused sets that include multiple nodes rather than single nodes. We suggest further challenges for both theory and applications.

Framing and Collective Action

Gunes Ertan

On May 13th 2014, 301 workers died at the Soma Holding coal mine in the Soma town of Manisa, Turkey. Most of the deaths were due to carbon monoxide poisoning as a result of fire. The exact causes of the fire are currently not known. The incident is the deadliest mining as well as workplace accident in the history of the modern Turkey.The incident triggered mass protests, mostly among anti-government citizens. Due to the nature of the event, unlike in many mobilizations, government officials this time could not ignore or easily dismiss the challenges posed by the protestors.Hence a ""framing war"" started between challengers and the government. This study aims at deciphering points of convergences and divergences emerged using firehose Twitter data acquired following the incident as well as official accounts of public officer and social movement organizations. I use topic modeling and network analysis to contribute to theorizing on framing and collective action.

Free Network Drawings - Capabilities and Implications for Collecting Ego Network Data

Tom Toepfer

Collecting ego networks is often accompanied by using visual tools, which graphically represent the personal relationships of respondents (cf. Hollstein/Pfeffer 2010). Beside the prominent concentric circles (Antonucci 1986) and other structured and standardized network diagrams, so called "free-designs" or network drawings are increasingly used. Using this technique of data collection, participants are asked to draw their social relations on a blanket piece of paper. Combined with qualitative interviews, unstructured network drawings do not only function for illustrating social networks, but they are also used as narration generator (cf. Hollstein/Pfeffer 2010) and can tell us something about the

process of representing networks. How do interviewees actually handle drawing their network on a blanket sheet of paper and what can we learn out of it in terms of any systematic network patterns, the data collection process itself and underlying cognitive schemata of the participants?
To trace these questions, we use data from the project "Visual tools for collecting ego-centered network data. A comparative study" (Head: Betina Hollstein), that compared four different visual tools with regard to network data collection. Using an affective name generator, 18 interviewees were asked to represent close and important alters on a blanked sheet of paper. Embedded in guided interviews, we conducted a concurrent and retrospective think aloud design, asking about the interviewee's associations and thoughts during and after the data collection. Therewith we are able to get a deeper insight to the data collection process.
In this presentation we a) present a typology of different free network drawings, b) illustrate findings on the processing of data collection, c) discuss the contribution of free designs to better understand individual's representations of social networks and, d) give an insight into capabilities of free network drawings for the further development of data collection instruments.

Friendship relationship formation in Year 1 students

Daniel Tischer and David Hughes

The project we are presenting here seeks to combine network data and psychometric profiles of students in a lecture theatre setting to inform emergence of friendship patterns, well-being and achievement in year 1 undergraduate students / freshmen(-women).

The company we keep influences our perceptions and actions and thus what we view as worthy goals and how we might go about achieving those goals. Peer relationships are amongst the most important in early adulthood, influencing our self-perceptions, career development, feelings of security and well-being. Given the diverse effects of social groups and in particular friends, it is surprising that few studies have examined these issues within a higher-education context and those that do exist have tended to neglect the effects of friendship formation.
Previous friendship formation studies also tend to be somewhat limited in scope. Most have focused on primary and secondary school settings where the choice of friends is, arguably, predetermined geographically, constrained by small student numbers (up to 30) and pre-existing friendships. Within higher education, Facebook friendship data or mixed-method studies across universities have permitted a broader assessment of friendship ties but neglect the classroom setting and thus give little information about the nature of the ties within educational settings.
Our study examines the relationship between friendship patterns and achievement in higher education and in doing so combines psychometric measurement of participant personality with longitudinal network data. Personality is driver of friendship formation and success and collecting this data allow us to examine whether or not different personality traits are associated with different network patterns. Spatial data regarding student position within the classroom will be analysed to see if certain

types of personality lead to different seating positions and also whether choice of seating is related to other network behaviour.

Geospatial and Social Network Causes of Group Violence

Christopher J. Callaghan, Daniel Cunningham, Sean F. Everton, and Kristen Tsolis

Drawing on previous research that found that overlapping geospatial areas (i.e., turf) and the patterns of ties between groups (i.e., social networks) can facilitate and/or constrain group conflict, we (Cunningham, Everton, and Tsolis 2017) examined the spatial and social network causes of violence between African transnational extremist organizations (TEOs). In particular, using data from the Armed Conflict Location and Event Dataset (ACLED), we estimated a series of exponential random graph models (ERGMs) that explored the patterns of violence among African TEOs. Although this initial analysis yielded insights into TEO violence, it did not take into account the directionality of the violence between the TEOs. That is the approach taken in this paper, which should deepen our understanding of TEO violence and help in the crafting of strategies to limit TEO violence in the future.

Global Networks of Science and Future Science Policy: The Role of U.S. Research Universities in Collaboration and Internationalization of New Scientific Knowledge

Alina Lungeanu, Yuan-Chih Fu, Liang Zhang and David Baker

Globalization of science has major implications for effective US national science policies due to its impact on both cross-national competition and collaborative opportunities (Zhang, Powell, & Baker 2015). Despite increasing globalization of scientific research, its patterns and consequences—both within US and across nations—are not fully clear. Therefore, understanding networks of science production, particularly the role played by US research universities, deserves much more attention than it has traditionally received.

Prior research showed that since the 1960's, the number of science, technology, engineering, and mathematics, as well as health (STEM+) publications has grown at an exponential annual rate of 3.5%. This dynamic has created "mega-global science," which is attributable to a worldwide expansion in the carry capacity for research (de Solla Price, 1963). Furthermore, university-based science is increasingly internationally collaborative. Of the one million plus new research publications in 2010, scientists located in at least two different nations co-author nearly 25%, increased from 2% in 1980. In the midst of this trend, the rate of growth in international collaboration undertaken by US based scientists has fallen behind that of scientists in West Europe, and will soon be challenged by East Asian scientists (Adams, 2013).

Our study has two goals. First, we explore changes in international collaboration network patterns from 1960 until 2010 using co-authorship networks in STEM+ publications. Second, we focus more squarely on collaboration patterns between US research institutions and their

international ties. Specifically, we examine which US universities and their networks, using which organizational characteristics and strategies have maximized international collaboration. Finally, to what degree have these networks contributed to the growth in global scientific collaboration?

To answer these questions we use more than 25 million research articles published from 1960 until 2010 in STEM+ journals and extracted from Web of Science (WoS) database provided by Thompson Reuters. We developed standard country code to account for historical changes and added these to all publications in the database. In addition, for research articles published in 1980 and 2010 we standardized institution codes for US universities, which are then merged with institutional characteristics from Integrated Postsecondary Education Data System (IPEDS).

Preliminary results show that US research universities have led the way in the expansion of science by acting as central hubs within their networks of, first domestic and then international, collaborative research. Our analyses also suggest that the rise of substantial hubs outside the U.S. have increasingly competed with this advantage. Additional analyses based on the 1980 and 2010 US university collaboration networks suggest that the structure of the collaboration network is changing and is correlated with university outcomes. Overall, the network becomes denser (i.e., more collaboration links in 2010 compared with 1980) and centralized (i.e., with a handful of universities dominating the collaboration network). Interestingly, two of the most productive US research universities show different patterns of collaboration: Harvard and Michigan had 170% and 346% increases in the number of US collaborators respectively. These metrics are correlated with the number of publications of 215% for Harvard and 252% for Michigan.

Globalization, Trade Networks, and Regional Trade Blocs: Alternative Routes to Development

Martin Jacinto

Despite the proliferation of democratic governments in the Global South, many periphery and semi-periphery countries display characteristics antithetical to democratic principles. World system theorists focus on the impact of core/periphery hierarchies on national political characteristics. Non-core countries face external economic pressure that hinders democratic development, and suppresses the influence of local democratic forces. Recent studies posit that structural inequality in the world economic system is formed and reinforced through trade networks. Structural inequality stifles a peripheral country's upward mobility, and adversely affects their democratic development. However, few studies show how trade networks within peripheral countries are used to counteract external pressure from core countries. Many peripheral and semi-peripheral countries are forming their own regional trading blocs that result in small clusters of trade networks. I ask the following questions: 1) Do these small clusters of trade networks provide alternative routes to economic mobility? 2) Do these small clusters support political development within less developed countries? Have structural inequalities

within the world economy hindered democratic development across peripheral and semi-peripheral countries, or have these countries formed small groups that allow for inchoate democracies to survive? For this study, I analyze structural equivalence which is a concept of similarity in that actors are structurally equivalent if and only if actors have ties with others in the same neighborhood. From the structural equivalence analysis, I used blockmodels to analyze which structurally equivalent actors cluster with each other and how one clusters interact with another other cluster. Finally, I conducted a correspondence analysis to analyze which clusters are forming the strongest ties with each other by analyzing the variation they explain within the overall trade network. Findings challenge the view that the national democratic development of peripheral and semi-peripheral countries is dependent solely on the actions of core countries.

Goodness-of-Fit Testing for Behavior in Joint Dynamic Network/Behavior Models with an Extension to Two-Mode Networks

Cheng Wang, Carter T. Butts, John R. Hipp, Rupa Jose and Cynthia M. Lakon

The recent popularity of models that capture the dynamic co-evolution of both network structure and behavior has driven the need for indices to assess the fit of these models. Whereas there are several existing indices for assessing the ability of the model to reproduce the network over time, to date there are few indices for assessing the ability of the model to reproduce the behavior of the individuals in the sample over time.

Drawing on the strategy of assessing the fit of a model by comparing global values of the distribution of behavior in the actual observed network to those from networks simulated based on the model parameter values, we propose four goals that a researcher could reasonably expect of a joint structure/behavior model regarding how well it captures behavior, and describe indices for assessing each of these. First, one fundamental goal is that the model should reproduce the distribution of the behavioral variable(s) in the observed sample at each time point. Second, given the dynamic nature of the model, we would expect that a useful model should accurately capture transitions over time in the level of the behavioral variable(s). A third goal for a useful model is that it should generate networks in which the behavior patterns align with key statistics (e.g., vertex-level indices) of the social network. Finally, a fourth goal is that a useful model should be able to capture the degree of behavior clustering within the network.

These reasonably simple and easily implemented indices can be used for assessing model adequacy with any dynamic network models jointly working with networks and behavior, including the Stochastic Actor-Based model using the RSiena software package. We demonstrate the indices with an empirical example to show how they can be employed in practical settings and extend to the affiliation dynamics in two-mode networks.

Graph properties affecting link analysis

Anthony Johnson

Social network visualizations are commonly used in law enforcement and other areas to identify persons of interest within a graph. How dependent are these judgments to features of the graph, and are there apparent biases in these analyses? Are experts different from novices in their use of graph information?
This paper compares expert and novice use of strategies used to make decisions based on social network position. Three strategies identified in prior work are studied: number and ratio of direct connections, high versus low base rates, and layout proximity. Misuse of layout proximity in the absence of direct connections is also discussed as a possible cognitive bias related to graph perception.

Group Polarization in Opinion Network Dynamics

Michael Gabbay, Zane Kelly, Justin Reedy and John Gastil

Group polarization is a behavior whereby discussion causes group members to shift their opinions in a more extreme direction so that the mean post-discussion opinion exceeds the mean pre-discussion opinion. Group polarization is a robust experimental phenomenon that has been well-studied within social psychology. However, we present experimental evidence, theoretical arguments, and mathematical models in support of a novel mechanism for group polarization. Our experiment involved online group discussion concerning the outcomes of upcoming National Football League games. All three variables manipulated --- policy side, disagreement level, network structure --- show statistically significant results, which challenge standard theories of informational and normative influence. Two mathematical models are developed which are in qualitative and quantitative agreement with our data. The first is a simple preference aggregation model for triads. The second is a more general model of continuous opinion dynamics on networks which evolves member opinions and uncertainties using coupled nonlinear differential equations. The model can generate shifts toward the extreme without the assumption of greater resistance to persuasion among extremists as is typically made in the opinion network modeling literature.

HIV-related behaviors and peer network exposure on Facebook: The networked contexts of peer influence in a multidimensional online social networking environment among young Black men who have sex with men (YBMSM)

Lindsay Young, Kayo Fujimoto and John Schneider

For young men who have sex with men (YMSM), the proliferation of online social-networking sites (SNS) – i.e., the Internet-based platforms that enable connection and communication between users -- has made building community and seeking partners easier, faster, and more selective. In

response to the popularity of online social platforms, clinicians and health researchers are paying closer attention to the relationship between SNS use and sexual risk behaviors among at-risk groups like YMSM. Adopting a behavioral surveillance approach, this body of research is still developing, but thus far findings are mixed: some studies reveal positive associations between SNS use and risk behaviors; others find no association; and still others identify positive associations with protective behaviors.

Although studies like these illuminate protective and risk characteristics of at-risk SNS users, they suffer from two noteworthy limitations. First, the general trend has been to focus almost exclusively on partner-seeking uses of SNS as the means of sexual risk exposure. Consequently, other important connections made in most mainstream SNS environments like friendships and group memberships remain underexplored contexts of HIV protection and risk. Second, prior efforts to survey the sexual behaviors of SNS users has had little to say about how these behaviors are affected by the actual social structure of these networked communication environments.

In this study we address these gaps by focusing on a salient multidimensional social networking environment – Facebook – among a large cohort of young Black MSM (YBMSM) and investigate the extent to which exposure to peers in both friendship and group affiliation contexts influence individual sexual risk behaviors. To pursue this objective we use Network Autocorrelation Models, which statistically measure and test network effects on individual behaviors. Drawing from a respondent-driven sample of 525 YBMSM in South Chicago collected as part of UConnect, a social networks study of YBMSM in Chicago, we model both protective and risk behaviors, including PrEP awareness, recent testing, condomless sex and recreational and sex-related drug use, as functions of: (a) "relational exposure" through direct facebook friendship, (b) "positional exposure through peers who occupy structurally equivalent positions in the friendship network, and (c) "affiliation exposure" through co-membership in organized facebook groups. Separate from these three forms of network effects, we also assume that an individual's position in the facebook friendship network (i.e., occupying a certain network position such as centrality, bridging, and isolates) affects his or her HIV-related behaviors and will therefore be modeled as additional local-level parameters in the model.

Our findings will provide important insights regarding the effects of online social embeddedness on HIV-related risk and protection, which is an increasingly salient and, as of yet, underexplored context of YMSM's social lives. Further, modeling multiple risk and protective behaviors will show for which types of HIV-related behaviors each form of online network exposure is a greater influencer. Given the need for interventions that are more socially contextualized and culturally salient, our findings will inform which aspects of YBMSMs' online interactions are viable points for intervention or useful opportunities for engagement.

How I stopped worrying and learned to love the passage of time

Maksim Tsvetovat

In Network analysis, the notion of time has always been the elefant in the room. In some of the earliest writings on SNA (Granovetter, Krackhardt, Simon, etc) the idea that an edge of a network is actually a temporal phenomena was addressed in various ways, and then brushed away as an inconvenience.

Krackhardt used an logarithmic frequency scale to encode strength of ties. Granovetter talked about emotional energy expenditures in a unit of time. Dunbar talked about cognitive limitations, which is simply our ability to cope with incoming and outgoing data over time.

And what did we always have at the end? A binary edge. A real-valued edge, maybe, or a Bayesian edge, at best.

Then, we scrambled to re-assemble a temporal narrative from these heavily aliased slices -- hence the eternal debate of homophily vs. diffusion, questions of how and if ties decay, incredible complexity of SIENA models, as well as strange agent-based concoctions that I myself have perpetrated.

In this paper, I'd like to come back to the original notion of communication as a directed micro-behavior happening in a continuous, not discrete, time -- and, as such, social networks as aggolomerations of these continuous, fluid behaviours.

When we do that, suddenly disjoint findings can start falling into place. Centrality metrics get a temporal nature and we can differentiate roles not just by how many people you talk to, but when. We'll show temporal degree, betweenness, and eigenvector centralities. In fact, I believe that treating centralities as a temporal phenomenon resolves some of the critical interpretation issues. Diffusion vs. homophily debate resolves itself peacefully, and the two processes can live happily ever after. ""Mysterious"" Dunbar number becomes a straightforward arithmetic derivation. Mapping network ties to micro-behaviors becomes straightforward, without unwarranted determinism or a ""crutch"" of Bayesian inference.

Why have we not done it this way before? We did not have the means to collect empirical data of this sort (now we do, thanks to cell phones and Twitter and Facebook), nor we had the computing capacity to analyze such amounts of data and theorize about it.

In a spirit of bringing new and untested ideas to INSNA conferences (which I have reliably done for 15 years), I urge you to poke this idea full of holes.

Image Classification Based Social Network Analysis Constructs

Rich Takacs, Janis Butkevics, Christine Sowa, Stephanie Pitts, and Ian McCulloh

The accuracy and subsequent utility of social network analysis (SNA) and social media analysis (SMA) in regional languages continue to be hindered by the cost of linguistic experts and the limitations of Machine Translation (MT) applications. This work seeks to overcome the computational limitations of MT by implementing a human-in-the-loop image classification approach to SNA/SMA.

Image classification for topic and area specific search queries in social media offers advantages over current practices. The valence of imagery, combined with the explanatory and symbolic aspects tied to image interpretation not only provide the motivation to define specific events through images, but according the exemplification theory, images are a powerful means of producing belief change precisely because they elicit affect. The result is that social media imagery is being utilized to document localized events, define larger social movements, and shape public perception of complex issues. With the difficulties in text mining in linguistically complex languages, image classification offers an opportunity to bound social media search queries to specific topics and/or within limited geographic areas.

Utilizing cutting-edge supervised learning image classification as its basis, this work creates classifiers for image-based social media queries; provides a user with relevant social media content based on image classification; conducts robust text and sentiment analysis to provide fidelity concerning the social media conversation surrounding those images in multiple languages; and conducts follower network-based social network analysis for users sharing specific images.

Infighting and Network Structure in the Syrian Insurgency

Michael Gabbay, Emily Gade and Mohammed Hafez

Today's insurgencies and civil wars are rarely battles between two opposing sides; instead, they are fragmented conflicts in which militant movements consist of a proliferation of multiple independent armed groups. Understanding why and when these groups fight one another can help scholars and policymakers alike better understand how conflicts are likely to unfold. We employ a network-analytic perspective to relate the structures of infighting and cooperative networks within a militant movement. In particular, we put forth propositions relating infighting between groups to factors such as power, ideology, and prior cooperation. Our data consists of a network of Syrian militant groups constructed from a corpus of militant rhetoric using a combination of automated text processing and manual coding. We test the propositions on this data using techniques including community detection and exponential random graphs.

Influence of sexual network characteristics on willingness to use PrEP among MSM in Tijuana, Mexico

Heather Pines, Britt Skaathun, David Smith, James Fowler, Alicia Harvey-Vera, Gudelia Rangel, Shirley Semple and Thomas Patterson

To maximize the impact of pre-exposure prophylaxis (PrEP) for HIV prevention and control costs, sexual networks can be used to target PrEP to those at greatest risk of HIV infection. Information about the influence of sexual network characteristics on willingness to use PrEP is needed to assess the potential acceptability of network-based PrEP delivery programs. We examined the influence of sexual network characteristics on willingness to use PrEP among men who have sex with men (MSM) in Tijuana, Mexico.

To date (3/2016-3/2017), 358 HIV-negative MSM have been recruited via venue-based and respondent-driven sampling in Tijuana. Interviewer-administered surveys collected egocentric sexual network data on up to 20 male or transgender partners in the past 4 months and information on participants' willingness to use PrEP if available for free. Logistic regression was used to examine the relationship between sexual network characteristics and willingness to use PrEP adjusting for socio-demographic, behavioral, and psychosocial factors.

Participants had a median age of 39 years (interquartile range [IQR] = 29-46; 27% under 30 years) and mostly identified as male (97%), Latino (99%), and bisexual (53%) or gay (33%). Reported sexual networks had a median size of 2.0 (IQR=1-4) and consisted of ≥1 transgender partner (20%), ≥1 partner living outside Tijuana (30%), ≥1 age discordant (>10 years younger or older than the participant) partner (57%), and ≥1 condomless anal intercourse partner (70%). Overall, 86% of participants were willing to use PrEP. Willingness to use PrEP was higher among those who reported more social support (adjusted odds ratio [AOR] = 1.01, 95% confidence interval [CI]: 1.00, 1.02), greater outness about having sex with men (AOR = 1.30, 95% CI: 1.07, 1.57), higher levels of internalized homophobia (AOR = 1.09, 95% CI: 1.03, 1.16), comfort discussing same-sex sexual behaviors with health care providers (AOR = 2.39, 95% CI: 1.10, 5.23), HIV testing in the past 12 months (AOR = 3.17, 95% CI: 1.37, 7.34), partners living outside Tijuana (AOR = 3.18, 95% CI: 1.21, 8.35), and condomless anal intercourse (CAI) partners (AOR = 2.13, 95% CI: 0.98, 4.63), while willingness to use PrEP was lower among those who reported age discordant partners (AOR = 0.41, 95% CI: 0.17, 0.96).

PrEP interest was high among MSM in Tijuana. Our finding that willingness to use PrEP was associated with reporting partners who live outside Tijuana and CAI partners suggests that PrEP delivery in the context of interventions that leverage information on sexual network risk and composition may be acceptable to MSM in Tijuana. Strategies to reduce stigma toward same-sex sexual behaviors and other barriers to accessing HIV prevention services may also be needed to enhance the impact of network-based PrEP delivery programs for MSM in Mexico and other similar low- and middle-income countries.

Influence Power and Allegiances: Let the Model Fit the Culture

Gwyneth Sutherlin

The means to collect, visualize and analyze data from online sources such as social media, blogs, news and events reporting are used to trace connections, map patterns of influence, and explore themes of online allegiance clusters. From the nodes and links we aim to infer offline activity where we can affect change among individuals or where we can target online narrative engagement. These techniques rely on social science precepts for constructing the algorithms that generate the colorful graphs and network diagrams. This paper delves into that hidden social science, peering inside the analytic 'black box', to determine which collection, visualization and modeling tools for online data are best suited to understanding topics like influence, power and allegiance in complex multi-cultural and multilingual networks. Russian elite networks will be used to illustrate the importance of selecting the right technique for what you what to learn, and how to think about cultural variation in these techniques in order to bring into relief the relevant contextual properties.

Leveraging Multiple Social Media Platforms for Evaluating Story Credibility

Cody Buntain

Evaluating information accuracy in social media is an increasingly important and well-studied area, and the recent attention being paid to "fake news," propaganda, and other content of questionable credibility has only served to highlight the need for more research. Much of the existing research into accuracy and credibility perceptions on social media has found the degree of links to external web sites has a significant influence on users' judgements of credibility. These links, their stories, and their external sites may appear legitimate at first glance, but this appearance may be manipulated with the intent to deceive. Recent research has shown, however, that despite malevolent intent, models of crowdsourced credibility perceptions can identify a large portion of fake news stories shared on Twitter. We build on this recent work by leveraging the multi-faceted topography of social media offerings to obtain multiple views into how a particular story is shared across platforms. Specifically, news organizations (both legitimate or otherwise) have a vested interest in sharing their work and driving traffic to their sites (especially fake news given the current monetary incentives of these stories), so they tend to share their stories across multiple platforms, like Facebook, Twitter, Reddit, Snapchat, etc. By leveraging these multiple views, we can construct a more thorough understanding of true and false stories' propagations. Targeting these multiple platforms, we develop an automated classification model over an existing set of crowdsourced, Twitter credibility assessments, verified against journalistically assessed fake news stories that were highly shared on Facebook. We then apply this model to information sharing behaviors in Reddit to determine whether predictors of credibility are consistent across popular social media platforms. Conversations threads about these stories are then aggregated across these

platforms to determine whether these multiple views improve our ability to identify stories of questionable veracity.

Leveraging Social Network Analysis & Cyber Forensics Approaches to Study Cyber Propaganda Campaigns

Samer Al-Khateeb, Muhammad Hussain and Nitin Agarwal

In today's information technology age our political discourse is shrinking to fit our smartphone screens. Further, with the availability of inexpensive and ubiquitous mass communication tools like social media, disseminating false information and propaganda is both convenient and effective. Groups' use social media to coordinate cyber propaganda campaigns in order to achieve strategic and political goals, influence mass thinking, and steer behaviors or perspectives about an event. In this research, we study the Online Deviant Groups (ODGs) who created a lot of cyber propaganda that were projected against the NATO's Trident Juncture Exercise 2015 (TRJE 2015) on both Twitter and blogs. An 'Anti-NATO' narrative was observed on social media websites that got stronger as the TRJE 2015 event approached. Call for civil disobedience, planned protests, and direct action against TRJE 2015 propagated on social media websites. We employ computational social network analysis and cyber forensics informed methodologies to study information competitors who seek to take the initiative and the strategic message away from NATO in order to further their own agenda. Through cyber forensics analysis (with Maltego tool), we extract metadata associated with propaganda-riddled websites. The extracted metadata helps in the collection of social network information (i.e., friends and followers) and communication network information (i.e., network depicting flow of information such as tweets, retweets, mentions, hyperlinks, etc.). Through computational social network analysis, we identify influential users and powerful groups (or, the focal structures) coordinating the cyber propaganda campaigns. The study examines 21 blogs having over 18,000 blog posts dating back to 1997 and over 9,000 Twitter users for the period between August 3, 2014 and September 12, 2015. These blogs were identified, crawled and stored in our database that is accessible through the Blogtrackers tool. Blogtrackers tool further helped us identify the activity patterns of blogs, key-words patterns, the influence a blog or a blogger has on the community, and analyze the sentiment diffusion in the community.

Looking across borders: Antecedents of interterm advice seeking

Evgenia Dolgova, Dianne Bevelander, Michael Page and Karen Stephenson

How does collaboration dynamics within teams affect external information sourcing? We study the origins of brokerage and multiplex social network dynamics in five cohorts of MBA students at a European university. Participants (n = 642) provided responses on collaboration and advice networks at the start of the MBA program and at the end of the term. We apply stochastic actor based modeling of social network dynamics (RSiena) to investigate the interplay within and across team collaboration. This study contributes to the literature on antecedents of social network

dynamics by illustrating how internal team processes affect the emergence of brokerage in larger social systems.
Mapping the Political Economic Landscape of Educational Technology: A Networks Perspective,Priscilla M. Regan and Elsa T. Khwaja,"In the past decade, a massive surge for investment in the educational technology (ed-tech) industry and the emergence of powerful firms has illuminated a great web of complexity through various types of entangled interrelationships. When analyzing funding relations between investors and ed-tech companies, we begin to see these complex interactions, how they create convoluted interlocking structures, and which central actors potentially serve as powerful players in the political economic landscape. This exploratory analysis of the network effects present in the ed-tech industry, which includes a content review of top investors and investment trends, can reveal political and economic motivations, gradually leading to an increased prominence of the business of ed-tech. The paper outlines how key players' influence, based on their funding relationships, can demonstrate these motivations and future connectivity, how investments take place, and how certain actors co-exist in the ed-tech political economic landscape.

This analysis will identify the top players and their "embeddedness" in the ed-tech industry applying theory and methods from social network analysis to explain their influence, power, and prestige within the network. Based on their current investments, the study provides insights on the patterns evident among the top venture capitalists and their ed-tech investing relations, to describe the narrative of the growing ed-tech network. Network visualizations of the top 13 investors and their ed-tech companies (based in US), alongside their top co-investors (based on the number of companies they have in common within their investment portfolio), provide insight on centrality (power dynamics of key actors) as proxies for influence, brokerage, and prestige. The network visualizations illustrate a level of interconnectivity and cohesiveness in the network and reveal the most influential and central investors and ed-tech companies.

The research shows how the qualitative attributes of key actors and their positions in the networks illuminate political and economic power. The study also begins to show how ideologies and motivations of firms are critical beyond business and economics. Findings suggest that some investors fund technologies based on companies' interest in education reform, such as efforts to promote and implement initiatives surrounding diversity and inclusion in K-12 education. The paper examines two of the top investors identified, Kapor Capital and New Schools Venture Fund, who demonstrate a strong interest towards investing in companies that aim for positive social impact or the elimination of socio-economic barriers. Though the majority of Ed-tech funding has gone to higher education, the K-12 space in the US has shown massive funding and school adoption of innovative technologies. This adoption has varied in terms of access, further influencing the inequalities already apparent in the educational system.

Matched bipartite block model with covariates

Zahra Razaee, Arash Amini and Jingyi Jessica Li

Community detection or clustering is a fundamental task in the analysis of network data. Many real networks have a bipartite structure which makes community detection challenging. In this paper, we consider a model which allows for matched communities in the bipartite setting, in addition to node covariates with information about the matching. We derive a simple fast algorithm for fitting the model based on variational inference ideas and show its effectiveness on both simulated and real data. A variation of the model to allow for degree-correction is also considered, in addition to a novel approach to fitting such degree-corrected models.

Measuring Relationalized Respeto and Understanding Its Impact on Smoking Behavior Among Mexican Heritage Adults Residing in the United States

Hena Thakur, Jeffrey Lienert, Christopher Marcum, Alexander Prokhorov, Anna Wilkinson and Laura Koehly

There is growing evidence to suggest that cultural beliefs are important to engagement with the health care system and, ultimately, health outcomes. Among individuals with Mexican heritage, respeto---which dictates deferential behavior and esteem toward older family members---is one such cultural belief that may have implications for health outcomes. Importantly, respeto is about relationships; however, measurement of respeto has traditionally not focused on specific relationships, per se, but has focused on broad characterization of interactions within the family system. Our study aims to introduce respeto from a relationalized perspective using two samples of Mexican heritage adults living in Houston, Texas. Our first sample consists of 485 participants (56.35% female, average age of 41.10 years) within 162 households and our second sample consists of 162 participants (50.15% female, average age of 38.82 years) within 91 households. We develop a four-item respeto scale grounded in a social network approach, demonstrate the reliability of the scale and assess validity of our new measure based on intergenerational exchange. The scale is then used to assign respeto values to network members based on participants' assessments. Subsequently, we examine the effect of receiving encouragement from valued respeto ties on smoking behavior decisions. Thus, we provide a scale for measuring respeto at the dyadic level and highlight the scale's utility in understanding readiness for behavior change among Mexican heritage adults.

Modeling Network-level Effects on Subgroup Insularity

Tracy Sweet and Qiwen Zheng

Social networks analysis often involves quantifying subgroup structure in which tie density is greater among nodes in the same subgroup than between subgroups. One such measure, subgroup insularity or segregation, is the extent that subgroups are separate from each other. We introduce a new

measure, γ, which is a parameter from the mixed membership stochastic blockmodel (MMSBM; Airoldi et al., 2008), and differs from many existing measures in that γ does not depend on node membership.

When examining a collection of similar networks, one can examine the association between subgroup insularity and network attributes. To estimate the effects of network-level covariates on subgroup insularity, we propose a multilevel MMSBM that maps network covariates with our new measure of insularity and simultaneously estimates both. We present some simulations as well as a real-world application to illustrate the feasibility of both our new measure and network model.

Modeling the Effects of Research Assessments on Scientific Collaboration. The Case of the British "Research Excellence Framework"

Raphael H. Heiberger and Oliver Wieczorek

Nowadays, research assessments are a common part of everyday-life in academia. They are used to determine the quality of universities and to distribute resources to the best departments. However, there is little research so far on the effects of such assessments on scientific collaboration between departments. Our paper focuses on the impact that these permanent evaluation programs have on networks between departments. We concentrate on the British Research Excellence Framework (REF) and its predecessor, the Research Assessment Exercise (RAE) and employ Temporal Exponential Random Graph Modeling (TERGM) to study the development of relationships over time in Chemistry, Medicine, and Physics. The RAE and REF have been conducted on a regular basis since 1992. This allows us to trace the ranking of departments for more than two decades and to model the effects of revaluations (devaluations) on the formation (abolishment) of research collaborations. To do so, we combine the official RAE/REF dataset with a comprehensive Scopus dataset. In this way, we are able to cover 100 British departments in regard to their ranking, funding, number of researchers, publication success and prestige. Our results reveal strong homophily effects on scientific collaboration and elitist closure. However, there exist significant differences between disciplines.

Modelling the resilience of coastal communities: the co-evolution of cultural views and stakeholder networks

Christina Prell, Michael Paolisso, Katherine Johnson, Klaus Hubacek and Brian Needleman

Coastal regions across the United States are vulnerable to climate change such as sea-level rise, storm surges, and flooding. In addition, human responses to these impacts can also potentially trigger unintended side effects, changing the landscape even further. A challenge to understanding these changes in coastal areas is accounting for the variety of cultural views, responses and management decisions stakeholders might make, and how these choices interact with other evolving shoreline features, such as marshes and wetlands, in both linear and nonlinear ways. Yet predicting management decisions (and their environmental consequences) is far from

straightforward, as stakeholders' understanding of the natural environment depends upon a variety of socio-cultural processes, such as stakeholders' cultural beliefs, institutional affiliations, and social networks. In this project, we develop a multidisciplinary, coupled systems approach to both frame and research the Deal Island Peninsula (DIP), located in coastal Maryland.

This study models coupled human-natural systems as multilevel networks, and integrates a number of temporal, sociocultural process into the framework to account for the linear and non-linear effects pertaining to shoreline and marsh dynamics that potentially arise under a number of climate change and management scenarios.

N-Human Dynamical Influential System and Model

Ridwan Jalali

Merely from our experience, we can judge, and estimate what is what, but we are often uncertain on to what level our estimation is accurate. Nevertheless, near-perfect judgments can still be pursued theoretically using the increasingly valuable tool of mathematical modeling. In the realm of humanity, knowing what entities have had an influence or actively influencing us is, in a moment of truth, obvious. However, estimating how much influence each entity imposes on us is difficult unless we unravel the underlying principles that govern and rule the realm. Similarly, the global human-to-human interactions system is generally open. In other words, it is possible under some circumstances that any two persons in the world interact and impose some directed or undirected influence on each other. The magnitude of the influence is very difficult to measure in such open system, given that it is governed with unlimited number of rules and constraints (e.g. where, who and how the interaction happened). Alternatively, in this study, we reduce the complexity by assuming a closed system which in turns reduces the dimensionality of the constraints and consequently the analysis. Assuming a closed human interaction system, we attack the problem of how much a person is influenced by each of the others. In doing so, we borrow the gravitational model from physics and apply it on this humanitarian system. However, unlike the physics N-Body problem where bodies are tied with constant gravitational force, we assume that humans in this system are imposing gravitational forces on each other on event-based. The magnitude of the imposed force is proportional to the masses of the interacting actors and their uncertainty level. To observe the behavior of our model, we put it under test using relatively large Arabic tweets data from Twitter. First, we compare the proposition of whom are the most influential persons proposed by our model with the propositions proposed by fundamental network centrality measures. More importantly, we run a comprehensive statistical evaluation seeking to magnify interesting minute insights from all segments in the network.

Network Analysis in the Study of Forced Migration

Melonie Richey and Dawn Wozneak

Any sociocultural analyst or social science researcher would likely agree that the subject of forced migration is central to 21st century geopolitics. The push/pull factors and drivers of forced migration – whether in Syria, Central Africa, or the Caribbean – comprise a variety of networks germane to population movement: social, geographic/physical, infrastructural. People make the decision to flee based on violence, immediate physical threat, societal unrest, and social strain. People tend to flee to areas where friends, relatives, or those from the same community have already fled. People tend to flee to areas where prospects for better economic futures exist. People also tend to flee using the path of least resistance. These are true in all instances of forced migration. The purpose of this paper is to present a theoretical framework, along with methodological implications and use cases across diverse geographies, for how analysts can use network analysis techniques to model occurrences of forced migration. Drawing on research from Syria; Turkey; Sub-Saharan Africa; the Lake Chad Basin region; and Cuba, Haiti, and South Florida, this paper will cover theory, methods, and lessons learned about modeling geophysical migration networks and integrating social networks, social media, and other drivers into both observation and prediction. The theoretical underpinnings will include a mixed methods approach using network analysis, contagion theory, strain theory, statistical analysis, geospatial clustering techniques, field surveys, and social media content analysis. The researchers intend to draw on multiple bodies of work to conduct a high-level, theoretical discussion germane to how different tools and techniques can be applied to the issue of forced migration.

Network Canvas: A comprehensive suite for capturing network data

Patrick Janulis, Gregory Phillips, Joshua Melville, Bernie Hogan, Noshir Contractor, Michael Bass and Michelle Birkett

This presentation will introduce a software suite (Network Canvas) for capturing social network and other complex data. Originally developed for use in a large cohort study of YMSM as well as a study of social support among individuals living with long-term disabilities, this tool is currently being generalized for use in a wide variety of research settings. The main goal of Network Canvas is to facilitate the collection of social network data through user friendly touchscreen optimized interfaces. The development of this tool is driven by a design philosophy that promotes co-creation of data by participants and interviewers in effort to improve both the validity and efficiency of data collection.

Network Canvas has three core components: Architect, Canvas, and Server. Architect facilitates the construction of an interview protocol without requiring any knowledge of computer programming. Canvas actualizes this

protocol through a touch screen optimized user friendly interview. Server allows for the storage, processing, basic analysis, and exportation of the data collected during the interview. Combined, these components are intended to provide an end-to-end solution for capturing complex data that substantially reduce the burden on both participants and researchers.

Beyond introducing the software suite, innovative applications using Network Canvas to promote public health will also be discussed such as leveraging the tool to improve partner notification services for individuals recently diagnosed with sexually transmitted infections.

Network Influences on Policy Implementation: Evidence from a Global Health Treaty

Thomas Valente, Stephanie Pitts, Heather Wipfli and George G. Vega Yon

Inter-country networks of general trade, tobacco trade, distances, and two communication networks derived from GLOBALink, an online dedicated forum for tobacco control, were constructed. Regression and spatial autoregressive models were calculated assessing network exposures association with the level of treaty implementation for five articles: 5, general implementation; 6, taxation; 8, secondhand smoke; 11, labeling; and 13 advertising. Exposure to other country implementations via three networks, tobacco trade, geographic distance, and GLOBALink referrals, were associated with that focal country's implementation of three articles: taxation, second-hand smoke, and labeling. Exposure via the GLOBALink co-subscriptions network was associated with implementation of three articles: second-hand smoke, labeling, and advertising. There were no network exposure effects on implementation of article 5, general provisions. These results suggest that GLOBALink, a forum in use for 20 years (1992 – 2012) with over 7,000 participants by its closing in 2012, was useful for enabling countries to ratify and implement the FCTC. Thus, new global agreements and treaties should be accompanied by communication forums that can assist lawmakers, advocates, and activists in getting needed policy changes ratified and implemented.

Network Reactions to Banking Regulations

Selman Erol and Guillermo Ordonez

Optimal regulatory restrictions on banks have to solve a delicate balance. Tighter regulations reduce the likelihood of banks' distress. Looser regulations foster the allocation of funds towards productive investments. With multiple banks, optimal regulation becomes even more challenging. Banks form partnerships in the interbank lending market in order to face liquidity needs and to meet investment possibilities. We show that the interbank network can suddenly collapse when regulations are pushed beyond a critical level, with a discontinuous increase in systemic risk as the cross-insurance of banks collapses.

Network Structure Explains the Relationship between Social Abilities and Team Performance

Jennifer Labrecque and Kayla de La Haye

In contrast to early explorations of team performance that traditionally focused on task-based skills and knowledge of individual team members (e.g., average IQ), more recent models are beginning to explore social abilities (features of social and emotional intelligence) as a potentially important driver of team performance. Why should social abilities be such a valuable asset to a team? The current work begins to examine how social abilities may contribute to the group interaction and coordination processes that are crucial to many types of team tasks by assessing the role of social networks in this relationship. We predict that social abilities are likely to give rise to particular types of network structures that influence a team's capacity to perform well. We test this relationship using an experimental design in which mixed-gender teams of three to five participants worked together to complete a series of problem-solving tasks and individually completed social intelligence assessments. In addition to assessing social intelligence and group performance, we explored a range of types of networks (trust, influence, advice, leadership) and identified structural features of those networks (e.g., density, reciprocity, triads). Results indicate that various structural features of these networks explain (mediate) the relationship between team social intelligence and team performance. For example, features of social abilities that reflect gregariousness play a prominent role in these models, and a similar mediation relationship across several network types (i.e., trust, influence, leadership) emerges to explain the relationship between social intelligence and performance. Better understanding the role of team social networks, therefore, provides novel insight into the link between social abilities and team performance.

Networks, Epidemics, and the Rise of Christianity

Sean F. Everton and Robert Schroeder

In one of the more innovative applications of social network theory, Rodney Stark (1996) argues that social networks played a role in helping Christians to "benefit" from the epidemics that swept through the ancient Roman Empire in the second and third centuries of the Common Era. More precisely, he believes social networks were one of the factors why the early Christian Church was better equipped to respond to the epidemics than were its pagan competitors. His argument is three-fold: he contends that (1) the church offered better explanations for the epidemics; (2) its doctrines on love, charity, and social service led to higher survival rates among Christians; and (3) because pagans had lower survival rates, large numbers of them would have lost their social ties to other pagans that would have otherwise prevented them from converting to Christianity. We consider each of these arguments, but focus on how they relate to social networks. Moreover, we submit his tentative conclusions concerning the makeup of Christian and pagan social networks. In particular, we use the R package EpiModel (Jenness et al. 2017), which is designed to model

the spread of diseases through a network, to simulate the effect that the epidemics had on Christian and pagan social networks and the ties between them.

Observational evidence of “selective sharing” on social media

Julia Kamin

Social network sites like Facebook and Twitter are widely understood to be echo chambers in which users selectively connect to like-minded others and likewise “selectively share” information that aligns with their political views. But while ideological homophily (the choice to connect to similar others) has been empirically observed in multiple studies, the common assumption that “selective sharing” exists has yet to be empirically tested. Research does show that social media users tend to share ideologically-friendly information, but in order for a bias to exist it would have to be demonstrated that a liberal(conservative) user selectively shares proportionally more liberal(conservative) information than she is exposed to. In this project I test for “selective sharing” both by using online survey experiments and by observing posting behavior on the social media site Twitter. In the experimental setting, I ask subjects to select from among a given set of news stories which they would be most likely to share on social media. I find that subjects are, indeed, politically biased in the information they say they would share, far more so that the information they say they would read (“selective exposure”). But, somewhat paradoxically, initial analyses of Twitter data suggests that users do not selectively share political information; they instead tweet out a proportion of liberal/conservative information that is roughly equivalent to tweets they are exposed to. This paradox may be explained by the observation that Twitter users, unlike participants in the online experiments, choose to expose themselves to a balance (or imbalance) of news information that already reflects their ideological preferences. To the extent that we can say Twitter users ""selectively share"" information, then, it may not occur in their choice to ""retweet"" - but rather is a consequence of their previous choices on whom to follow.

Oligarch Networks

John Sutherland Earle, Scott Gehlbach, Anton Shirikov and Solomiya Shpak

In countries with weak institutions, oligarchs – wealthy individuals with potential political connections – often hide their ownership of enterprises behind related individuals, holding companies, and other entities to protect their assets from predation and taxation by competitors and the state. Connections among such entities represent a network of oligarch control. In this paper, we argue that an oligarch’s choice of network faces a tradeoff between opacity and security—more distant and diffuse ownership reduces the transparency of oligarch ownership, at the cost of increased risk of betrayal or loss of control. Key variables characterizing the network choices include the length of ownership chains, whether the oligarch appears anywhere in the formal chain, and the types of entities – individual, corporate, domestic, or foreign – used to hide ownership in the chain. The analysis has particular

implications for the structure of networks where the oligarch has strong political connections versus those where the oligarch is unconnected with the current power or even associated with the opposition. Unconnected oligarchs will tend to place a greater weight on opacity, and even more so for opposition-aligned oligarchs.
Our empirical analysis explores this idea in the setting of Ukraine around the time of the Orange Revolution of 2004. The starting point for constructing the oligarch control network includes lists published regularly by journalists on oligarchs, their close family members and acquaintances, and the firms that they control. We then find other assets and related persons by searching iteratively for chains of ownership over two remarkable data sets containing ownership information for every registered firm in Ukraine. Using the list of connected entites, we build the networks of oligarch-connected firms and examine main futures of these networks.
We employ network analysis to characterize the networks. Measures of asset hiding include the presence of oligarchs in the formal chains, and the shortest distance from the firm to the oligarch, or related individual. Additionally, the degree to which the networks of different oligarchs represent non-overlapping communities, thus suggesting the degree to which oligarchs compete or collude with one another. Seeking to explain variation in the character of such networks, we explore the role of enterprise and oligarch characteristics that affect the tradeoff between opacity and security.
Based on explicit statements by oligarchs and journalists' assessments, we also classify oligarchs by political affiliation prior to the Orange Revolution: the "blue" group, including supporters of the Party of Regions and Presidential Candidate Viktor Yanukovych, the "orange" group, including supporters of Candidate Viktor Yushchenko, and what we call "gray" for oligarchs whose loyalties are ambiguous or undetermined. We examine the hypothesis that the "orange" group placed a greater weight on opacity than did the "blue" group prior to the political turnover, and that this relationship reversed thereafter.

On the Validity of the Bayesian Network Accuracy Model

Francis Lee and Carter T. Butts

The validity of using survey measurements for network inference for latent relations has been tacitly assumed throughout network research. Advances in the field of informant accuracy, have shown that for behavioral data, observational data and recalled behavior by informants are imperfectly correlated, which calls into question whether complex relations like friendship can be accurately measured even with models that incorporate informant accuracy. While existing data does not provide a criterion validity check for inferring friendship, other notions of validity can still be applied. For instance, if friendship reports are generated from a common underlying network that is perceivable (albeit imperfectly) by all actors, then random subsets of actors should produce estimates that should agree (i.e., split half reliability). We can examine the split-half reliability of model estimates to test the internal validity. We generate independent random subsplits and analyze the consistency between these models to assess this reliability, comparing these against the reliability

scores of random permutations of the graph estimate. We show significantly higher levels of reliability than can be explained by chance, suggesting that models are reliably estimating an underlying relation. Furthermore, we integrate this evidence with evidence of construct validity checks to suggest that these networks are valid.

"Organization network analysis, community detection and modularity in graphs

Anshuman Guha and Eyob Gebremariam

Understanding communications, information, and decisions flow within a network is important to achieve increased operational effectiveness with higher collaboration and operational effectiveness with higher collaboration. To achieve it, current research work focuses on combining graph exploration techniques like organizational network analysis (ONA) & organization structural analysis, graph level diagnostics with traditional community detection algorithms. This would achieve increased operational effectiveness with higher collaboration and exchange of information between the right people, transform organizations to identify formal and informal leaders to facilitate a change and use talent more effectively by minimizing role confusion and redundancy. Every organization has people (nodes) who serve as critical medium for transfer of ideas and information. Central nodes share lots of information and influence network effectively. By identifying and managing central nodes, changes can be adopted more quickly and pervasively, and minimize costly disruptions. The organizational structure analysis is done using the measures of connectedness, hierarchy, efficiency, and least upper boundedness. The graph level diagnostics are done using graph diameter, clustering coefficient & graph density metrics. Indicators of centrality identify the most important vertices that influence and provide opinion leadership within an organization. In this analysis, centrality indices like betweenness centrality, assortativity coefficient, degree, eigenvector centrality, edge density etc. are used to identify important nodes within a network. Different subgroups and community detection techniques like clique percolation, label propagation algorithm, fastgreedy, leading eigenvector, walktrap & other methods are used and results are compared which is then concluded by significance testing of a community. Wilcoxon rank-sum test on the internal and external degrees of a community helps analyzing whether we have a community or an anti-community.
Performance of this research work is evaluated using dataset obtained from Zachary's karate club which is a network of friendships between members of a karate club at a US university. Results obtained suggested variety of different subgroups compared to two subgroups in initial Zachary experiment. Also. the nodes with high degree values are authorities as well in the network with lot of incoming edges. Some of them do not have high betweenness centrality. The vertex centrality values for all nodes are close to each other so information flow across this network is homogenous. Low centralization suggests that network is not organized around its most central points, but it is not peripheral too. Rather this network has central agents spread widely through the graph. The structural analysis revealed that connectedness is high as there are no isolates. The hierarchy is higher & with increased efficiency is due to fewer lateral peer-to- peer ties. The least upper boundedness is upper-range, which

suggests unity of command. This low diameter network has higher relative network clustering coefficient compared to its density, which indicate the presence of large clusters in the network. Different community detection algorithms indicate similar sub-groups within the network & highlight interconnection nodes between these sub-groups. High modularity for a partitioning reflects dense connections within communities and sparse connections across communities.

PDGM: Percolation-based Directed Graph Matching in Social Networks

Lijing Wang, Jin-Hee Cho, Ing-Ray Chen and Jiangzhuo Chen

Linking multiple accounts owned by the same user across different online social networks (OSNs) is an important issue in social networks, known as \emph{identity reconciliation}. Graph matching is one of popular techniques to solve this problem by identifying a map that matches a set of vertices across different OSNs. Among them, percolation-based graph matching (PGM) has been explored to identify entities belonging to a same user across two different networks based on a set of initial pre-matched seed nodes and graph structural information. However, existing PGM algorithms have been applied in only undirected networks while many OSNs are represented by directional relationships (e.g., followers or followees in Twitter or Facebook). For PGM to be applicable in real world OSNs represented by directed networks with a small set of overlapping vertices, we propose a percolation-based directed graph matching algorithm, namely PDGM, by considering the following two key features: (1) similarity of two nodes based on directional relationships (i.e., outgoing edges vs. incoming edges); and (2) celebrity penalty such as penalty given for nodes with a high in-degree. Through the extensive simulation experiments, our results show that the proposed PDGM outperforms the baseline PGM counterpart that does not consider either directional relationships or celebrity penalty.

Popularity in Context: Global and Local Status in Adolescent Friendship Networks

James Murphy

Both popularity and the pervasive clustering of adolescent friendships are widely discussed topics in network research. It is somewhat surprising then that popularity has been treated exclusively as a global phenomenon, an adolescent's position in a schoolwide network. This paper conceptually and empirically distinguishes this global status from "local status," popularity among a subset of socially proximate peers. As popularity indicates social approval, this distinction is important because each form refers to a distinct reference group—the peer group and the larger collective— with potentially conflicting expectations or values. Using data from 112 schools in the National Longitudinal Study Adolescent Health (Add Health), I use the local-global distinction to reexamine two key aspects of development previously linked with global status: substance use and affective attachment to school (belonging).

Because groups can vary greatly in size, fixed choice name generators—common to many network surveys including Add Health—pose a challenge for

measuring local status. I introduce a simulation based measure in which each student's observed in-degree within a (sub)graph is compared to the expected value in a uniform random graph conditioning upon the dyad census. That is, I compare the observed in-degree to a counterfactual network in which every student is (probabilistically) equally popular but the dyadic tendencies are otherwise identical to the observed subgraph. Peer groups are identified using the multilevel Infomap community detection algorithm.

In addition to local (subgroup) and global (whole network) measures, I apply the same procedure to a subgraph consisting of ego and all alters outside their subgroup to construct an "extralocal" status. Alternating between global and extralocal measures as the operational complement to local status helps assess different potential mechanisms.

Results from hierarchical linear models show that global popularity has a strong positive association with belonging, which can be decomposed into distinct local and "extralocal" contributions. Local status appears particularly salient in higher grade levels. However, when a student's local popularity is very high relative to their extralocal standing, belonging declines. Local status may encourage affective identification with the larger community but only if reinforced by approval from outside the immediate peer group. Without such reinforcement, local popularity may alienate the student from the broader community.

Both local and extralocal status bear, on average, a small positive association with substance use, as measured by frequency of drinking, drunkenness, and cigarette smoking. However, unlike extralocal status, the strength and direction of local status's association with substance use varies greatly across peer groups (but not schools). Findings for both belonging and substance use are robust to the inclusion of school fixed effects and student demographic, academic, and extracurricular backgrounds.

By NASN, the paper will incorporate peer group and school characteristics to better understand the observed differences across peer groups. Beyond adolescent friendship, this research contributes to a nascent literature on status multiplicity in social networks generally. I demonstrate the potential importance of this distinction for understanding individual behavior and psychology and their respective roles fostering affective and normative cohesion in complex organizations.

PrEP-Chicago: A diffusion of innovation based intervention for HIV prevention among young men who have sex with men

John Schneider, Matthew Ferreira and Lindsay Young

PrEP-Chicago is a randomized controlled crossover peer change agent intervention designed to promote the adoption of pre-exposure prophylaxis (PrEP) for HIV prevention among young men who have sex with men (MSM). PrEP is a new biomedical prevention intervention has been shown to be up to 99% effective in preventing HIV with CDC clinical practice guidelines published in 2014. Racial disparities exist and young Black MSM have had

limited PrEP uptake. PrEP-Chicago recruitment of study participants began in March 2016 and we report here on preliminary findings from the first year of this RCT (pre-crossover). Participants (n=423) were recruited using RDS and randomized to either the intervention or control condition. Initial seeds were selected based upon their structural position (ie. high betweeness centrality) from a previously described large Facebook network. The intervention is composed of two parts: 1) A half-day peer change agent (PCA) training workshop led by intervention staff is conducted among a small group of 6-10 participants and 2) ""Booster"" sessions are continued contact between intervention staff and participants through a series of follow-up check-in telephone calls. Control condition is a group sex-diary session. The goal of the intervention is to motivate participants to have PrEP discussions within their social network and motivate their peers to engage in PrEP care. The primary outcomes of this study are the number of individuals (friends of study participants) successfully referred to a PrEP information line (PrEPline) and the number of those individuals who make an initial clinic appointment. Callers into the PrEPline provide their Facebook name so that they can be linked to study participants within the larger Facebook network. Since March 2016, 253 calls were made into the PrEPline. Controlling for month of call and day of week an increase of 0.04 calls with each booster/baseline completed in the prior two days was observed which is equivalent to 6.4% of the average calls/day and suggestive of a positive effect of baseline and booster session ($p=0.005$). Calls from linked friends were also higher in the intervention arm compared to the control condition: 9.5 vs 7.2 friends ($p<0.001$). In summary, interim analysis demonstrates preliminary efficacy of a diffusion of innovation intervention that utilizes peer change agents originating from centrally located positions in a large Facebook network. This work is important given the increasing numbers of young Black MSM becoming HIV infected and will be an important component of HIV elimination efforts in most at risk communities.

Pricing Network Effects: Competition

Itay Fainmesser and Andrea Galeotti

We study influencer marketing and its effect on market efficiency. Firms sell horizontally differentiated products. Consumers are influenced by other consumers' choices, and some consumers are more influential than others. Firms' influencer strategy involves discovering the influence of some consumers and price discriminating based on this information.

Firms subsidize above-average influential consumers and charge premia to below-average influential consumers; the premia/discounts depend on the strength of network effects and the level of information that firms have on consumers' influence. From a normative perspective, influencer marketing leads to inefficient consumer-product matches. This inefficiencies are passed on to firms but consumers benefit.

Prison-Based Therapeutic Communities as Dynamic Social Networks

David Schaefer, Jacob Young, Dana Haynie, Martin Bouchard and Derek Kreager

The therapeutic community (TC) is a common and proven-effective modality for prison-based substance abuse treatment. TC philosophy is guided by a core set of principles surrounding community-building and integration that are inherently social in nature (e.g., trust-building and peer-reinforcement). The current project uses social network methods to address a range of questions related to TC network structure, change, and outcomes for treatment engagement. Data consist of monthly self-report data from residents of a Pennsylvania medium-security prison TC gathered over 10 waves. The unit houses approximately 60 inmates, of whom over 70% participated in each wave. For this presentation, we will investigate questions specifically related to TC structural dynamics, including: (1) What is the overall structure of the network and how stable is it over time? (2) How does individual position in the network change during the course of treatment? (3) Do residents shift from peripheral to more prominent network positions as they progress through treatment? And, (4) What selection processes guide inmate relationship formation and maintenance behavior?

Radical Right Media and Politicians within the Hungarian Media Network

Attila Farkas

A lot of articles explaining radical right party throught the elites, electoral successful, organization, ideology, or approaching certain parties via supply or demand theories. Although the alternative media network is also very important as the other features of success.
The aim of this article is to identify and analyse the radical right media network in a case of Hungary.
Since 2010 the radical right party in Hungary has become very popular. In the artice I am providing an issue-centered approach to examine and locate the radical right media within the Hungarian media sphere. The resoult is that the radical right media are staying out of the mainstream media flow except in few cases.

Role of Place for Community Formation in Online Citizen Science Projects

Jacqueline Cameron and Tom Yeh

As online communities allow for geographically distant social networks to form around issues, what role does place have on communities? This paper explores this issue in online citizen science platforms, where non-scientists can collaborate and contribute to scientific research and environmental causes. Citizen science platforms have allowed networks to build across distance and include non-traditional participants in science. These communities often can enable large-scale ecological research through

the geographical breadth of participants and can bypass local communities to engage users. However, place remains an essential component for participants. It is a motivating factor to become engaged in environmental work and allows for shifts in relationship status as local knowledge helps users surpass traditional expertise barriers in science.

This paper presents results from an analysis of iNaturalist, a citizen science platform for worldwide collection of biodiversity data. We look at the use of the website's project feature. Projects allow users to contribute to user-created groups, which are often tied to particular localities and pre-existing organizational communities. We use this analysis to understand two questions concerning the relationship between users, projects, and place. 1. How do project communities in iNaturalist influence the types of relationships and behaviors between users of the platform? 2. How does place influence user participation and project success?

Roma Undergraduates' Personal Network in the Process of College Transition. A Social Capital Approach

Bea David and Agnes Lukacs

In 2011 special colleges of religious denomination were established for university students of Roma origin in five Hungarian cities to provide assistance and mentoring during their studies. From 2012 the Institute of Mental Health, Semmelweis University launched a unique research with the follow-up of students of the Christian Roma Collegium Network (CRCN).
In the process of such college transition Roma university students' personal networks become unstable. We attempt to model the structural mobility (through the college transition) of the Roma students from a social capital perspective. We argue that such an approach can provide a deeper understanding of the process of academic adjustment. We describe the dimensions which are relevant for this process, highlighting the resources students have at hand for college transition and professional advancement. To show the personal networks of these students we use the model set up by Brandes et al. (2008) and analyse the identified groups utilizing the social capital approach.
We mapped seventy-six students' networks applying contact diary. Origin, host and fellow groups are identified. These groups significantly differ in their composition and provide different ('bonding' or 'bridging') type of resources, and their availability to the Gyspy students also varies. We found significant differences between the students in their tendency to rely on origin, host and fellow groups in the process of academic adjustment.

Saunas, bars or dating apps: Human papillomavirus detection in men who have sex with men in association with where one meets his sexual partners

Carol Strong, Ya-Lun Liang and Zong-Rong Lee

Mobile sex seeking via dating apps or websites has become popular among men who have sex with men (MSM) in Taiwan. It is the most frequent method

to meet potential partners, even more so than physical venues, such as saunas, pubs or gyms.
The lifetime risk of getting anogenital human papillomavirus (HPV) infection among men is about 50% globally. HPV is a very prevalent and almost unavoidable pathogen infecting the epithelia. When infected, it can be reproduced and transmitted sporadically. Given the rarity of HPV screening compared to other sexually transmitted infections (STIs), no research has been published regarding social networks and HPV. Little is known regarding broader group-level units, such as socialization venues or social media, in association with HPV detection.
In this study, we hypothesized that types of socialization venues and social media for MSM to meet potential sexual partners are associated with HPV detection. Specifically, MSM who were infected with the same HPV genotype were more likely to cluster in certain popular venues or use the same social media.

A total of 253 MSM, 20 years of age and older were recruited from community health centers and saunas in Southern Taiwan in 2015-2016. At baseline, men completed a questionnaire. Anal and penile swabs were collected for HPV testing. Men were seen again at 6th month when they filled out a sexual network questionnaire and were screened for anal and penile HPV. HPV DNA testing and genotyping were performed to detect 37 HPV genotypes, including 21 high-risk types and 16 low-risk types. For network analysis, an egocentric network data collection method with name generation and interpretation was utilized. Participants were asked to select from a list popular socialization venues and social media to indicate where they used to meet potential partners in the past six months. Venues and social media were categorized into the following categories: saunas, bars, gyms, LGBTQ health centers, dating websites, and apps.
Quadratic Assignment Procedure (QAP) and MRQAP were conducted to examine the association between the detection of HPV genotypes and socialization venues or social media in R. Dyads were used as the unit for analysis. We calculated frequencies of having the same HPV genotypes as the dependent network variable and frequencies using the same types of venues or social media as independent network variables.

A total of 182 participants returned for the follow-up. Eight-six men (47.3%) had at least one HPV type detected at the anal or the penile site. QAP analysis showed that detection of any type of HPV at any site is not associated with locations, dating apps or dating websites they used to meet potential partners.

Despite no association identified in current analytical method, the impact of geosocial networking channels on STI with high prevalence, such as HPV, requires more exploration. Other statistical tools for inferential network analysis and stratified analysis should also be tested to examine the association between HPV detection and physical or virtual channels to meet sexual partners in MSM.

Secondhand Social Capital: Boundary Spanning, Secondhand Closure, And Individual Performance

Neha Shah, Daniel Levin and Rob Cross

We move beyond the performance returns of individuals' direct network connections to study the effects of "secondhand" social capital, i.e., from the networks of one's contacts. We propose that certain colleagues may be more valuable to one's job performance than others when their spillovers of novel information combine with spillovers of the cooperation needed to obtain that novelty. In a study of 1,273 engineers across 16 business units, we find that the most benefit to one's own performance comes from having ties that span business units and that also include secondhand closure (i.e., where one's contacts are each embedded in a constrained, dense network). Bridging the organizational boundary provides the novelty; and secondhand closure provides the cooperation. Further, by examining who in the network is constraining these contacts, we are able to trace their cooperative motivation both to reputational and organizational identity concerns, which each create a spillover of cooperation toward the focal individual, who reaps the returns.

Self-Organised Networks at the Edge of Chaos: A New Perspective for Managing Complex Construction Projects

Huda Almadhoob and Stephen Pryke

The dynamic nature of social networks implies that they are built on on-going, changing and evolving processes. They are not deterministic and thus have no single optimal point, but rather presence of a range of observable structural 'patterns' or 'signatures' that embody the self-organising principles (Robins, 2011 in Scott and Carrington, 2011). This on-going PhD project suggests that large construction projects should be perceived as complex systems which usually operate at the edge of chaos and spontaneously self-organise themselves. That is, at any point in time, projects are either going to fall into true chaos, or being reshaped, by passing through a prodromal phase called the "Edge of Chaos". Extending the prior work of Pryke et al. (2017) on self-organisation in complex projects, here we offer an exploratory case-study illustration, using Social Network Analysis to analyse in depth the structure and dynamics of the evolving London Bank Station Capacity upgrade project network. The initial findings have shown that self-organised networks demonstrate small-world properties. This is further studied using Watts and Strogatz' small-world model, proposed by Latora and Marchiori (2003), which measures network efficiency on both local and global scales over two transitory stages. Network weighted cost has been proposed as a third measure which along with efficiency can provide a better quantitative insight into the dynamics of the evolving complex networks. The interaction between these three measures reveals that as the projects progress, the effectiveness and efficiency of the new evolved network structure are higher than those of the original structure, in response to internal or external change events. No correlation has been found between node diversity and network

effectiveness. This confirms that the networks have attributes of 'small-world', where nodes are clustering based on their similarities. Understanding the evolving nature of self-organised networks are essential to successfully understand the system's resilience and in particular, for project management it will reveal how these can act as a dynamic counterbalance to resolve the dilemma over how to manage the tensions between competition and cooperation as well as control and flexibility in large construction projects. To achieve this, importance of informal relationships that usually rise above the prescribed contractual boundaries has been demonstrated as the platform needed to activate and nurture self-organising process.

Social capital and HIV-serodiscordance: Differences in the access to personal and professional resources for HIV-positive and HIV-negative partners

James Iveniuk, Liviana Calzavara, Sandra Bullock, Joshua Mendelsohn, Dan Allman, Ann Burchell, Laura Bisaillon, Amrita Daftary, Bertrand Lebouché, Renée Masching, Tamara Thompson, Jocelyn Watchorn and The Positive Plus One Team

As many as 23% of people living with HIV in Canada may be in serodiscordant relationships (where one partner has HIV, and the other does not). Stigma surrounding HIV, as well as the health challenges associated with HIV, may limit access to social capital for persons in these relationships. Furthermore, having different HIV statuses may shape both partners' connectedness to their social worlds, leading to different social capital profiles. This is key, since social capital is tied to better long-term health outcomes, and may impact relationship quality. In order to address this topic, we investigated social capital among people in HIV-serodiscordant relationships. We hypothesized that compared to HIV-negative partners, HIV-positive partners would have lower levels of 'personal' social capital (resources from friends and family) due to HIV stigma, but higher levels of 'professional' social capital (resources from doctors, and other service providers) due to high rates of HIV treatment in Canada. To test these hypotheses, we employed data from a national Canadian online and telephone survey of people in serodiscordant relationships (N=366; 214 HIV-positive, 152 HIV-negative). These data included 95 dyads (matched partners). Social capital was measured using a version of Van Der Gaag and Snijders' (2004) resource generator, which asked respondents to self-report on their access to various resources (e.g. help when sick, advice about sex) from different kinds of social contacts (e.g. family, friends). To account for non-independence within dyads, we employed actor-partner interdependence models. HIV-positive and HIV-negative persons did not differ from one another in levels of personal social capital, contrary to one of our hypotheses, but HIV-positive people did have more access to professional social capital, controlling for demographic characteristics, relationship duration, relationship satisfaction, and disclosure of the relationship to one's network. Positive and negative individuals also reported similar levels of help from each other. However, HIV-negative individuals were more likely to report that they could access advice about sex from their partner. Disclosure of the relationship to one's contacts was associated with higher levels of personal and professional social capital, and being more

satisfied with one's serodiscordant relationship was associated with higher levels of social capital from one's partner. However, we did not detect any significant effects of partners' satisfaction or partners' disclosure on any social capital measure. Our findings show that in serodiscordant relationships, the HIV-positive partner may bridge the couple to sources of professional knowledge about HIV, thereby placing them in a position of relative expertise within the relationship, especially as regards safer sexual activity. The results also suggest that one's partner's satisfaction or openness about the relationship may not shape one's own social capital. We discuss the implications of our findings for HIV service provision, as well as for the study of social connectedness in romantic/sexual relationships, and the impact of HIV on social capital.

Social Media Firestorms

Alicia Bargar, Rich Takacs, Brant Chee, David Silberberg, and Ian McCulloh

Social media firestorms describe the rapid creation of large volumes of negative word of mouth and complaint behaviors against a person, organization, event, or social cause, often paired with indignation and resultant shifts in focus from an actual point of criticism. With social media facilitating a constant flow of communication, large audiences can be reached during a firestorm and temporal dominance of a single topic can be achieved. Furthermore, with the ability to reach thousands of users in near real-time, it is nearly impossible to stop the diffusion of negative word of mouth if the emergence of a social media firestorm is detected too late. Therefore, timely intervention is crucial to initiate effective countermeasures.

This work combines social media anomaly detection methods and social network analysis to identify the emergence and graph-based characteristics of firestorms. In contrast to current content-volume based analysis practices, this approach offers the potential for earlier detection of topic-centric organization on social media. Achieved through a combination of qualitative analysis of firestorm content and improved quantitative social network analysis methods focused on the relationships between and characteristics of users in early firestorm development, this proposed system offers the potential for early indications and warning of firestorm development.

This work focuses on the application of emerging trends in social network analysis and social science to include majority illusion theory, multiple sentiment analysis constructs, and both graph-level and node-specific metrics to understand the development of social media firestorms, their ability to sustain growth, and the ability of a network to create real-world impact from online social behaviors.

“Social smarts” shape social networks

Kayla de La Haye and Jennifer Labrecque,

Social abilities, including aspects of emotional and social intelligence, are known to have a profound impact on how individuals interact, with greater social abilities leading to stronger affiliation, trust, and influence (Bracket, 2011; Goleman, 2007). However, little is known about how these social abilities give rise to social network structures in groups and teams. There is existing evidence that personality influences network structure, with individuals high on agreeableness tending to have a higher indegree in friendship networks (Selfhout et al., 2010). In the present study, we consider the role of a broad range of social abilities known to shape interpersonal interactions, which includes dimensions of personality, social perceptiveness, empathy, social skills, social responsibility, and holistic thinking, in shaping the emergence of social networks in groups.

Forty-two mixed gender groups of three to five participants participated in our study. After completing a series of group tasks, participants individually reported on social networks of trust, advice, influence and leadership among the group members as well as individually-completed validated measures of personality, social intelligence, and holistic thinking. Our analyses identified structural features of these multiplex networks and their relationship to individual and group-level social abilities, and applied exponential random graph models to predict social network structures given individual and group social abilities.

Overall, we found evidence that individuals with greater social abilities were likely to have greater centrality in these various networks. However, the specific type of social abilities associated with centrality differed depending on the type of network. Thus, different social abilities (e.g., socially accommodating vs. socially outgoing) differentially predicted node centrality in different types of networks. At the group level, the average and range of social abilities was consistently associated with structural features of these multiplex networks (density, reciprocity, transitivity): higher average social abilities, and less variability in social abilities, were both commonly linked to greater network density and reciprocity. This work highlights the important role of “social smarts” in shaping social networks, as well as the nuanced role that different types of social abilities play in shaping different dimensions of these networks. We discuss the implications of this work in for group composition, performance, and training.

Socio-Cultural Cognitive Maps

Kathleen Carley

This talk describes a new methodology for inferring network structure from node level attribute data. The procedure is a dense data reduction technique that identifies the network that best fits the underlying

frequency or similarity data. A feature of this approach is that it supports the comparison and combination of diverse data from a network and social influence perspective and supports what if forecasting.

Socioeconomic disparities in geographic access to HIV/AIDS prevention and care services provided by a health service network serving young Latino MSM

Mariano Kanamori, Kayo Fujimoto, Mark Williams, Sheyla Aguilar de Santana, John Schneider, Mary Jo Trepka and Mario De La Rosa

Introduction. In Miami-Dade County (MDC), 66% of the more than 2.5 million residents are Latinos, and the county has the highest percentage of foreign-born Latinos residents in the nation. It also has a significant number of recent and undocumented immigrants. In MDC, Latinos account for more than half of the HIV cases (all ages and 13-29 years old). Most HIV-infected Latinos are men who have sex with men. This is a study of a network of 40 venues providing HIV/AIDS prevention, care and related services to young Latino men who have sex with men (YLMSM). It includes commercial establishments, health care centers, and social organizations. Our goal is to explore whether there are socioeconomic differences in YLMSM's geographic accessibility to available HIV/AIDS prevention, care and related services.
Methods. The study uses cross-sectional data collected in 2016 by the Young Men's Affiliation Project (YMAP). A list of 59 venues serving YLMSM in Miami was developed under the guidance of investigators, staff members and community consultants. Forty venues from this list were randomly selected and a representative from each venue (owner, manager, etc.) was interviewed for two hours. For each venue, a participant reported services provided by his/her venue from a list of 18 health services, and collaborations with other venues in the network. The collaboration relationship was defined as: (1) worked together on an activity, project, or event; and/or (2) had a referral agreement; and/or (3) had sponsorship collaborations. We performed network visualization analyses including symmetric data; a thematic map with the number of services provided by each venue; a base map with the average of household income in 2016 for each sub-area; and, walkability maps using Kernel density estimations with parameters' weights including the number of services provided by each venue and a two-kilometer walking distance radius. Analyses were performed using UCINET6, NetDraw2.160, and ARCGIS.
Results. We found that this network has (1) three venues with high-degree centrality (many venues reported collaborations with them), (2) eight venues with high Eigenvector centrality scores (these venues have connections with other venues that have high levels of collaboration), (3) isolated venues (low Eigenvector centrality scores) not providing services to YLMSM, and (4) venues providing comprehensive services (more than 10) not collaborating with other venues (low Eigenvector Centrality scores). We also found four network clusters of health services in Miami. Two of these clusters are in low household income areas (Downtown Miami and north MDC), and two are in middle/high income areas (western part of the county and South Beach). Venues where people socialize are located in medium and high socio-economic areas. Overall, many YLMSM in low household income areas live beyond walking distance to health service network clusters.

Discussion. Having network clusters of health services distributed evenly among socio-economic groups does not resolve geographic disparities for accessing these services. Geographic accessibility is a potential structural barrier for accessing these services among the poor.

Spatial and social embeddedness of emergency contact ties

Emily Smith, Carter Butts, John Hipp and Nicholas Nagle

The importance of networks for the dissemination of information has been widely agreed upon, whether through face-to-face interaction (Centola and Macy, 2007; Granovetter, 1973) or online (Bakshy et al., 2012; Guille et al., 2013; Zinoviev, 2011). How information is diffused during emergencies or disasters is of interest to researchers and arguably to emergency managements officials and organizations as well. When a disaster occurs, information diffuses quickly, and this information diffuses through pre-existing personal ties. Thus, in order to understand where information will go when a disaster occurs, we need to understand these conduits for information diffusion and where they are located. However, although disasters are inherently spatial phenomena, we do not currently have a grasp on the geography of these ties. Using a spatially stratified egocentric network sample of adults in the western United States, we examine respondents' set of potential emergency contact ties in an attempt to characterize the relation with respect to social and geographic space. By studying the emergency contact relation before it has necessarily been realized, we gain insight into where and to whom information might travel in the event of a crisis, emergency, or disaster. Preliminary results indicate that non-household emergency contact ties tend to be relatively long-range, suggesting that despite the spatial nature of disasters, information does not necessarily remain local.

Stable Networks with Local Social Rankings

Chen Cheng and Yiqing Xing

In this paper we characterize stable networks when agents’ preferences solely depend on their local social ranking, which refers to the fact that an agent is the x-th wealthiest person among his/her neighbors on the given network. A “revolution” brings about a reshuffling of social rankings by redistributing wealth, and needs the support of at least m people. An agent underwrites the revolution if it (strictly) betters his/her ranking. A network is “stable”, or revolution-free, if there exists an allocation of wealth such that no revolution is possible.

We provide a necessary and sufficient condition for stability: A social network is stable if and only if it has an independent set of size m, which means that there exists a group of m agents, no two of which are linked. As an extension, a similar necessary and sufficient condition is provided for directed networks.

We apply this condition to investigate the likelihood of stable networks for various class of random networks, including the Erdős-Rényi random networks.

In addition, we show that homophily hurts stability. In particular, when agents can be classified into multiple subgroups: as the network becomes more homophilous, i.e. agents are more likely to be connected with others from the same subgroup, keeping the average degree constant, the network is less likely to be "stable".

On the contrary, if agents' preferences are based on comparing solely to the strangers instead of neighbors, a parallel necessary and sufficient condition characterizes stable networks. In this case, homophilous patterns make network more stable.

We apply this framework to discuss public good provision and voting on networks.

Structured Text Analysis for Evaluating Shared Cognition

Michael Schultz, Leslie Dechurch and Noshir Contractor

The establishment and maintenance of shared cognition is a key determinant of the stability, effectiveness, and performance in work teams. Despite their proven importance, quantitative research on shared cognition has been impeded by the conventional survey-based measurements, which are intrusive, time-consuming, and largely artificial. Our study seeks improve research on shared cognition by developing a method to extract mental models from transcripts of discussion.
Our method is based on three distinct units of analysis: individual linguistic features, networks of dyadic similarity, and group-level network properties. At the lowest level, we operationalize individual mental models as a network of relations between topics, as determined by topic modeling (LDA). Second, we use the pairwise similarity between individuals' mental model representations to construct weighted networks of individuals. At the highest level, team level shared cognition is modeled as aggregates of these networks. Thus, the overall cognitive architecture consists of multiple content networks with ties representing individual similarity. The degree to which mental models are shared can be then evaluated by the modularity and clustering properties of the network.
We validate and test these models in a real-world setting by applying them to the transcripts of the three manned Skylab missions. The Skylab missions are known to have experienced major variations in mental models within and across teams. Two missions were extremely productive, while the third experienced major personnel problems that culminated in an unplanned work stoppage. The long duration and isolation of these missions provides enable us to capture long-term dynamics of shared cognition in the absence of extraneous influences. The availability of verbatim transcripts of all conversations among the crew and between crew and ground control enable us to evaluate these dynamics at a high level of detail and with fine-grained precision.
This work contributes in two principle ways. First it provides a novel process of extracting networks from text data at a relatively high level of abstraction. Second, it improves the measurement of mental models, allowing mental model research to be conducted in contexts where surveys are unavailable or impossible.

Structures of Perceived & Observed Trust in Multi-Team Systems

Ly Dinh

An abundance of research has argued that interpersonal trust is a fundamental driving force for cohesive and high-performing teams. Specifically, in the context of multi-team systems (MTS), where team members are expected to coordinate with both their own team members and also those of other teams, trust becomes a crucial knot that ties individuals and groups together. Given the complex and multi-layed structure of MTS, a network-theoretic approach is necessary to uncover the dynamics of trust at various levels ranging from within-team to between-team member relations. Drawing from concepts of structural balance (Heider, 1958; van de Bunt, Wittek, & de Klepper, 2005) and triadic closure as indicators of trust attitudes and behaviors (Uzzi, 1997; Buskens, 2002; Coleman, 1990), the study examines the influence of perceived and observed trust relations between team members on the overall performance of a multi-team system.

Trust between members of an MTS can be reflected through both an individual's attitude towards the other team member, as well as through the individual's behaviors towards that member. Trust as a dimension of attitude represents a person willingness to be vulnerable and having positive expectations towards the other party (Rousseau et al, 1998). On the other hand, trust as a type of behavior involves cooperating and frequently interacting with the other party (Sitkin et al, 1993). Trusting attitudes, as perceptions can be measured through self-reports, while trusting behaviors may be observed directly in experimental and relational settings. We used data from both self-reported survey and experimental simulations in order to answer the following guiding research questions: What perceived and observed trust structures are most likely to be associated with multi-team systems' performance? What is the relationship between perceived trust and observed trust relations in a multi-team setting?

Observed relational data is obtained from Virtual Battlespace 2 (VBS2) simulations of 33 MTS that consists of two teams, phantom and stinger. There is one commander and one drive in each team, whose mission is to navigating two different courses in which they need to (a) keep a log of landmarks visited, (b) successfully overcome hazards and (c) coordinate with members of the other team to reach the rendezvous point before fighting insurgents. Self-perceived trust of an individual towards each member of the MTS is measured using the question: "to what extent do you trust each member of the squad?". Given that there are two missions, self-reported data is collected at three time points; before mission, after mission 1, and after mission 2. We found that most teams have unbalanced perceived trust structures at the beginning, and only 5 teams managed to achieve balance in the end, in which all members have positive trust attitudes towards the other. We also observed that these 5 teams contained more transitive and closed triads, indicating the presence of frequent interactions and potential trust-building relations. Continuing network analyses of trust perceptions and observed trust relations will explore

how they are related to the multi-team system's performance in terms of task thoroughness, efficacy, speed, and members' coordination.

Sustaining Cooperation with Multiple Relationships

Chen Cheng, Wei Huang and Yiqing Xing

We study the sustaining of cooperation with multiplexity on networks: agents interact with each other on not only one, but potentially many, relationships. Agents repeatedly play cooperation game with endogenously determined size of cooperation (similar to Ali and Miller 2016) on each link/relationship. Firstly, with fixed network structures, we analyze how agents' incentives, characterized by maximal sizes of cooperation, are shaped by networks. We do so under three schemes: perfect community enforcement, multiplexity only, and partial community enforcement with information diffusion. Secondly, we endogenize network formation by asking the following question: starting with a given network, if an agent has one additional link to establish, will she choose to link with a current neighbor or a stranger, i.e. to multiplex or not?

We provide the following theoretical predictions:
1. Agents have strong incentives to multiplex and may fall into a "multiplexity trap''. That is, they may keep adding new links with existing neighbors and isolating the rest of the society. This could happen even when cooperating with current neighbors (multiplexing) produces much lower gains of trade than cooperating with strangers.
2. Agents prefer multiplexing to linking with strangers, when the society has a not-so-dispersed degree distribution, or when it has a very dispersed degree distribution but exhibits homophily in degrees (i.e., people link with others of similar degrees).
3. Agents do not link with strangers if it only makes the society more connected. Instead, they would rather multiplex, or link with someone that they are already well connected with.

We also provide empirical evidence that supports our theoretical predictions. Using the Indian Village Survey Data provided by Banerjee et al. (Science 2013) and Jackson, Rodriguez-Barraquer and Tan (AER 2012), we are able to show the following results:
1. Strong patterns of multiplexing exist. When two households already have a relationship, there is significant and positive probability that they will have multiple relationships.
2. The more dispersed the degree distribution of a network, the less likely people will multiplex.
3. The more homophilous a network is in terms of degree, the more likely people will multiplex.

The Cost of Ties: Explaining balance and status in signed tie formation

Nicholas Harrigan, Janice Yap, Bing Yang Tan and Yu Xun Tan

What drives signed tie formation? The two main competing explanations are balance theory and status theory. We test these theories with a stochastic actor oriented model (SAOM) of four longitudinal networks – friendship,

esteem, dislike, and disdain – of 115 undergraduates. We find that balance theory is dominant in friendship ties, while status theory is dominant in esteem, dislike, and disdain ties. We argue this is explained by the difference in cost of ties: costly friendship ties generally require mutual investment and have a norm of loyalty, generating balance; while low-cost ties lack these characteristics, allowing status to dominate.

The Diffusion of EHR Incentive Programs in Physician Patient-Sharing Networks

Meng-Hao Li

In 2011, the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs were established to facilitate the adoption and meaningful use of certified EHR technology in ambulatory practices and hospitals. However, current program evaluation mostly relies on conventional survey methods to investigate obstacles that the participants encounter (Adler-Milstein et al., 2014; 2015). The evaluation approach presumes that participants are independent from each other without any relationships. The assumption may not be realistic when participant networks are considered. For example, prior medical diffusion studies indicated that physician networks are likely a determinant of a new product adoption, through either direct physician relations (network cohesion) or indirect physician relations (structural equivalence) (Burt, 1987; Marsden & Podolny, 1990; Strang & Tuma, 1993; Van den Bulte & Lilien, 2001). The analogous pattern might be observed in the diffusion process of the EHR incentive programs. Nevertheless, network cohesion and structural equivalence approaches paid little attention to how spatial proximity or spatial interaction between two physicians affects the adoption/diffusion process (Autant-Bernard, Mairesse, & Massard, 2007). A direct physician network connection coupling with spatial closeness is likely to increase the propensity for the program infection. Similar physician network positions coupling with spatial closeness are possible to increase the likelihood of the program infection. Spatial proximity might serve as a moderator to influence how the EHR incentive program participation spreads from one physician to another physician with a direct/indirect connection. Hence, the purpose of study is to understand how physicians' network cohesion, structural equivalence and spatial proximity collectively determine the participation of the EHR incentive programs.

The implementation of the EHR incentive programs involves three stages. The first stage requires participants to establish an EHR environment for the electronic extraction of clinical data. The second stage requires participants to ensure the meaningful use of EHRs. The final stage expects participants to produce better clinical outcomes and quality of care. The programs specified eligible participants to Medicare and Medicaid providers and hospitals. When those participants meet criteria of the stages, federal reimbursement are given. The data used in this study collected from the Centers for Medicare and Medicaid Services, Department of Health and Human Services. This study will focus on 9,273 physicians who participated in the first stage of the program from 2011 to 2015 in three hospital referral regions (HRR), Arlington areas (HRR code: 426; 195 zip codes), Washington areas (HRR code:113; 504 zip codes) and Baltimore areas (HRR code: 223; 207 zip codes). The physician patient-sharing

networks (total network size = 24,291) in each area were constructed to examine how the program participation spreads among the physician networks. The event history analysis will be used to estimate the program diffusion process with the time-to-event data. The analysis results are expected to enrich our understanding of how network properties influence the diffusion of EHR incentive programs and whether spatial proximity moderates the effects of network cohesion and structural equivalence on the diffusion of the EHR incentive programs.

The diffusion of smoking initiation among diverse, urban American adolescents over the high school period

Kayla de La Haye, Hee-Sung Shin, George Vega Yon and Thomas Valente

While social networks research has shown that similarities in cigarette smoking among adolescent friends is caused by social selection and influence (Ennet et al., 2006; Hass et al., 2010; Fujimoto & Valente, 2012; Go et al., 2012; Green et al., 2013), work in this area has some important limitations. Many of the existing studies used data that is now 25 years old, measured at a time when adolescent smoking rates in the United States were approximately double the rate that is observed today (National Youth Tobacco Survey). Moreover, samples used in these studies typically followed subjects for just one year, and lacked socio-demographic diversity. This study addresses these issues. We investigate the diffusion of smoking initiation in adolescent friendship networks, using sociometric survey data from a large cohort of 1,425 diverse high-school students that are drawn from four high schools nested in a low-income urban neighborhood, and who were followed during their entire high-school period (3 years, from 2010 to 2012). Furthermore, we explore how the role of social selection and popularity in this process. We assess the presence of social influence using two different approaches: Stochastic Actor Oriented Models, and Spatial Autoregressive Models. While these two methods may not be fully comparable, it does provides insights about the possible conclusions that using different methods may yield, as well providing further evidence of network effects, if any.

The effect of FDA recalls on the strategic alliance networks in the medical device industry

Angelo Mele and Shweta Gaonkar

The structure of strategic alliances among firms in an industry shapes competition, investments in R&D and market performance (Ahuja, 2000). Companies invest in alliances with different goals: research collaborations, marketing agreements, manufacturing contracts, distribution ties, licensing, equity alliances, and joint ventures. It is important to understand how these decisions affect firms' performance and markets efficiency.
The inter-organizational alliance network literature in management and economics has established the theoretical importance of alliance ties for the success and survival of firms against their competitors (e.g. Shan, 1990; Mitchell and Singh, 1992; Goyal and Joshi, 2003). Moreover, these strategic networks are crucial for a firms' performance because they

provide valuable resources (Pisano and Teece, 1989), information and status (Davis and Eisenhardt, 2011).
The Medical Device industry is an ideal context for such a study, because the availability of technical knowledge and patents are necessary but not sufficient conditions for a firm's success. Strategic alliances are indeed an integral part of the firm's assets, and contribute to their economic performance (Ahuja, 2000).
However, understanding the causal impact of networks on economic performance is a challenging task, because of the impossibility of running a randomized controlled trial, where strategic alliances are randomly assigned to firms. (Mele, 2016; Bramoulle and Fortin, 2009; Banerjee et Al, 2013). The empirical strategy of this project is to use an event (the FDA recall or approval) that is likely to affect the value that a firm brings to a strategic alliance, and a difference-in-difference approach to identify: 1) the determinants of network formation in the Medical Devices industry; 2) the effect of strategic alliances on firms' performance.
We collected data from the Medical Device Register, containing 29,684 firms from 1996 to 2013. We matched these companies with Compustat data for the financial performance and the SDC alliances database. We obtained the FDA recalls from the FDA website. In addition we are collecting patent data from Thompson Innovation, to track the networks of knowledge in this industry over time. Our data allows us to observe a firm and its strategic alliance network over time. We will study the impact of an FDA recall or approval on:
1. the composition of the strategic alliance network,
2. the economic performance of the firms in the strategic alliance network, and
3. the stock prices of the alliance network.
Furthermore, we can distinguish positive events (approval) and negative events (recall) and study whether they have a differential impact on the network and performance.

The Effects of Lay and Formal Support Resources on Recovery from Serious Mental Illness

Erin Pullen and Brea Perry

It is well established that social relationships have a significant impact on mental health and recovery from serious mental illness (SMI). Social support, from both lay and professional ties, plays an important role as individuals are diagnosed, treated, and manage SMI. In this research, we consider the effects of support from both lay and professional ties on several dimensions of recovery.

Data are from the Indianapolis Network Mental Health Study (INMHS, n=169, obs=338), which captures the experiences of individuals during their first encounter with the mental health treatment system. This longitudinal study includes both detailed measures of mental health status and functioning and egocentric network data. Using two-level random-intercept models – observations over time (L1) nested with individual egos (L2) – we examine whether the effects on recovery outcomes of viewing a provider as someone who provides beneficial informational support are contingent on support within egos' networks.

Analyses reveal that, in the presence of networks with low levels of support provision, viewing a provider as someone who provides informational support has a positive impact on all recovery outcomes examined (prognosis, general life satisfaction, self-esteem, overall health). However, in the presence of networks with higher mean levels of support provision, have a provider who provides beneficial advice or information has neutral or negative impacts on the outcomes of interest.

Findings suggest that in the absence of a strongly supportive lay network, formal ties may be substituted for lay relationships, providing support resources that facilitate recovery from SMI.

The formation of nonprofit learning network

Xunyu Xiang and Lucy Jordan

Learning is of great importance in enhancing organizational performance (Walshe, Harvey & Jas, 2010). Prior studies have provided ample evidence on the potential benefits or outcomes of organizational learning. Less attention has been paid on the formation and process of learning, particularly from the nonprofit perspective (Bate & Robert, 2002). Existing nonprofit studies concentrate more on the cross-sectoral learning or individual organizational learning (Mchargue, 2003; Gill, 2009; Peng, 2016). There is absence of a focus on learning within the organization network. Due to the differences between the nonprofit and business sectors, we presume that the dynamic of learning on the network level is also varied. This exploratory study addresses this gap in understanding of learning within networks in the nonprofit context. We examine how the process of network building varies based on whether it occurs for purpose of project-building or learning. Does the network emerge voluntarily or is it initiated by a third actor, like a nonprofit support organization? This study attempts to discover the structural characteristics of the nonprofit learning network for the further studies and practice.
This study applies the learning-network theory and 'learning race' perspective to exploring a learning network in Southern China. Utilizing the snowball sampling strategy, more than 20 Nonprofit Organizations (NPOs) involved in one learning network were sample. Social network analysis data analysis method is applied.
Preliminary analysis shows that the 'learning network' has some distinct characteristics compared with the 'project network'. The nonprofit learning network is not built purposively, and often is established in the informal fashion. Target organizations prefer having a diversified learning partners rather than learning from the organization focused on the same field. There was diversity among the organizations regarding how and where they met their learning partners, and evidence that they form the network voluntarily, without support from the nonprofit support organization. The findings were somewhat contrary to what was expected vis a vis a central role for the nonprofit support organizations indicating rather more spontaneous and organization-to-organization network building. The study findings provide contextual information to better understand the developing NPO sector in Southern China, and contribute more broadly to understanding of network-based studies in the nonprofit sector.

The Friend of My Friend is My Enemy?: Modeling and Analyzing Social Balance in an Online Community

Christine Sowa

This paper explores the most popular subgroups on the social discovery website Reddit to identify how users feel about the identical information. Should users both share the same sentiment, it is assumed that they have something in common and are deemed ""friends."" If they fundamentally disagree about the topic per sentiment analysis, they are ""enemies"" per social theory. While the author expected a balance to arise among the friends and enemies, it did not, leading one to believe that informal social network allegiances represent an imbalanced social structure that can potentially be balanced following further intervention.

The Role of Brokers in Academic Network Building

Diego Gomez-Zara, Wouter Vermeer, Zachary Gibson, Connor Bain, Gabriella Anton, Leslie Dechurch, Uri Wilensky and Noshir Contractor

Academic networking is fundamental to integrate and establish research communities. However, the literature has not studied in great detail the processes that describe how these communities are built. Most studies focus on static dyadic and triadic relations, and do not consider the temporal dimension and the order of those interactions.

The formation of collaborations and new research communities is dynamically driven by a process in which scholars get introduced to other scholars, creating new connections and opportunities for research. To facilitate this, some scholars act as brokers, driving the creation of new research connections. Brokers have the ability to introduce and connect scholars who did not previously know each other. Which scholars take on the role of broker, which attributes they have, and how the temporal dimension plays a role in this process remains largely unclear. In this paper, we examine the role of these brokers.

We use various attributes to classify the scholars in our network: academic affiliation, position, tenure, nationality, role in the venue. Based on an existing framework that describes five types of brokerage roles (Coordinator, Itinerant, Gatekeeper, Representative, and Laison,) we use Relational Event Modeling to analyze the brokers' interactions considering dynamic relational data. We test how these attributes affect brokerage behavior, to better understand the network formation process and its drivers.

Data for this study comes from an interdisciplinary academic conference, which lasted four days. We collected data using two methods. First, we traced interactions of 317 participants using electronic badges during this event. Resulting in a dataset consisting of 1,202 interactions with their respective timestamps. Second, we provided a survey to the participants, which asked about demographics, characteristics, and academic background.

Preliminary results suggest that brokers are often those participants that are speakers, organizers of the venue, and those scholars that prefer working with scholars from other disciplines. Also, researchers with a strong identification with interdisciplinary act as Itinerant Brokers, while researchers who collaborate with interdisciplinary scholars perform as Gatekeepers and Representatives.

By analyzing this connection process dynamically, our findings substantiate the notion of brokerage as an important role that scholars perform in academic venues and the influence of brokers for constructing new research networks.

The role of temporal data and the patterns of interaction in the interpretation tie strength and stability

Michael Penta

Within network science, the approach most commonly used to understand and describe the strength of a tie is to focus on the summation of interaction events between the individuals of a dyad as an indicator of a tie's strength. Traditionally, this has been a consequence of the nature of data collected at the time, which has been limited in its size and its temporal qualities.

Currently, though, there is a far greater availability of communication log data, like that describing cellphone, email, or application interaction (Facebook, Whatsapp, Instagram, Twitter), that provides researchers with greater opportunity to describe the interaction patterns within dyadic relationships.

Research done within the psychological literature studying relationships suggest that these temporal changes, in addition to the frequency of interaction, are indicators the health and stability of a relationship and that all of these evolve over the lifetime of a tie. The tools and theory often available to network researchers do not provide sufficient understanding of these patterns to effectively use them in the interpretation of large networks of relationships.

Looking at the interactions between approximately 60,000 relationships over a four-year period, varying in length and intensity, in this work I develop the means of interpreting this temporal data. Here I examine the role that regularity, responsiveness and the pattern of interaction within a dyad have on the stability of the ties and how these patterns change over time within a relationship.

Results of this work suggest that relationships that are the most stable and most long lasting interact regularly, on the order of once or twice a day on average. This relationship is not simply linear though - on the measures of responsiveness and regularity, simply more interaction was not directly related to the longest lasting relationships. In both of these measurements, a certain maximum level of interaction and responsiveness was present in the longest lasting relationships, beyond which relationships demonstrated increased instability. Similarly - increased

asymmetry within a dyadic relationship was related to greater stability, with relationships expressing higher levels of equality in interaction much more likely to dissolve following a break in interaction.

Relationships that last the longest change their pattern of interaction the least. Increased instability in the pattern of interaction is associated with the dissolution of interaction but is also related to longterm shifts in the pattern of interaction. Increased variability in behavior may be a marker of relationship change occurring.

While changes in behavior are associated with breakdowns in relationships, there appears to be a typical growth pattern in responsiveness, which is curvilinear. Relationships, on average, grow in responsiveness over the first 250 days of the relationship and then decrease into a longer term pattern of flat growth.

Differences in sending behavior and responsiveness between dyadic partners are often different and change over the lifetime of a relationship, suggesting that individuals approach interaction behavior differently, as theorized by attachment style theories. Individual egos demonstrate common patterns of interaction across relationships with different alters.

The Role of Twitter in the 2016 U.S. Congressional Races

Yotam Shmargad, Jordan Bruce, Zuleima Cota, Erman Gurses, Jeff Jensen, Colin Kyle, Don-E Merson, Lance Sacknoff, Farig Sadeque, Karthik Srinivasan and Limin Zhang

Since the emergence of social media, there has been some debate about whether they improve or hinder democracy. On the one hand, these platforms present a relatively inexpensive way to find and engage with one's constituents, which can open the door for newer, less well-funded candidates. On the other hand, social media may merely exacerbate preexisting inequalities by providing better-funded candidates another way to outspend their competitors. We investigate the role that social media play in democracy by combining campaign finance and electoral outcome data with data about the Twitter networks of candidates in the 2016 U.S. Congressional races. We find that, when competing candidates differ widely in the financial resources available to them, they see larger gaps in electoral outcomes. However, this effect is significantly moderated when better-funded candidates do not have a strong Twitter presence. In particular, even when financial resources differ widely between candidates, gaps in electoral outcomes are not too large if the better-funded candidate does not have many Retweeters (or sharers) of their messages on Twitter. Moreover, the Twitter activity of lower-funded candidates did not significantly decrease electoral outcome gaps, suggesting that social media may have an overall negative effect on democracy by providing new means for better-funded candidates to get their messages out.

The social consequences of networked individualization

Snorre Ralund

Benefits of network ties that span accross groups and dissolves the hard boundaries of tightly knit communities, have been pilling up ever since Granovetter's famous paper on weak ties (Granovetter 1973; Burt 2004; Vedres and Stark 2010). Network theory has thus provided strong arguments against a purely negative and one-sided view of the individualization process (Wellman 1979; Wellman 2012), broadly speaking the alienating effects of modernity. While many studies have shown how the successful individual benefits from his wide ranging and crosscutting network, they failed to recognize the unequal distribution of these benefits, that indeed the sum of the individual benefits might not match the losses of the collective. This study investigates which global network structures are related to highest success rates.

Using an acquaintanceship network dataset collected through Facebook consisting of >25.000 higher education students from 67 different study-programs at four danish universities, I compare global network structures of cohorts to retention rates and survey-based indicators of social wellbeing (e.g. loneliness).
Methodologically I contribute to a network analytical measure of individualization (Simmel 2010 (1955); Pescosolido & Rubin 2000; Wellman 2002), describing the degree to which ties are organized around tightly knit and delimited groups and not as complex intersections between loosely defined groupings. I propose a measure of groupness, that sorts out some of the deficiencies of Shwed and Bearman's (2010) measure of ""community salience"", and problems arising with comparative analysis of different networks that do not share fundamental properties of size and density.

I compare the level of groupness of student cohorts to retention rates and loneliness. Results show that the retention rate increase consistently the more individual ties fall within well delimited groupings (increasing with 25 percentage point from the most scattered to the most grouped). Furthermore the level of groupness is also related to lower levels of reported loneliness and a range of other social indicators.
In line with McFarland et al. (2014) I show that variations in global network structures can be attributed to differences in organizational practices (the allocation of students into classes and course trajectories), spawning a discussion about networked features of social foci (Feld 1980). Furthermore I discuss the results in relation to network theories of friendship formation, and propose a formal sociological explanation in the Simmelian sense (Simmel 1950:175).

The Social Networks of Individuals with Down Syndrome

Anne Roll

This paper introduces a new approach to describe and analyze the social networks of individuals with Down syndrome (DS) (n=30) from their perspective and from the perspective of their key persons (e.g. family

member, friend) (n=30). Social networks are crucial for a person's health and well-being. Research on social networks shows that having a strong social network and support system enables social inclusion, improves well-being, and avoids institutionalization for individuals with intellectual disabilities (ID). Especially for individuals with DS who live and age in the community, social networks provide essential support in their daily lives. However, as people with Down syndrome age, their social networks, because with increasing life expectancy their parents, who are often their primary support providers, may no longer be available.

This study is innovative in two ways: first, it investigates the social networks of individuals with DS from their own perspective and second, it integrates the perspective of a key person of the individual with DS's social network. The reason for including key persons is to investigate whether their perceptions of the social network of the individual with DS differ from the perception of the person him or herself and if so, how. For example, do both identify equal or different numbers of network members? A mixed-method egocentric network approach was used to also analyze the functional and structural social network characteristics. The person with DS and the researcher created and visualized their social networks on the computer, using the network tool Vennmaker. The researcher used a name generator question to elicit network members, and the closeness of network members was visualized by concentric circles. The structural network characteristics were collected by asking about the frequency of contact with network members, the distance from where the person with DS lives, and whether the network members were connected to each other. The functional network characteristics were collected by asking questions about the support that individuals with DS receive and provide. The same questions were used to collect these data about the social networks of the respective person with DS from his or her key person. The social networks were created in separate sessions with the individuals with DS and with their respective key persons.

The paper has three goals: 1) to share lessons learned from involving people with DS in research on their social networks, using a computer-supported social network program, 2) to describe the characteristics and functions of the social networks of individuals with DS from their own perspective, and 3) to describe the characteristics and functions of the social networks of individual with DS from the perspective of a key person and to compare and assess the degree of agreement and difference between those descriptions. Preliminary results are presented.

Tools for Assessing the Model Adequacy of Exponential Graph Models (ERGMs) and Comparing Sets of Networks Using Labeled Features

Nolan Phillips and Carter Butts

Although exponential random graph models (ERGMs) have become increasingly popular among network researchers, the development of tools to (1) assess the adequacy, (2) further facilitate model selection, and (3) compare the generative features across a set of networks have lagged behind. Thus, we develop and demonstrate the utility of a suite of techniques to address each of these issues; moreover, we are creating an R package comprised of

these tools. Currently, the model assessment tools for an ERGM fit to a network evaluate the ability of the model to reproduce adequately the network's topological features (i.e.; the structural properties of isomorphic networks) in simulations. However, network scholars have shown that particular node's structural position matters, but tools to assess the model's adequacy in recapitulating these labeled features do not exist. Our first set of tools evaluates the adequacy of an ERGM using labeled features. The labeled features can be nodes' IDs or attributes as well as edges' attributes. This approach is intrinsically exploratory; yet it can illuminate specific features that the model does not adequately reproduce, which can subsequently assist researchers in improving their models. However, these tools do have scope conditions. ERGMs fit to networks without labeled attributes that instead consist of unlabeled, structural properties cannot be assessed with these techniques. Rather, these assessment tools are ideally suited for when interest lies in capturing the features of the nodes and when a model can plausibly do so (i.e.; the network contains distinguishing information, though this information does not need to be mutually exclusive). Therefore, our approach builds upon the existing adequacy checks for topological features. Additionally, we produce several techniques that researchers can use for model selection by calculating alternative accuracy measures of models' fit. A key contribution here is our development of a held-out predictive evaluation (HOPE) technique that provides a within sample validation method. HOPE can identify nodes or edge sets that are most anomalous in a network under a fitted ERGM's parameters, and it can be applied to ERGMs that only contain structural properties. Finally, we establish a novel way of comparing the generative features found by an ERGM across a set of networks. This enables researchers to assess the degree of similarity between all of the networks produced by each ERGM's parameters and speaks to how ubiquitous the generative features are for this set. Furthermore, network scholars can use these tools to examine hypothetical situations (such as, if a homophily was stronger or a node had more bridging ties) to analyze these changes' effects relative to the original network. Taken together, we develop a suite of techniques that build upon the extant ERGM assessment tools to (1) evaluate the adequacy of ERGMs fit to labeled networks, (2) assist scholars with model selection, and (3) compare the generative features across a set of networks. There are a plethora of other tools that could be developed in this area; our hope is that these methods encourage others to develop more.

Towards a Multilevel Analysis for Egocentric Network Data: An application of Multiple Membership Multiple Classification (MMMC)

Ly Dinh and William C. Barley

Social network scholars are becoming increasingly aware of the nested, hierarchical, and dependent nature of sampled network data. Recent developments on multilevel analysis such as permutation-based tests and random graph models enabled scholars to collect and analyze network data at multiple levels of analysis ranging from egos, dyads, to the global network. As these methods are mainly based on maximum likelihood procedures and simulations to determine statistically significant network

structures, they require substantial sample sizes and minimal loss of data. In reality, obtaining nearly-complete samples is proven very difficult in many network studies, and researchers often resort to traditional statistical techniques such as linear regressions that collapses the multiple layers of the network to a single level of analysis surrounding the egos. This approach introduces certain kinds of errors that biases that may over- or underestimate the effect sizes, and also it does not sufficiently explain where and how certain network effects are occurring. Is there then a method that can account for the multi-level nature of networks, and is also tolerant of missing data? With this question in mind, we propose a method called multiple membership multiple classification (MMMC) model. While still preserving the nested structure of the network, MMMC is more robust against missing data problems as it enables complete-case analysis of available ego- and tie-level cases.

Using an original dataset obtained from our egocentric network study of interdisciplinary collaboration among members of a scientific organization, we demonstrate how multiple membership multiple classification (MMMC) model can be used. The data is collected using an online network survey sent to 250 members of the organization. Through multiple follow-up emails over two weeks, we received 101 complete responses, resulting in a final response rate of 40%. Our data contains both ego-level and tie-level attributes among each and every dyad, thus allowing us to apply MMMC to estimate model parameters as well as to examine the share of variation within and between both levels of the network. We compared the single tie-level null model (DIC=3012, $p<0.001$) to the multi-level model (DIC=2648, $p<0.001$) and found significant improvements in model fit. Thus, a multi-level approach is necessary, as differences in variance are accounted for in each level of analysis. Additionally, results indicate that the majority of variance is explained at the tie-level for both models, taking 62%, while the ego-level accounts for 38%.

Ultimately, we assert the importance of responsibly analyzing multi-level egocentric network data even in the face of missing values, being aware that although we may avoid issue of biased estimates, our results are limited to inferences at the level of the average tie among egos within our population under study. In order to make inferences about certain classes of ties, or higher-order structural properties, a larger sample size with minimal missing data will be necessary.

Towards an ecology of ties: How weak ties challenge activist sustainment

Hjamar Bang Carlsen and Snorre Ralund

We recast the notion of social ties, strong and weak, within an ecological framework. Ties are thought of as more or less stable patterns of interaction that happen within certain situations and relate to another within certain environments. Ties are not just resource, but demand resources - they should be thought of as investments. Using dynamic interaction data at scale we can investigate the (in)stabilities of tie formation instead of assuming them. Actors need to continually interact and invest time and effort in their relations. These investments happen in

situations with certain interaction orders, certain morally and emotional expectation, that condition actors investment. Furthermore ties relate to one another within an environment that condition whether ties are in competition with one another over attention or not. This theoretical conceptualization is used to analysis social movement mobilization processes where membership inflow increases the size of networks and the demand for interaction. Furthermore the setting where activists interact have specific situational features that are important for understanding tie formations. Our ecology of ties framework lead to 3 theoretical claims about activist engagement processes in social movement groups:

1) The interaction order, under which ties are made, conditions ego investment in alter.
2) The size of membership influx poses problems for membership integration. This can lead to social congestion effects where initially mobilized actors are not integrated due to the overburdening of core activists.
3) Strong and weak ties stand, under certain conditions, in direct competition with one another. The influx of weak ties can thereby undermine the reproduction of strong ties which in turn can lead to movement withdrawal.

We test our theoretical claims on the Danish Refugee Solidarity Movements. Our data consists of 163 Facebook groups, capturing the activity of 86.251 users, amounting to 34.740 posts, 3.777.037 likes, 446.906 comments. This enables a highly interactional approach, but of course also provoke questions of validity beyond Facebook. We end the paper by addressing the virtues of Facebook data both as a proxy of engagement beyond Facebook and as an interesting political arena in and of itself.

Transitivity of Joint Interests among Key Actors in Conflict Syria and Iraq: Implications for a Post-ISIS Middle East

Lawrence A. Kuznar and Allison Astorino-Courtois

Predicting the stability of alliances in the Syrian and Iraqi conflicts has been extremely difficult. The transitivity of the alliance network provides insights into how and why alliances may shift, as well as the future stability of the regional network. The transitivity of a network of 23 key actors (both state, non-state, regional and global) in Syria and Iraq was examined along five competing interests (security, prestige, economic, identity, domestic) for the current conflict and for a situation in which ISIS has been defeated as a territory-holding organization. Key results include: ISIS is extremely marginalized probably making its defeat inevitable, the region's actors share little common interests in most ways, although the region is well-integrated with transitive relations in the economic sphere, making economic negotiations the best lever for increasing regional stability.

Uncovering the spatially distant feedback loops of global trade: A network and input-output approach

Christina Prell, Kuishuang Feng, Klaus Hubacek and Laixiang Sun

Land-use change is increasingly driven by global trade. The term "telecoupling" has been gaining ground as a means to describe how human actions in one part of the world can have spatially distant impacts on land and land-use in another. These interactions can, over time, create both direct and spatially distant feedback loops, in which human activity and land use mutually impact one another over great expanses. In this paper, we develop an analytical framework to clarify spatially distant feedbacks in the case of land use and global trade. We use an innovative mix of multi-regional input-output (MRIO) analysis and stochastic actor-oriented models (SAOMs) for analyzing the co-evolution of changes in trade network patterns with those of land use, as embodied in trade. Our results indicate that the formation of trade ties and changes in embodied land use mutually impact one another, and further, that these changes are linked to disparities in countries' wealth. Through identifying this feedback loop, our results support ongoing discussions about the unequal trade patterns between rich and poor countries that result in uneven distributions of negative environmental impacts. Finally, evidence for this feedback loop is present even when controlling for a number of underlying mechanisms, such as countries' land endowments, their geographical distance from one another, and a number of endogenous network tendencies.

Using a Network Approach to Explore Coping Resources Needed by Families Affected by Inborn Errors of Metabolism

Jennifer Cleary, Hena Thakur, Pearl Eni, Jeffrey Lienert, Dawn Lea, Christopher Marcum and Laura Koehly

Although a fairly substantial body of research exists on caregiving in general, the research on caregivers of children with inherited diseases is much sparser. Caregivers of children with chronic illnesses report higher levels of stress as compared to caregivers of healthy children and differ in necessary resources for stress management, indicating this is a vulnerable population that could benefit from such research. Additionally, the physical environment, particularly in cases of urban vs. rural environments, differentially affects healthcare access (e.g. clinics, healthcare providers, medicines, and health information), where rural environment is associated with limited access and greater barriers to access. Typically, research has used either qualitative interviews or quantitative survey measures to assess stressors, coping strategies, needs and resources in the caregiving population. Individually, these approaches provide valuable insight into caregivers' personal experiences or performance on a variety of standardized stress, coping, or health measures. However, a mixed methods approach can allow us to quantitatively explore the richness of information that qualitative data affords. Accordingly, this project employs a mixed methods design, using network analysis to explore the connections among resources and needs mentioned in participants' responses to qualitative, open-ended survey

questions. We illustrate the structure of resources and needs surrounding 49 primary caregivers of children affected by a group of rare, inherited conditions known collectively as Inborn Errors of Metabolism (IEMs). In particular, we explore rural and non-rural IEM caregivers as separate groups and find that, on average, the centrality of resources available or needed differs between the two environments. Specifically, degree and closeness centrality are greater in the non-rural group as compared to degree and closeness centrality in the rural group. As caregivers of children affected by a rare disease, these families may experience a unique set of circumstances that highlight similarities or differences in access to formal healthcare as well as access to other, more informal resources for effective coping. Understanding how these families' needs co-occur, as well as how they may be influenced by geography, may be instrumental in developing effective interventions that appropriately address important needs across both populations.

Using electronic trace data to study social network changes related to an open office environment

Alex Perrone, Nathan Bos and Ariel Greenberg

We conducted a pre-post social network analysis of an organizational unit moving from closed offices into an open office environment. Self-report data showed increases in social familiarity, skill familiarity, frequency of communication and face-to-face contact after the move, despite no change in formal collaboration patterns. These results could indicate important potential benefits from co-location. The data, however, came from a small number of respondents in both the experimental and control conditions, and the data also has network dependencies that are difficult to statistically control.
To address these issues, we developed novel methods to contextualize and confirm these findings with electronic trace data. Using transformations of three types of easily available electronic data (email metadata and two levels of billing data), we developed algorithms to predict familiarity and communication outcomes and validated them with available self-reports. We then were able to compare model-predicted outcomes in the open office to model-predicted outcomes from a larger pool of other groups in the same organization at multiple time periods. Analysis suggest that the self-report results were valid; there were changes in predicted familiarity and communication in the group that moved to the open office outside of the predicted variation among other groups. Both limitations and potential extensions of this method will be discussed.

Using Network Analysis to Measure Transactive Memory Systems

Kylie King

Transactive memory systems (TMSs) represent the structures and processes that teams use to share information and work together to perform tasks. TMS has been evaluated in the past through proxies for performance, external evaluations, and self-report inventories. This paper proposes the application of social network analysis to the measurement of TMS.

The present study evaluates the coordination, enjoyment, and trust networks of small teams (4-5 members) of undergraduate students working on semester-long projects. More specifically, this paper evaluates how the strong-tie density and transitivity of expressive networks (enjoyment and trust) and instrumental networks (coordination) may demonstrate the strength of a team's TMS and influence team performance.

Two primary research questions are explored, including the correlation between the proposed network measures and team performance and the validity of the proposed measures (including external validity, generalizability, and incremental validity). Findings include that the densities and transitivites instrumental networks are more closely related with team performance and are, therefore, likely to be better measures of TMS. This study contributes to network research by applying network analysis to small teams through the use of strong-tie density and strong-tie transitivity.

Varying-Coefficient Models for Dynamic Networks

Jihui Lee, Gen Li and James D. Wilson

Dynamic networks are commonly used in applications where relational data are observed over time. Statistical models for such data should capture the temporal dependencies between networks observed in time as well as the structural dependencies among the nodes in each network. As a consequence, effectively making inference on dynamic networks is a computationally challenging task, and many dynamic network models are intractable even for moderately sized networks. In this paper, we propose and investigate a family of dynamic network models, known as varying-coefficient exponential random graph models (VCERGMs), that characterize the evolution of network topology through smoothly varying parameters. The VCERGM provides an interpretable dynamic network model that enables the inference of temporal heterogeneity in dynamic networks. We establish how to fit the VCERGM through maximum pseudo-likelihood techniques, and provide a computationally tractable method for statistical inference of complex dynamic networks. We furthermore devise a bootstrap hypothesis testing framework for testing the temporal heterogeneity of an observed dynamic network sequence. We apply the VCERGM to the US Congress co-voting network and a resting-state brain connectivity case study and show that our method provides relevant and interpretable patterns. Comprehensive simulation studies demonstrate the advantages of our proposed method over existing methods.

Venue avoidance and impact on HIV risk and prevention behavior among young Black MSM

Kayo Fujimoto, Peng Wang, Lisa Kuhns and John Schneiders

Young men who have sex with men (MSM) have an elevated rate of HIV infection in the U.S. The social or preventive venues that young MSM may frequent provide clues to sexual network formation and downstream HIV infections. Avoiding venues, especially avoidance from going to health venues, may be linked to poor health outcomes. Race/ethnicity may

contribute to driving negative venue affiliation ties, i.e., avoidance from going to specific social or health service venues, leading to health disparity. Our previous studies have focused on examining venues where young MSM congregate (positive venue affiliation ties) and their association with sociodemographic characteristics, or sexual risk or protective behaviors. However, negative venue affiliation ties may provide us with better understanding of social mechanisms of racial/ethnic disparities in disease burden to MSM of color. The objective of this study is to examine negative venue affiliation ties of young Black MSM (YBMSM) to venues (or YBMSM's avoidance of affiliating with unique venues), in relation to where they congregate/affiliate (i.e., positive venue affiliation ties), their one-mode network (combined peer referral, social, and sex nomination data), and their sexual behavior (UAI, number of sex partners, etc.), drug use behavior, and protective behavior. A purposeful sample of 543 YBMSM aged 16 to 29 were recruited using respondent-driven sampling (RDS) in 2014-2016 in Chicago, IL, and Houston, TX. We conducted multivariate exponential random graph models (ERGMs) to model multilevel structures of avoidance network, affiliation network, and one-mode peer network simultaneously. Results indicated that YBMSM tend to have multiple avoided venues, and avoided and affiliated venues tend to co-exist, and peer network is interacted with YBMSM's venue avoidance. Our study provides policy implication for the need for consideration of avoided venues for HIV prevention tailored to most at risk YMSM population.

Vertex Nomination Via Local Neighborhood Matching

Heather Patsolic, Youngser Park, Vince Lyzinski and Carey Priebe

Given two networks on overlapping, non-identical vertex sets, and a vertex of interest in one of the networks, we seek to find a corresponding vertex in the second network. In moderately sized networks, graph matching can be applied directly to recover the correspondences. In this paper, we present a principled methodology appropriate for situations in which the networks are too large for brute-force graph matching. Our methodology identifies vertices in the neighborhood of the vertex of interest in the first network that have verifiable corresponding vertices in the second network. Leveraging these known correspondences, referred to as seeds, we match the induced subgraphs in each network generated by the neighborhoods of these verified seeds, and rank the vertices of the second network in terms of the most likely matches to the original vertex of interest. We demonstrate the applicability of our methodology through simulations and real data examples, including a pair of high school friendship networks.

"Voters of the Year": 19 Voters Who Were Unintentional Election Poll Sensors on Twitter

William Hobbs, Lisa Friedland, Kenneth Joseph, Oren Tsur, Stefan Wojcik and David Lazer

Public opinion and election prediction models based on social media typically aggregate, weight, and average signals from a massive number of users. Here, we analyze political attention and poll movements to identify a small number of social ""sensors"" -- individuals whose levels of social media discussion of the major parties' candidates characterized the

candidates' ups and downs over the 2016 U.S. presidential election campaign. Starting with a sample of approximately 22,000 accounts on Twitter that we linked to voter registration records, we used penalized regressions to identify a set of 19 accounts (sensors) that were predictive for the candidates poll numbers (5 for Hillary Clinton, 13 for Donald Trump, and 1 for both). The predictions based on the activity of these handfuls of sensors accurately tracked later movements in poll margins. Despite the regressions allowing both supportive and opposition sensors, our separate models for Trump and Clinton poll support identified sensors for Hillary Clinton who were disproportionately women and for Donald Trump who were disproportionately white. The method did not predict changes in levels of undecideds and underestimated support for Donald Trump in September 2016, where the errors were correlated with discussions of protests of police shootings.

War by Other Means: Networks of Diplomacy and their Effects on War and Peace, 1648-1815

Michael Schultz and Jonah Stuart Brundage

In this paper, we explore the structures and processes of diplomatic contact between states from the Peace of Westphalia (1648) to the end of Napoleonic Wars (1815) and how it related to the outbreak of wars between great powers. We use the complete network of diplomatic missions to investigate the historical development of the modern system of interstate relations. The 1648-1815 period is typically regarded as a key moment of institutionalization of this system. Diplomatic networks are an ideal tool for formally depicting the interstate system, because diplomats, by definition, are the representatives of sovereigns sent to other sovereign actors. However, despite their availability, data on diplomatic missions have not been used comprehensively in network form, a gap that we aim to fill. We first describe how diplomatic contact spread and compare the diplomatic activities of great powers to those of other states. We find that diplomacy underwent a period of expansion with increasing density and hierarchy, followed by a period of consolidation with increasing centralization and fewer participants. Throughout, the Holy Roman Empire consistently occupied a central position in the diplomatic network. This finding is counter-intuitive with respect to the historical literature on geopolitics, which regards the eighteenth century as a period of relative decline for the Holy Roman Empire. Networking activity was differentiated by power. The strongest powers expanded their influence by sending more diplomats than they received. Weaker powers were more limited in their activity. Smaller regions tended to engage only with the nearest powers and allies. Next, we explore how the structures of diplomatic relations influenced treaties, wars, and alliances among the great powers of Europe. These data show that diplomacy had both dyadic and systemic effects. As expected, diplomatic contact between a pair of states predicted both conflict and cooperation. Results indicate that the structures and contexts around diplomatic contact were more important than contact alone in determining whether conflict or cooperation would occur. The presence of powerful neighbors who can mediate between powerful belligerents was found to be a deterrent to war. Conversely, structural holes were found to be a hindrance to peace. They prevented alliance formation and were

correlated with a higher numbers of casualties in war. These findings suggest that diplomatic networks ought to be incorporated into multivariate models of war, which typically rely on other types of unit,- dyad,- and system-level predictors.

When Theory Meets Practice: Exploring Challenges to Information Sharing Networks for Community Change

Jennifer Lawlor and Zachary Neal

In many communities, stakeholders working on addressing complex social problems are moving from individualized approaches to networked approaches, like collective impact, systemic action research, and network action research. While each of these approaches is unique, they share a focus on shifting the patterns of relationships for information sharing among stakeholders to generate networks that improve the efficiency of the work. (Here, we measure efficiency as the extent to which the network resembles a small world.) However, many of these theories depend on ideal circumstances and offer little in guidance about the types of challenges that may threaten network efficiency in the real world. In practice, challenges like stakeholder turnover often emerge, interfering with the formation of efficient networks. In this presentation, I will discuss an agent-based model that simulates the generation of networks among stakeholders engaging in networked community change efforts, with a particular focus on the model's functioning when challenges emerge, such as stakeholder turnover, participants not using homophily to form relationships, and unsuccessful organizers for the effort. The model was built to match up with the guidelines for behavior as dictated by the theories that often inform these types of efforts and then modified to include the common challenges that these efforts encounter. In this presentation, I will discuss how I selected challenges of interest to test using a systematic literature review and how each of the challenges was implemented in the model. I will also discuss the implications for network efficiency when change efforts encounter each type of challenge and will conclude with the implications for real-world implementation of change approaches.

With Friends Like These: Aggression From Equivalence And Amity

Robert Faris, Diane Felmlee and Cassie McMillan

Newly available data on negative tie networks has revived interest in the "enemy" tenets of balance theory, which has received mixed support in empirical analyses of animosity and bullying relations. We offer reasons why balance theory is unlikely to explain the relationship between ties of aggression and friendship among adolescents. In short, friends are also enemies. The pursuit of status, the struggle for control within friendships, and the competition with rivals for the same friends all make aggression more, not less, likely to occur between friends, at short social distances, and between structurally similar actors. We test our argument using Exponential Random Graph models on networks of aggression, conditional on prior networks of aggression and friendship, among 5,526 adolescents in 14 middle and high schools. We find that aggression is

especially likely to arise between friends and others who are socially close in the friendship network. Moreover, we find an independent positive effect of structural equivalence in the friendship network, suggesting that those with friends in common are also likely to harm each other. We discuss the implications of our findings for bullying prevention efforts.

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Takacs, Rich	FRI 0950, SAT 1640
Tan, Bing Yang	THUR 0910
Tan, Yu Xun	THUR 0910
Thakur, Hena	THUR 1700*, FRI 1520
The Positive Plus One Team	THUR 1140
Thompson, Tamara	THUR 1140
Tikhonov, Roman	FRI 1400
Tinnemann, Peter	THUR 1420
Tischer, Daniel	FRI 1500
Toepfer, Tom	THUR 0850
Trepka, Mary Jo	THUR 1700*
Tsolis, Kristen	FRI 1520
Tsur, Oren	FRI 0910
Tsvetovat, Maksim	FRI 1040
Tucker, Joan	THUR 0830

Valente, Thomas	THUR 1400, FRI 1400, SAT 1400
Van Durme, Benjamin	SAT 1620
Vargas, Edwin	FRI 1200
Vega Yon, George G.	THUR 1400, FRI 1400
Vermeer, Wouter	SAT 1100, SAT 1620
Vinokhodova, Alla	SAT 0910
Walkling, Ralph	THUR 1520
Wang, Cheng	FRI 1140
Wang, Lijing	FRI 1040, FRI 1640
Wang, Peng	THUR 1700*
Watchorn, Jocelyn	THUR 1140
Watts, Jameson	SAT 0930
Weidemann, Felix	THUR 1420
Wieczorek, Oliver	THUR 1520
Wilensky, Uri	SAT 1100, SAT 1620
Wilkinson, Anna	THUR 1700*
Williams, Mark	THUR 1700*
Wilson, James D.	FRI 1120
Wipfli, Heather	THUR 1400
Wojcik, Stefan	FRI 0910
Wood, George	THUR 0930
Wozneak, Dawn	THUR 1040
Xing, Yiqing	THUR 1440, THUR 1500
Yap, Janice	THUR 0910
Young, Lindsay	THUR 0950, THUR 1120
Zakhlebin, Igor	SAT 0910
Zhang, Liang	THUR 1440
Zhang, Limin	FRI 1440
Zheng, Qiwen	SAT 1120
Zhu, Lingjiong	THUR 1500

*Poster session